# SOME LEGAL CONSEQUENCES OF WEATHER MODIFICATION: AN UNCERTAIN FORECAST

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"It follows, therefore, that this enjoyment of or entitlement to the benefits of Nature should be protected by the courts if interfered with improperly and unlawfully."[1]

## INTRODUCTION

Millions of dollars worth of property and crops are lost each year through damage caused by floods, cyclones, droughts and bushfires.[2] Scientists are confident that they are on the path towards controlling such natural phenomena.[3] Their goals are to put an end to the devastation caused by cyclones and windstorms; to increase crop production through suppressing hailstorms and ensuring adequate rainfall; to reduce flood damage and prevent lightning strikes from starting bushfires; to ensure that rivers never run dry and that the skier never suffers from lack of snow; and possibly more importantly, to increase hydro-electric power production.[4]

However the trial and error of experimentation, and the conflicting interests of mankind, make this a hazardous enterprise and a headache for the lawyer who goes seeking a remedy when the skier's snow becomes the farmer's flood and the power company's profit a minute percentage of the cost of rebuilding a city.[5] Claims for damages and injunctions will likely be based upon allegations of interference with natural climatic

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1 Per curiam, *Southwest Weather Research Inc.* v. *Duncan* 319 S.W. 2d 940, 945 (1958).

2 See Australian newspaper reports in months of January and February of any year esp. articles in *Age* (Melbourne): 8 January 1979, 1 "Towers Flattened in Fierce Storm"; 11 January 1979, 1 "Havoc as Weather Goes Wild"; ibid. 5 "Livestock, Wild Animals Die in Heatwave"; 12 January 1979, 5 "Cooktown Battens down for Greta"; 23 January 1979, 1 "A Narrow Strip that Marks Disaster"; 26 January 1979, 3 "Winds Fan 62 Fires Across State". For U.S. position see H. J. Taubenfeld, *Weather Modification and the Law* (New York, Oceania Publications, 1968) 56-9.

3 Taubenfeld ibid. 1-21.

4 Ibid. 1-65.

5 *Adams* v. *State of California* Docket no. 10112, Sutter County Sup. Ct. Calif. 6 April 1974. Cited and discussed in E. A. Morris, "Preparation and Trial of Weather Modification Litigation" in H. J. Taubenfeld op. cit. 163 and Dean E. Mann, "The Yuba City Episode in Weather Modification" in W. A. Thomas (ed.) *Legal and Scientific Uncertainties of Weather Modification* (Durham N.C., Duke Uni. Press, 1977) 100.

forces and significant issues in the fields of property law and torts may arise in the wake of such claims.[6]

While scientific undertakings in this area have for many years been carried out in Australia,[7] there has been virtually no discussion here of the legal questions involved.[8] This is probably due to the fact that there has been no litigation directly dealing with weather modification here, although such has occurred in the United States where commercial rain-making and hail suppression programmes have been widespread for three decades.[9] The purpose of this article is to examine the legal means whereby injurious or potentially injurious weather modifying activities may be prevented or damages recovered for any loss or injury occasioned by the artificial manipulation of climatic forces.

Although personal injury may be suffered as well as property damage, it is the latter which is, as the following discussion will presently reveal, the more likely grievance and which also gives rise to more significant questions of law. Therefore it is primarily in the context of property damage that the legal analysis will be made, although issues relevant to a personal injuries claim will be adverted to.

Because of the recent origins of the science of weather modification and the lack of serious discussion of applicable law in this country, a consideration of legal issues which arise is preceded by brief accounts of first, the science itself and second, the few decided cases dealing specifically with claims arising out of weather modification activities. These discussions will shed some light on the manner in which claims relating to climatic alteration arise and the controversial legal issues which have been considered in the resolution of the claims.

Legal issues will then be considered in terms of the various causes of action potentially available for the protection of any legally recognized rights or interests likely to be interfered with by climate alteration activities.

## THE SCIENCE

### *Intentional Modifications*

Weather modification is the process of "artificially creating changes in atmospheric conditions".[10] Such activities have been carried on with some

[6] Contractual issues are not within the scope of this article.

[7] See infra fn. 14; and Vic. *Parl. Deb.* 1 November 1967, 1609 and 6 December 1967, 2995. Also J. Warner, "Rainmaking; the State of the Art" (1978) 16 *Ecos* (C.S.I.R.O. Environmental Research) 15.

[8] G. Harry, "Another Headache" (1953) 26 *A.L.J.* 527 deals with this area but not with legal issues.

[9] Comment, "The Weathermaker and the Law" (1956) 1 *S. Dak. L.R.* 105.

[10] A. G. McKenzie, "Weather Modification: A Review of the Science and the Law" (1975) 6 *Environmental Law* 387, esp. 412-13 for a consideration of some definitions.

success for over thirty years[11] on a systematic and scientific basis[12] in the United States, the Soviet Union, Switzerland, South Africa, South America[13] and Australia.[14]

It is important to note that most intentional weather modifications are effected by use of the same process irrespective of the particular form of climatic result intended. This process involves the "triggering off" of precipitation of rain in desirable atmospheric conditions for the purpose of stimulating rainfall or snowfall.[15] This is achieved by "seeding" the clouds with dry ice, silver iodide or other chemicals either from airplanes, rockets or ground-based generators.[16] "Overseeding", where excessive quantities of chemicals are released into the atmosphere is used to alleviate the conditions in which condensation of moisture becomes precipitation,[17] thereby reducing rainfall or suppressing hail, snow and even lightning.[18] A problem arises in that inaccurate "seeding" procedures may result in the production of effects opposite to those intended.

This same principle[19] can be used to influence indirectly the direction and force of cyclones, hurricanes, tornadoes and windstorms.[20] However, such activities involve a multitude of uncertainties in the control of climatic phenomena and the potential of effects on an international scale,[21] since changing the direction or force of, for example, hurricanes may result in destruction in a neighbouring country or alternatively in the reduction, in arid areas, of beneficial rainfall incidental to hurricane activity.[22] No further mention of issues arising from possible international effects will be made since these are not within the scope of this article.

*Inadvertant Modifications*

Climatic changes are also caused inadvertantly as a side effect of the

11 Taubenfeld, op. cit. 1-75 outlines various U.S. government projects.
12 For a more comprehensive account of the science see McKenzie, op. cit. 388-403 and D. D. Stark, "Weather Modification: Water—Three Cents per Acre Foot?" (1957) 45 *Calif. L.R.* 698, 699-704. Historical summaries are to be found in "The Weathermaker and the Law" op. cit. 105-7 and Comment, "Who Owns the Clouds?" (1948) 1 *Stan. L.R.* 43.
13 Thomas, op. cit. 85.
14 E.g. Bowen, "Artificial Rainmaking" C.S.I.R.O. Report (Australia) cited in "The Weathermaker and the Law" op. cit. 105-6.
15 The principle is essential to almost all intentional weather modification programmes and is used also for clearing cold fogs at airports. See W. O. Roberts, "The State of the Art in Weather Modification" in Taubenfeld op. cit. 1, 10-11.
16 McKenzie, op. cit. 394 and Taubenfeld, op. cit. 1-75.
17 By ensuring that there are so many particles in the atmosphere that none can accumulate sufficient moisture to precipitate. See Stark, op. cit. 702; McKenzie, op. cit. 395; "The Weathermaker and the Law" op. cit. 107.
18 McKenzie, op. cit. 387-92.
19 For initial discovery see V. J. Schaefer, "The Production of Ice Crystals in a Cloud of Super-Cooled Water Droplets" (1946) 104 *Science* 457 cited in Thomas, op. cit. 18.
20 Taubenfeld, op. cit. 24-5, 39-40.
21 McKenzie, op. cit. 397.
22 Thomas, op. cit. 26, 29, 48-9, 69, 127. For information relating to weather modification as a weapon of war, see Taubenfeld, op. cit. 31.

urban and industrial pursuits of man and the pollutant effects of transportation,[23] both of which have increased atmospheric concentrations of carbon dioxide, affected atmospheric radiation balances and raised temperatures in the lower atmosphere.[24]

Deforestation, irrigation and field-burning have also assisted in producing such effects as well as increasing humidity in some regions, effecting an alteration in wind patterns and restricting visibility generally.[25] Such activities may be complained of for a variety of reasons, though to be relevant to this study, an essential factor must be that injury has resulted from climate change which itself has been caused by the generally pollutant acts. In some cases an activity such as the production of vast quantities of smoke by field-burning, may be recoverable in nuisance irrespective of the fact that the natural composition of the atmosphere is interfered with or unbalanced. The discussion of such actions is within the scope of this article only insofar as what is complained of is the fact that the natural balance of the atmosphere is upset and not, for example, that smoke damage has been caused to goods or property, although in practice the same set of facts in respect of inadvertant weather modification may in many circumstances give rise to both allegations.

Subject to this limitation, the remedies available for intentional or inadvertant weather modification activities will be considered together, except that the absence of intention to cause a particular effect may in some cases provide a defence to a legal action.

## WEATHER MODIFICATION LITIGATION

The few decided cases which are directly relevant have been heard in the United States. Injunctions against weather modification activities have been granted,[26] but to date it appears that damages have not been awarded.[27] In general, cases have been meagrely reported but various causes of action having been suggested, including trespass, nuisance, negligence and the rule in *Rylands* v. *Fletcher*.[28] Though certain legal principles appear to have been enunciated, decisions have usually been made upon an evidentiary basis. The most common difficulty experienced by plaintiffs is an inability to prove the causal nexus between their injuries and the weather modifier's activities, though scientific advancement in

[23] McKenzie, op. cit. 399-402; also *Age* (Melbourne) newspaper article 12 May 1979, 9 "Missing Gas may be in Ocean".
[24] Ibid., and Thomas, op. cit. 11.
[25] McKenzie, op. cit. 398-9; Thomas, op. cit. 132, 135.
[26] E.g. *Southwest Weather Research Inc.* v. *Duncan* 319 S.W. 2d 940 (1958).
[27] E.g. *Adams* v. *State of California* Docket no. 10112 Sutter County Sup. Ct. Calif. 6 April 1964 (award not against modifiers). For articles where case is discussed, see fn. 5 and fn. 36.
[28] (1866) L.R. 1 Ex. 265; affd. (1868) L.R. 3 H.L. 330.

monitoring the direction and effects of climatic phenomena should assist in overcoming this problem.[29]

These cases will exemplify first, the difficulty of establishing factual causation of injuries by weather modification operations, next, the confusion surrounding the existence and extent of legally protected rights or interests in weather conditions, and finally, the uncertainty as to with whom such rights or interests repose.

*Causation*

Apparently the first recorded case occurred in New York State in the United States of America in the late 1800s.[30] It involved a Presbyterian minister who had organized a too successful rain prayer meeting which resulted immediately in a series of severe storms. He was sued for damages by a farmer whose barn had burned down after being struck by lightning, but escaped liability on the basis that only rain was prayed for, the lightning being the "gratuitous gift of God".[31] The next case was in 1916, when suit was brought against a Mr Hatfield, who had been hired by the City of San Diego to make rain which subsequently washed out a dam, caused loss of life and considerable property damage.[32] The injured plaintiff again failed on the ground that the damage was held to be the result of an Act of God.

The reluctance of courts to accept that man's activities could significantly influence natural weather conditions was not overcome by the scientific accreditation of artificial rain-making in the late 1940s[33] and has in fact remained a considerable burden to those persons seeking to prove factual causation between the activities of weather modifiers and injury caused by climatic aberration.[34]

Findings of insufficient proof of the causal nexus between weather modification activities and the damage complained of were the grounds for rejecting claims for damages brought against weather modifiers in three actions arising out of severe flooding in Oklahoma in 1953 (*Samples* v. *Irving P. Krick Inc.*)[35] and in California in 1955 (*Adams* v. *State of California*)[36] and storms and flooding in Washington State in 1956 (*Auvil*

[29] For information on the developments in monitoring the direction and effects of cloud seeding operations see Stark, op. cit. 707; Thomas, op. cit. 13; McKenzie, op. cit. 397.

[30] *Phinnaes Dodd* v. *Duncan McLeod* cited in B. Partridge *Country Lawyer* (London, George C. Harrap & Co. Ltd., 1940) 83-88.

[31] Ibid.

[32] Cited in "Who Owns the Clouds" op. cit. 43-44.

[33] After the results of experiments by Schaefer and Langmuir were published in 1946.

[34] See e.g. *Adams* v. *State of California* Docket no. 10112 Sutter County Superior Court Calif. 6 April 1964. See fn. 5 and fn. 36 where this case is cited and discussed.

[35] Civils No.'s 6212-6, 6223-6, 6224-6 W. Oklahoma 1954. Cited in "The Weather-maker and the Law", op. cit. 109.

[36] Docket no. 10112 Sutter County Superior Court Calif. 6 April 1964. See Morris, op. cit.; Mann, op. cit.; J. C. Oppenheimer, "The Legal Aspects of Weather Modification" (1958) *Ins. L.J.* 314, 319; also fn. 5.

*Orchard Co. Inc.* v. *Weather Modification, Inc. & Apple Weather, Inc.*).[36a]

Aside from *Slutsky* v. *City of New York*,[37] where, on the limited materials available, it appears that factual causation was either proved or conceded, there are only the *Southwest Weather* cases where the causal nexus between the weather modification activities and the injury sustained has been established. Causation was established and injunctions granted in these three cases (*Southwest Weather Research Inc.* v. *Duncan*;[38] *Southwest Weather Research Inc.* v. *Rounsaville*;[39] *Southwest Weather Research Inc.* v. *Jones*[40]) which arose out of the activities of the same defendant, who in the course of a hail suppression programme over cattle grazing land in northern Texas, caused a decrease in rainfall. Causation was established in these cases as the court was prepared to accept lay opinion evidence as to the likelihood of precipitation taking place and also visual observation evidence of the destruction of rain clouds by weather modification activities.

Proof of causation in the manner sustained in the *Southwest Weather* cases is now less likely since *Farmers and Ranchers for Natural Weather* v. *Atmospherics Inc.*,[41] decided in the state of Texas in 1974, wherein the plaintiff's lay opinion evidence and visual observation evidence similar to that accepted in the *Southwest Weather* cases was not sufficient to counter expert testimony from the defendant's witnesses. The necessity of expert scientific evidence is clear, though it should be noted that failure of plaintiffs to prove factual causation is due first, to the existence of considerable scientific controversy over the scope and consistency of the effects that weather modification activities have upon the environment and second, as a result of the fact that defendants are usually unable to find competent independent scientific witnesses who are prepared to testify against the business and other interests operating in the field.

### *Private Rights*

Assuming that factual causation can be established, as it was in the *Southwest Weather* cases, then the plaintiff's rights and interests in the natural resources of the atmosphere must be considered. In these three cases, the court's decisions were based upon the principle that landholders (including lessees: see *Jones'* case)[41a] have rights to the airborne moisture above their land. Such rights appear to be related to the plaintiff's interests in the land below although this view was contrary to dicta in the earlier

[36a] Cause No. 19268, (Sup. Ct. Chelan Cy. Wash. 1956) cited and discussed in Oppenheimer, op. cit. 319.
[37] 97 N.Y.S. 2d 238 (Sup. Ct.) (1950) cited and discussed in Oppenheimer, op. cit. 318.
[38] 319 S.W. 2d 940 (1958).
[39] 320 S.W. 2d 211 (1959).
[40] 327 S.W. 2d 417 (1959).
[41] Civil No. 7594 (District Ct. Lamb. Cy. Texas 3 May 1974). Cited in W. A. Thomas, op. cit. 40.
[41a] *Southwest Weather Research Inc.* v. *Jones* 327 S.W. 2d 417 (1959).

case of *Slutsky* v. *City of New York* where the court stated that the plaintiff resort proprietor had no vested property rights in the clouds or the moisture therein.[42] A more recent, but lower court decision which shall be referred to as the *Blue Ridge* case[43] seems to have followed the *Southwest Weather* cases in holding that landowners beneath clouds have a property interest in the precipitation from them, but which may be subservient to the public interest when properly approved.[44]

In granting injunctions against the defendant weather modifier the court in *Duncan's case* (one of the *Southwest Weather cases*)[45] said:

> "We believe that under our system of government the landowner is entitled to such precipitation as Nature deigns to bestow. We believe that the landowner is entitled, therefore and thereby, to such rainfall as may come from clouds over his own property that Nature, in her caprice, may provide. It follows, therefore, that this enjoyment of or entitlement to the benefits of Nature should be protected by the courts if interfered with improperly and unlawfully. . . . We do not mean to say or imply that . . . the landowner has a right to prevent or control weather modification over land not his own."[46]

It is interesting to note that on appeal the Court also held that the trial judge was justified in finding that "clouds were destroyed over property of appellees by operations of the appellants",[47] though what was most likely meant is that their potential precipitative value to the landholder was destroyed by the operations of the appellants.

In the *Southwest Weather* cases, ranchers successfully enjoined a programme of hail suppression over their properties, where the object of the programme was the reduction of considerable hail damage to the crops of local farmers. Although the facts of these cases clearly indicated the existence of significant farming interests in competition with those of the plaintiffs, in none of the cases did the court address itself to the balancing of the individual's rights against the public benefit, implying that the interest protected is exclusive and possessory, not one which would be subject to competing interests.[48] The view that the nature of this action

[42] See Thomas, op. cit. 40.

[43] *Pennsylvania Natural Weather Association* v. *Blue Ridge Weather Modification Association* 44 Pa. D. & C. 2d 749 (1968) (C.P. Fulton County Pa. 2 February 1968) cited and discussed by R. J. Davis in Thomas, op. cit. 40.

[44] Ibid., and Thomas, op. cit. 38.

[45] *Southwest Weather Research Inc.* v. *Duncan* 319 S.W. 2d 940 (1958).

[46] Ibid. 945. The last sentence of the quotation implies that the action is based on a property right remediable in trespass. On the other hand, an action in nuisance may lie for activities outside the boundaries of property when extended vertically upward and across to delineate the landowner's airspace. See *Bernstein of Leigh (Baron)* v. *Skyviews and General Ltd* [1977] 3 W.L.R. 136.

[47] Ibid. Although this finding may support an action in conversion for what has quaintly been referred to as "cloud rustling", the writer is of the opinion (see infra at 142) that theories asserting the potential existence of possessory rights in clouds are invalid on scientific and public policy bases.

[48] The omission of the "public benefit" factor further implies that the decision here was based on a property right which finds its protection in an action for trespass. However, as will be discussed (infra at 135) U.S. decisions do not appear to draw

was trespassory is reinforced by the last sentence of the above quotation which indicates that the right protected is determined by the plaintiff's interest in real property.

It is, however, difficult to ascertain precisely upon what principle this right to the moisture in air superadjacent to a landholding is based. The court did not state any rationale for the existence of this right, but the alternatives appear to be either

(1) an invocation of the *cujus est solum* doctrine, whereby the ownership of land is said to include the ownership of everything above to the heavens and below to the centre of the earth, or

(2) the establishment or recognition of some right to the benefit of nature's atmospheric resources, such right being appurtenant to a possessory interest in land.

These alternatives will be discussed in more detail below. There is however, authority for the argument that some sort of right or interest in airborne moisture does repose in private landholders beneath and that this right or interest is protected in law.

*Public Rights*

Aside from the possibility of private interests in airborne moisture, there appears to be in existence a public right or interest in the same, which has also been recognized by the court decisions in *Avery* v. *O'Dwyer*,[49] *Reeves* v. *O'Dwyer*,[50] and *Slutsky* v. *City of New York*.[51]

These three actions involving a rain-making programme by the City of New York, aimed at augmenting the city's water supply during a drought, were unsuccessful due to a finding that the public interest in the benefits of the programme overrode the infringed rights of the plaintiff.[52] It is significant in these cases that the cloud-seeding took place a considerable distance away from, and not directly over, the plaintiff's land, as was the situation in the *Southwest Weather* cases.

The decision in *Slutsky's* case, which in effect decided the two following cases, was significant for its balancing of the public benefit against private interest. The court felt that:

"... it must balance the conflicting interests between a remote possibility of inconvenience to the plaintiff's resort and its guests with the problem

clear distinctions between actions in trespass and in nuisance. There is some support for the right established here finding its protection in the law of nuisance.

[49] 305 N.Y. 658; 112 N.E. 2d 428 (1953).

[50] 98 N.Y.S. 2d 452 (Sup. Ct.) (1950) cited in "The Weathermaker and the Law" op. cit. 109.

[51] 97 N.Y.S. 2d 238 (Sup. Ct.) (1950) cited in Oppenheimer, op. cit. 318.

[52] *Avery's* case and *Reeves'* case were not proceeded with after the decision was given in *Slutsky's* case, which was referred to in Vic. *Parl. Deb.* 1 November 1967, 1609, 3110. The writer has been unable to trace further the development of these cases. *Avery's* case was an action for damages and was relisted for hearing but no record of the hearing has been found. See also "The Weathermaker and the Law" op. cit. 110.

> of maintaining and supplying the inhabitants of the City of New York... with an adequate supply of pure and wholesome water . . . This court will not prevent a possible private injury at the expense of a positive public advantage."[53]

The implication therefore, is that the public has a recognized right to influence weather conditions in a manner suitable to its own purposes. The *Blue Ridge* case[54] confirmed this position by asserting that this public right or interest when properly approved will override the right or interest of a private landowner to the natural benefits of atmospheric resources such as the precipitation of rain.

It is significant that the more recent *Blue Ridge* case prescribed that this public interest be properly approved. The implication being that the public interest may not be dominant unless it is properly approved. In *Slutsky's* case, it appears that the court was prepared to infer from the facts the proper approval of the exercise by the City of New York of its right to modify the weather. It may very well be that a private party carrying out weather modification activities which are for the public benefit, but not specifically on behalf of a public body such as the City of New York, would find that the courts are unprepared to offer priority to his interests, and protection against competing interests of private landholders. Such an argument would be in accordance with the decision which was given on other grounds in the *Southwest Weather* cases where the public benefit of the activities appears to have been ignored. It may also have been an important factor in the decision made for the defendant in *Farmers and Ranchers for Natural Water* v. *Atmospherics Inc.*[54a] since, in that case, the fact that the defendant weather modifiers were in possession of a valid authority under the appropriate legislation was relevant to the decision in their favour.[55]

Although Victoria is the only state of Australia with weather modification legislation,[56] at least thirty states in the United States of America have enacted such legislation in one form or another, mainly for the purpose of regulating and licencing weather modification operations.[57] That the possession of a permit or authority under legislation is evidence of the approval of a public interest is shown by the fact that the government of Victoria specifically referred to *Slutsky's* case and the public benefit of rain-making operations when arguing for the provision of statutory immunity from suit in respect of injuries caused by the government or any authorized person carrying out such operations.[58] Moreover, the creation of this statutory immunity from suit for permit holders in

[53] Cited more fully in "The Weathermaker and the Law", op. cit. 110.
[54] See fn. 43.
[54a] See fn. 41.
[55] Thomas, op. cit. 40.
[56] *Rain-Making Control Act* 1967 (Vic.).
[57] See McKenzie, op. cit. 413; and "The Weathermaker and the Law", op. cit. 112-6.
[58] Vic. *Parl. Deb.* 1 November 1967, 1608-9.

itself gives strong support for the argument that persons duly exercising rights under the permits are doing so in a properly approved manner and in the interests of the public.

The possession of an authority under a statute which does not provide immunity from suit may still justify a dominant interest, but would be unlikely in itself to preclude liability in trespass or nuisance.[59]

In summary, any claims made in respect of damage caused by weather change will suffer from lack of both consistent scientific support and coherent legal authority upon which the action may be based. Decided cases reveal that proof of factual causation is a major problem, though once established, private and public rights based respectively upon undefined property-related interests and notions of public advantage exist and compete for priority. The scope of these rights, the existence of correlative duties, and the theoretical justification for their applications is unclear, though in a considerable body of legal writing in the United States attempts have been made to rationalize the law in this area by drawing analogies to various common law theories.[60] Those suggested analogies include the laws concerning airspace ownership, natural rights appurtenant to real property, the allocation of water resources, the ownership of oil and gas reserves, and animals *ferae naturae.*

## CAUSES OF ACTION AVAILABLE

Owing to the novel fact situations that weather modification presents and the various legal theories suggested, the analysis of legal issues in this area will be speculative with a view to identifying potential legal arguments and their applications. The discussion will proceed in terms of the causes of action possibly available to persons seeking either (1) to prevent climate alteration despite the lack of ascertainable damage, or (2) to obtain damages or an injunction in respect of injuries suffered as a result of climate alteration.

### *Trespass by Weather*

There are three general categories of actions in trespass:

(1) trespass to land;
(2) trespass to the person, which can be broken down into
    (a) assault,
    (b) battery, and
    (c) wrongful imprisonment; and

[59] Legislative authority may be a defence in an action for nuisance, but this does not extend to permissive authority. See *Anderson* v. *Souza* 243 P. 2d 497, 506 (1952). This is distinguished from a "legalized nuisance" situation, where statutory authorization for an activity or use of land will provide immunity from suit in nuisance for damage resulting therefrom or from any inevitable consequence. Cf. dicta of Barwick C.J. in *Benning* v. *Wong* (1969-70) 122 C.L.R. 249, 273 ". . . in either case the statute will be an answer if the authorized work is constructed and maintained with reasonable skill and care".

[60] See generally Oppenheimer, op. cit. 318 and McKenzie, op. cit. 403.

(3) trespass to goods.

Since weather can have a beneficial or deleterious effect on land, goods and people, the operation of all three forms may be possible, though any specific considerations relevant to a particular form of trespass will be dealt with after a discussion of the general principles of the law of trespass and their operation in the field of weather modification.

Since trespass is actionable per se, without proof of actual loss or damage to the plaintiff,[61] persons who have suffered no injury but who are intent on opposing weather modification activities "on principle" may find trespass to be the only cause of action available.[62] However, such an action may provide only a Pyrrhic victory, since, assuming that preventing the operations is the object of the action, the fact that the wrong is trivial or insubstantial are grounds for denying an injunction to which a successful plaintiff in trespass would, as a general rule, be entitled.[63]

Directness

Actions in trespass must complain of an interference which is "direct and immediate" and not "consequential". In *Southport Corporation* v. *Esso Petroleum Co. Ltd*[64] it was held that oil which was discharged offshore and floated onto the plaintiff's beach causing damage was "consequential" as it was not discharged directly onto the foreshore. In that case, Denning L.J. cited with approval *Reynolds* v. *Clarke*[65] where an action for trespass failed on the same ground, when the walls of the plaintiff's house had rotted from water which had been poured thereon by a rainspout that the defendant had attached to his own house. Similarly, in *Hutchins* v. *Maughan*[66] trespass was rejected when the plaintiff's dogs died from taking poisonous baits which the defendant had placed on his own land. It was so held since the injury was consequential and not immediately or directly occasioned by the defendant's act.

This necessity of directness could cause considerable difficulty in actions alleging trespass by artificially induced weather phenomena. This is because first, the impact of weather modification activities can very often be the deprivation of the benefits of nature and the lack of a physical manifestation or intrusion would probably preclude suit in trespass.

61 J. G. Fleming *Law of Torts* (5th ed., Sydney, Law Book Co., 1975) 15. Cf. trespass to goods infra.

62 Causes of action in negligence, nuisance and upon the principle in *Rylands* v. *Fletcher* require harm to the plaintiff for success of the action.

63 *Armstrong* v. *Sheppard and Short Ltd* [1959] 2 Q.B. 384; 3 W.L.R. 84; see also *Kelsen* v. *Imperial Tobacco Co. Ltd* [1957] 2 Q.B. 334; 2 W.L.R. 1007; 2 All E.R. 343; *Woollerton and Wilson Ltd* v. *Richard Costain Ltd* [1970] 1 W.L.R. 411; *Graham* v. *K.D. Morris & Sons Pty Ltd* [1974] Qd. R. 1.

64 [1956] A.C. 218. This view of Denning L.J. in the Court of Appeal was supported by two members of the House of Lords and no disagreement was expressed by any other member of the House.

65 (1726) 1 Stra. 634; 93 E.R. 747.

66 [1947] V.L.R. 131; A.L.R. 201.

Second, the processes of cloud seeding involve the releasing of particles into the atmosphere and the attachment of moisture to these particles until they become so heavy as to fall to the ground. This is the theoretical basis for most forms of intentional weather modification. The process appears to operate in stages, though in certain conditions the effect is immediate. Assuming that the particles are released directly into the plaintiff's airspace or so close thereto that it was inevitable that they would enter this protected zone, then it is most likely that this entrance by the particles would amount to a trespass. Certainly the specific facts of each case will determine the directness and immediacy of the intrusion, though it would seem that in weather modification cases, the best test would be the inevitability of the entry into the plaintiff's airspace or onto his land.[67]

However, there will be many occasions when the particles are released a considerable distance from the plaintiff's land and are simply carried there by the wind or other intermediate force similar to the off-loaded oil in *Southport Corporation*[68] or the laying of poisoned baits in *Hutchins* v. *Maughan*.[69] Similarly, where the intrusion on the plaintiff's land or airspace is a side effect of the acts of the weather modifier, for example where operations in one area set off a chain reaction which causes effects to the plaintiff in another region, then clearly the situation would be closer to *Reynolds* v. *Clarke*[70] where the fitting of a rainspout which channelled water onto the plaintiff's wall was held to be a consequential injury and not trespass.

The existence of intermediate actors and forces between the act of weather modifying and the interference with or invasion of the plaintiff's person, goods or land would in most cases[71] render the trespass consequential, even if the original act was mischievous to the point of creating actual danger.[72]

## "Fault" and the burden of proof

It is essential to a successful action in trespass that the court find the act of trespass to have been intentionally or negligently performed. The High Court of Australia in *McHale* v. *Watson and Others*[73] has held, contrary to English authority in *Fowler* v. *Lanning*,[74] that except when

[67] See *Davies* v. *Bennison* (1927) 22 Tas. L.R. 52.
[68] [1956] A.C. 218.
[69] [1947] V.L.R. 131; A.L.R. 201.
[70] (1726) 1 Stra. 634; 93 E.R. 747.
[71] The majority in *Scott* v. *Shepherd* (1773) 2 Black. W. 892; 3 Wils. 403; 96 E.R. 525 is some authority for the argument that the mere leaving in a public place of a thing may invest it with a potential for mischief so that injury occasioned thereby is a trespass.
[72] See *Scott* v. *Shepherd* ibid. per Blackstone J. where a "lighted squib" made of gunpowder was thrown from the street into a crowded market and thrown twice more within the market before injury was occasioned.
[73] (1964) 111 C.L.R. 384; affd. (1966) 115 C.L.R. 199.
[74] [1959] 1 Q.B. 426; 2 W.L.R. 241. But the skyways may themselves be highways.

trespass occurs on the highway the onus is upon the defendant to prove absence of intent and negligence on his part, if trespass is to be rejected. It has been suggested that the "negligence" in negligent trespass actions is not the same as in negligence actions.[75] However, for the purposes of the discussion in this article no such distinction will be drawn. Moreover, although decisions in respect of negligent trespass are primarily concerned with allegations of trespass to the person, they would likely apply by analogy to trespass to land and goods.

Furthermore, the court in *McHale* v. *Watson & Ors*[76] held that the burden of disproving negligence shifts to the defendant once the plaintiff proves that the defendant has directly injured him. Since an onus of disproof lies with the defendant, the plaintiff is provided with an advantage which, assuming that the specific cause of the injurious act is not known, the doctrine of *res ipsa loquitur* in a negligence action does not provide. This is because in Australia, as distinct from the United Kingdom, this doctrine does not cast any onus of proof on the defendant but works only so as to establish a rebuttable prima facie inference of negligence[77] which would more easily be displaced by the defendant than the satisfaction of an onus of disproof. It would be a highly unusual case where the defendant did not present sufficient evidence of reasonable care having been taken, thereby rebutting the presumption of negligence, but a more usual case where the court or jury would find that the defendant had not satisfied the onus of proving that he had not been negligent.

Since the same general facts may establish causes of action in both negligent trespass and negligence,[78] considerable evidentiary advantage could be had by suing in negligent trespass rather than negligence, provided the plaintiff can satisfy the court that the injury was direct. Furthermore, the restrictive proximity of damage notions existing in relation to negligence and nuisance do not appear to apply to actions in trespass nor possibly to actions for negligent trespass.[79]

*Trespass to Land*

The first issue peculiar to this form of action in respect of weather modification is the definition of the word "land". Since weather phenomena occur in the atmosphere above the surface of the land, the question arises as to how much of the atmosphere above the surface can be included in

[75] See F. A. Trindade, "Some Curiosities of Negligent Trespass to the Person—A Comparative Study" (1971) 20 *Int. & Comp. L.Q.* 706.
[76] (1964) 111 C.L.R. 384; affd. (1966) 115 C.L.R. 199.
[77] *Mummery* v. *Irvings Pty Ltd* (1956) 96 C.L.R. 99.
[78] *Williams* v. *Milotin* (1957) 97 C.L.R. 465.
[79] See Fleming, op. cit. 37-41; *Fowler* v. *Lanning* [1959] 1 Q.B. 426 per Diplock J.; *Wormald* v. *Cole* [1954] 1 Q.B. 614 and *Turner* v. *Thorne* (1960) 21 D.L.R. (2d) 29. However it has been suggested that reasonable forseeability may be a better criterion as to the proximity of damage: see G. Williams, "The Risk Principle" (1961) 77 *L.Q.R.* 179, 202-4.

the definition of land? The primary source of law with respect to airpace ownership is the so-called "*ad coelum*" doctrine.

*"Ad coelum"* and airspace ownership

There is general agreement amongst modern legal scholars[80] that whatever it was intended to mean,[81] the old Roman maxim *cujus est solum ejus est utque ad coelum et ad inferos*,[82] does not today determine the upward and downward extent of real property rights. Both English and American decisions[83] have restricted recovery in trespass for intrusions into superadjacent airspace[84] to the area of the ordinary use and enjoyment of land,[85] otherwise called the lower stratum of airspace. However, an action in nuisance may lie to prevent the use of the upper stratum to the extent that such use by other than the landholder amounts to an unreasonable interference with the enjoyment of the surface.[86]

A problem with American cases in this area is that there is very rarely a clear distinction made between whether the decisions are in fact based on trespass or nuisance grounds. This attitude is reflected in the views of Kraemer who appears to make no distinction between possessory property rights and property rights in the nature of the right to the use of enjoyment of land when he asserts that:

> "... Easements for light can be granted because the grantor has property rights in the airspace above the land; ..."[87]

In fact, O'Connell J., *per curium*, stated in *Martin* v. *Reynolds Metals Co.*[88] that the two torts coalesce at least insofar as courts look to the

[80] See *Bernstein of Leigh (Baron)* v. *Skyviews and General Ltd* [1977] 3 W.L.R. 136, 141. Also Fleming, op. cit. 44; A. D. McNair, *The Law of the Air* (3rd ed., London, Stevens and Sons, 1964) 31-6 and 41-4 where the views of other legal theorists are examined. See also McKenzie, op. cit. 406-7; "Who Owns the Clouds", op. cit. 48.

[81] For historical perspectives see McNair, op. cit. (1st ed., London, Butterworths & Co., 1932) 13-8 and (3rd ed. 1964) 393 (Appendix 1); C. L. Bouvé, "Private Ownership of Airspace" (1930) 1 *Air L.R.* 232; 376.

[82] The theory that ownership of land extends upward to the heavens and downward to the centre of the earth. See Blackstone *Commentaries* 18 (8th ed. 1788).

[83] See infra. See also Fleming, op. cit. 45 for more details of the position in the United States.

[84] Airspace or *coelum* is historically distinct from the air itself, the ownership of which is another question and will be dealt with below.

[85] See *Bernstein of Leigh (Baron)* v. *Skyviews and General Ltd* [1977] 3 W.L.R. 136; *Davies* v. *Bennison* (1927) 22 Tas. L.R. 52, 56; *Kelsen* v. *Imperial Tobacco Co.* [1957] 2 Q.B. 334; *Wandsworth Board of Works* v. *United Telephone Co.* (1884) 13 Q.B.D. 904 and for the U.S. see *Hinman* v. *Pacific Air Transport* 84 F. 2d 755, 758 (1936) per Wilbur and Haney JJ.: "We own so much of the space above the ground as we can occupy or make use of, in connection with the enjoyment of our land." *U.S.* v. *Causby* 328 U.S. 1062, 1067 (1946); *Portsmouth Harbor Land & Hotel Co.* v. *U.S.* 260 U.S. 327 (1922); see also McNair, op. cit. (3rd ed.) 48-57.

[86] See *Bernstein's* case, ibid. and *Swetland* v. *Curtiss Airports Corp.* 55 F. 2d 201 (1932). But see Shawcross and Beaumont *Air Law* (3rd ed., London, Butterworths, 1966) 498 and *Lacroix* v. *R.* [1954] 4 D.L.R. 470 for a more narrow view.

[87] S. F. Kraemer *Solar Law* (Colorado Springs, McGraw Hill, 1978) 37.

[88] 342 P. 2d 790, 795 (1959). McAllister C.J. generally concurred with the decision. However he dissented from the attempt to coalesce the two torts.

interference with the plaintiff's use and enjoyment of the land in order to determine whether or not his exclusive possession should be protected. Griffiths J. in *Bernstein's case*[89] uses similar words and notions to O'Connell J. in *Martin's case*,[90] when, after disposing of the *ad coelum* doctrine as "absurdity", he established the extent of airspace ownership in English law in the following terms:

> "The problem is to balance the rights of an owner to enjoy the use of his land against the rights of the general public to take advantage of all that science now offers in the use of airspace. This balance is . . . best struck . . . by restricting the rights of an owner in the airspace above his land to such height as is necessary for the ordinary use and enjoyment of his land and the structures upon it, and declaring that above that height he has no greater rights in the airspace than any other member of the public."[91]

Similarly, within this article, it will become clear that the treatment of the subject matter in terms of various separate causes of action potentially available is subject to limitations due to the fact that the same right or interest may in differing circumstances be protected by differing causes of action in tort.

However, despite the ambiguity of the American decisions as to which cause of action encompasses the right being protected, it is fairly well established on the basis of both English and American authorities that property rights relating to the use and enjoyment of land, but based upon the right to exclusive possession thereby founding an action in trespass, do extend upwards from the surface of land to a distance of the ordinary use thereof. There is also the possibility that a landholder's protectable airspace may be extended by the right to acquire airspace easements across neighbouring airspace holdings.[92] This will, however, be discussed in more detail below. Thus, if there is today any operation at all of the "*ad coelum*" doctrine in relation to airspace ownership, it is to the extent of "ordinary user" only, although the actual height of ordinary use is a question of fact in each case.[93] This height limitation on airspace ownership will therefore govern the extent to which weather modification activities will be subject to an action for trespass to land, whether such an action alleges (a) the flight of aircraft through the plaintiff's airspace or (b) the intrusion of weather phenomena into the airspace or onto the land of the plaintiff.

(a) Flight of aircraft

[89] *Bernstein of Leigh (Baron)* v. *Skyviews and General Ltd* [1977] 3 W.L.R. 136, 141.
[90] *Martin* v. *Reynolds Metals Co.* 342 P. 2d 790 794-5 (1959).
[91] *Bernstein*, op. cit. 141.
[92] See discussion of "natural rights" to land, infra.
[93] *Bernstein's* case, op. cit. 141. See also *Woollerton & Wilson Ltd* v. *Richard Costain Ltd* [1970] 1 W.L.R. 411 and *Graham* v. *K.D. Morris Pty Ltd* [1974] Qd. R. 1 where it was suggested that the right of ordinary user could extend over three hundred feet into the air.

A considerable amount of cloud-seeding involves the use of aircraft and it is common ground that in the United Kingdom, four Australian states, the U.S., N.Z. and many other countries, the "mere flight" or "innocent passage"[94] over land at a reasonable height having regard to weather and other conditions is not actionable as trespass or nuisance.[95] In discussing the extent of this statutory immunity, Griffith J. in *Bernstein's* case[96] asserted that in certain circumstances an action in nuisance could lie in respect of flight over the plaintiff's property in the upper stratum, if such flight was accompanied for example, by

> ". . . the deliberate emission of vast quantities of smoke that polluted the atmosphere and seriously interfered with the plaintiff's use and enjoyment of his property. . . ."[97]

Accordingly, insofar as the upper stratum is concerned, it appears that activities beyond "mere flight" may be actionable provided the plaintiff's use and enjoyment of his land has been interfered with.[98] Similarly, it is arguable that activities beyond "mere flight" in the lower stratum of airspace would be actionable in trespass; and since trespass is actionable without proof of damage, it is arguable that these activities need not even interfere with the plaintiff's use and enjoyment of his land.

Furthermore, even if such a flight is held to be within the ordinary incidents of "mere flight", actions in trespass may lie when aircraft fly at such a height above the plaintiff's land so as to come within the area of ordinary user but in weather or other conditions which render the flight unreasonable, since these factors are also conditions of the statutory immunity.

However, it would be rare, particularly in the case of rural land, that airplanes involved in weather modification would cross over a person's land at such a low altitude unless in the course of taking-off or landing.[99]

There are a number of American cases[100] where recovery has been

[94] Fleming, op. cit. 45. Also weather modification activities may not fall within the "ordinary incidents" of "mere flight".

[95] E.g. s. 3 *Wrongs Act* 1958 (Vic.); s. 3 *Damage by Aircraft Act* 1963 (Tas.); ss. 2(1)(4)(5) *Damage by Aircraft Act* 1952 (N.S.W.); s. 4 *Damage by Aircraft Act* 1964 (W.A.); s. 40(1) *Civil Aviation Act* 1949 (U.K.); s. 23 *Civil Aviation Act* 1964 (N.Z.); *The American Uniform State Law of Aeronautics* 55 (U.S.); *Civil Aviation (Damage by Aircraft) Act* 1958 (Cth).

[96] *Bernstein's* case, op. cit. 143.

[97] Ibid.

[98] Ibid., and McNair, op. cit. (3rd ed.) 45-57 for English and American authorities, esp. cases mentioned Note 77. See also *Anderson* v. *Souza* 243 P. 2d 497 (1952).

[99] Aerial spraying or crop dusting activities may well fall within this area of ordinary user as they are conducted at much lower altitudes than cloud seeding. Such activities are also unlikely to be considered as an "ordinary incident" of "mere flight".

[100] See *Hinman* v. *Pacific Air Transport* 84 F. 2d 755 (1936); *U.S.* v. *Causby* 328 U.S. 1062 (1946); *Scott* v. *Dudley* 214 Ga. 565; 105 S.E. 2d 752 (1959); *Griggs* v. *County of Allegheny, Pa.* 369 U.S. 84 (1962) cited in McNair, op. cit. (3rd ed.) 53. Furthermore U.S. cases often allege that compensation should be paid for easements taken by the state by virtue of the Fifth and Fourteenth amendments to the U.S. Constitution.

allowed when flight landing and take-off paths have run directly over a plaintiff's property sometimes at altitudes of as low as five feet. However such actions are in respect of flights which are causally unconnected with damage caused by weather modification, but may possibly work to prevent such flights over a plaintiff's land with some ameliorative effect upon the activities, should no other cause of action be available. Clearly, the value of such an action would be marginal.

(b) Intrusion of weather phenomena

As mentioned above, most weather modification involves the emission of chemical particles either from airplanes, rockets or ground generators with the intention that these particles should attract water, then fall to the ground.[101] It is arguable that the entry of particles into the plaintiff's airspace, either as a result of having been intentionally directed over the land by the use of prevailing weather conditions, or machinery, or by falling with the effect of gravitational force from the higher stratum, may amount to an intrusion into a landowner's airspace especially if there is collision between the particles and the ground.[102] The recent decision of the Queensland Supreme Court in *Graham* v. *K.D. Morris Pty Ltd*[103] made it clear that trespass may lie for an intrusion into airspace up to three hundred and sixty feet above the ground, even if there is no actual contact between the intruding object and the plaintiff's land.

It was also noted that the entry of particles into the lower stratum, especially when this occurs after moisture has been accumulated by particles in the upper stratum, may be insufficiently direct owing to the intervention of, for example, the wind or other intermediate forces.[104] Although intrusions resulting from activities at a considerable distance from the plaintiff's land may similarly be consequential, if the seeding takes place not far above or beside the plaintiff's land or airspace, the facts may be closer to *Kenyon* v. *Hart*[105] where Blackburn J. held that the act of shooting a pheasant so that it falls on someone else's land will amount to trespass. The joint action of a bird falling to the ground with the bullet in it is closely analagous to a raindrop being absorbed from the air by a particle[106] and falling to the ground with the particle inside it. Although one raindrop would be unlikely to cause any harm, any loss or damage caused by the combined action of a number of droplets formed by particles

101 See Stark, op. cit. 702; McKenzie, op. cit. 392-5, Taubenfeld, op. cit. and Thomas, op. cit. generally.
102 See *Nicholls* v. *Ely Beet Sugar Factory* [1931] 2 Ch. 84 where trespass was held when water was poured directly into the plaintiff's property.
103 [1974] Qd. R. 1. See also *Kelsen* v. *Imperial Tobacco Co.* [1957] 2 Q.B. 334, and *Woollerton & Wilson Ltd* v. *Richard Costain Ltd* [1970] 1 W.L.R. 411.
104 See supra 132-133.
105 (1865) 6 B. & S. 257; 122 E.R. 1188.
106 The actual process involves the gradual accumulation of atmospheric moisture by the particle until it becomes sufficiently heavy to fall.

projected or dropped into the plaintiff's airspace by the defendant weather modifier's activities may very well be held to be recoverable in trespass.

In a pertinent U.S. decision, *Martin* v. *Reynolds Metals Co.*,[107] the court defined trespass broadly as:

> ". . . any intrusion which invades the possessor's protected interest in exclusive possession, whether that intrusion is by visible or invisible pieces of matter or by energy which can be measured only by the mathematical language of the physicist."[108]

This was an action for trespass by a landowner against an aluminium manufacturer alleging that fluoride compounds in the form of gases and particles had, by the operation of the defendant's plant, become airborne and settled on the plaintiff's land rendering it unfit for raising livestock during a certain period. The court held that the intrusion of the fluoride particles did constitute trespass.[109] This decision was reached after a comprehensive consideration of the United States authorities[110] which, similar to English authorities in this area,[111] have held that trespass to land occurs in circumstances such as the dropping of molten lead particles,[112] the falling of spray from a cooling tower,[113] and the settling of soot and carbon from a mill.[114] Likewise, in cases involving gunshot passing over and also falling onto land,[115] trespass has been found. Furthermore, the fact that trespass has been found in U.S. cases involving vibration of the soil and concussion of the air,[116] provided the court with additional support and breadth for this definition.

Assuming the applicability of this definition to Australian cases, there would be little difficulty in encompassing within its scope artificially created rainfall or snowfall which is of course an integral factor in most intentional climatic alteration. Similarly, where there is no intrusion of

[107] 342 P. 2d 790 (1959).
[108] Ibid. 794.
[109] Ibid.
[110] Ibid. 792-5.
[111] McNair, op. cit. (1st ed.) 13-27 and (3rd ed. 1964) 34; see also Fleming, op. cit. 43-5.
[112] *Young* v. *Fort Francis Pulp and Paper Co., Canada* (1919) 17 Ont. W.N. 6.
[113] *Van Alstyne* v. *Rochester Telephone Corp.* 163 Misc. 258; 296 N.Y.S. 726 cited in *Martin* v. *Reynolds* op. cit. fn. 107, at 793.
[114] *B. & R. Luncheonette, Inc.* v. *Fairmont Theatre Corp.* 278 App. Div. 133, 103 N.Y.S. 2d 747 cited in *Martin* v. *Reynolds* op. cit. fn. 107, at 793.
[115] *Munro* v. *Williams* 94 Conn. 377; 109 A. 129; 13 A.L.R. 508; *Peters* v. *Ambridge District Sportsmen's Ass'n.* 121 Beaver Pa. 99 (1952); *DiGirolamo* v. *Philadelphia Gun Club* 371 Pa. 40; 89 A. 2d 357 (1952); *Whittaker* v. *Stangvick* 100 Minn. 386; 11 N.W. 295 (1907); *Portsmouth Harbor Land & Hotel Co.* v. *U.S.* 260 U.S. 327 (1922). All cited in *Martin* v. *Reynolds* op. cit. fn. 107, at 793.
[116] *McNeill* v. *Redington* 67 Cal. App. 2d 315; 154 P. 2d 428 (1945); *Bedell* v. *Goulter* 199 Or. 344; 261 P. 2d 842 (1953). Fleming, op. cit. 40 rejects the factual distinction sometimes made between damage caused by rocks projected from blasting and vibration damage from, for example, pile driving, though supports it on the policy ground that trespass should be limited as much as possible to physical intrusions and not encroach upon nuisance, which is better adapted to adjudicating competing claims of landowners to the enjoyment and exploitation of their land.

particles, it is possibly arguable from *Martin's* case[117] that since an intrusion of energy or other intangible phenomena may be held to be a trespass, it is likely that the invasion of airspace by high winds or electrical energy in the form of lightning, caused by seeding elsewhere, as well as the more obviously physical manifestations of weather, could be actionable in trespass. Furthermore, subject to acceptance of scientific proof of causation, the deprivation of natural atmospheric benefits may also be actionable in trespass despite lack of an obvious physical manifestation since, for example, a transference of airborne moisture by wind or other meteorological force has a measurable physical cause and effect although the physical repercussions thereof move from the plaintiff's property to somewhere else rather than the converse. This understanding of causation would give considerable scope for the application of the law of trespass to weather modification activities.

It should also be noted that the abnormal sensitivity of the plaintiff's use of his land or the delicacy of his trade which prevents recovery in nuisance,[118] does not limit actions in trespass. Thus where a plaintiff is, for example, attempting to grow crops such as dates, which require very low rainfall, then the fact that this use of his land is particularly sensitive to rainfall damage would be irrelevant in an action for trespass.

*Trespass to the person*

As mentioned above, personal injury may be occasioned by weather phenomena such as artificially created lightning, wind, snow or rain. The application of the general principles of the law of trespass and the availability of an action in negligent trespass have been discussed above.[119] However, for an action in civil assault or battery, no actual and immediate physical contact with the person of the plaintiff is required, so long as there is some positive act by the defendant, which in turn causes offensive contact of something with the person of the plaintiff in a battery action, or mere apprehension of such contact in an assault action.[120] This is significant in a weather modification context where the defendant will never have come into immediate physical contact with the plaintiff, but only through the agency of certain artificially created weather phenomena.

Finally, the weather modifier must have either intended or been substantially certain that offensive contact or apprehension of contact would take place.[121] Hence, the intention to make rain, snow, hail or lightning fall in a particular area which is densely populated would likely be sufficient

117 *Martin* v. *Reynolds Metals Co.* 342 P. 2d 790 (1959).
118 *Don Brass Foundry Pty Ltd* v. *Stead* (1948) 48 S.R. (N.S.W.) 482; *Amphitheatres Inc.* v. *Portland Meadows* 198 P. 2d 847; 5 A.L.R. 2d 690 (1948); *Noyes* v. *Huron & Erie Mortgage Corp.* [1932] 3 D.L.R. 143. See also Fleming, op. cit. 40, 406.
119 See supra 131 ff.
120 Fleming, op. cit. 23-4.
121 See *R.* v. *Larkin* [1943] 1 All E.R. 217, 219 esp. per Humphreys J.

to justify an action in assault or battery. However the intention to cause the same effects in a sparsely populated area would be much less certain to cause physical contact or the apprehension of this, and consequently unlikely to justify a finding in trespass to the person.

*Trespass to goods*

Personal property may be damaged by weather phenomena in the same way as land or the crops growing on land. Naturally, there is no airspace around goods which is ownable by virtue of the ownership of the goods themselves. Nonetheless the general principles of the law of trespass apply to interference with or damage to goods by direct and immediate acts of weather modification, although unintended interferences are not recoverable in the absence of negligence[122] and ascertainable damage is quite likely to be considered essential.[123]

Ownership of the air

The ownership of airspace has already been considered in terms of the land to which it is superadjacent. The question may then arise as to whether or not the air within the airspace is subject to any personal property rights. The air is composed of various substances, with water in a gaseous state being, in general, the major component. This percentage of atmospheric moisture varies from time to time and from one place to another, and it is the manipulation of this atmospheric moisture which weather modification is primarily concerned with.

(a) *Ad coelum* doctrine and historical factors

The *ad coelum* doctrine is the source of present law with respect to airspace, but it has never been applicable to the contents of airspace, with the air or, *aer*, being distinct from airspace, that is, *coelum* or *spateum*,[124] this latter concept being descriptive of the block of space superadjacent to any block of land, the legal protection of such space being essentially the same as that granted to the land below. However the air itself is a "substance" flowing through airspace while airspace is merely a legally defined spatial area within which rights may or may not be protected according to the circumstances.

The air, like water flowing in streams, has been classified by Pothier as "negative community"[125] and *res communis*, therefore incapable of being privately owned, although historically in civil law and common law every member of the community had at least a limited right of user in

[122] *N.C.B.* v. *Evans* [1951] 2 K.B. 861; see also Fleming, op. cit. 50.
[123] *Everitt* v. *Martin* [1953] N.Z.L.R. 298.
[124] McNair, op. cit. (1st ed. 1932) 14-15.
[125] From Pothier's *Traite de Droit Du Proprieté* No. 21 quoted in *Geer* v. *Connecticut* 161 U.S. 519, 525 (1895-96) and cited by S. D. Clark and I. A. Renard, *The Law of Allocation of Water for Private Use* Vol. 1 Australian Water Resources Council, Research Project 69-76 Melb. 1972, 54 and McKenzie, op. cit. 405.

respect of natural resources such as air and water.[126] This right of user was not so extensive as a property owner's right to exclusive possession of his property.

As mentioned above,[127] some U.S. cases assert that landholders have property related rights to the moisture in the atmosphere above their land. Furthermore, it has been suggested that some weather modification activities involve the taking of atmospheric moisture from one region and using it in another. In the U.S.A. this has been quaintly referred to as "cloud rustlin' " implying the existence of private property rights in clouds which are after all only concentrations of atmospheric moisture. The doctrine of prior appropriation has been forwarded as justification for possessory property rights in clouds.

(b) Prior appropriation

This doctrine, which is the basis for English law relating to animals *ferae naturae* and American law with respect to oil and gas deposits and water rights in some states of the United States, was earlier in the history of rain-making suggested as the reason why clouds could be owned.[128] Clouds have been likened to a flight of wild ducks, the ownership of which is acquired by making them fall to the ground.[129] As simplistically appealing as the theory may be, it is scientifically fallacious in that it wrongly assumes physical capture and hence possession of atmospheric moisture to be possible in the same way as it is with wild animals.[130] It is rightly rejected today[131] on the additional ground of being contrary to public interest owing to the necessity of rainfall and moisture in preserving all life on earth.[132] Similarly, the public interest in the preservation and management of natural resources for the community at large has been the reason why this doctrine has not been applied to allow private ownership of oil and gas deposits in Australia.[133]

It is therefore unlikely that the courts would favour any assertion of

126 Clark and Renard ibid. 55.
127 See supra 127.
128 Brooks, op. cit. 119.
129 Ibid.
130 It is based on a visual rather than physical understanding of the nature of clouds which have no definite corpus, being merely transient concentration of atmospheric moisture.
131 McKenzie, op. cit. 407-8.
132 The doctrine asserted that legal title to animals *ferae naturae*, oil and gas deposits, and percolating and surface waters in some states of the U.S., was acquired by the first person to appropriate or make use of the resource. See "The Weathermaker and the Law", op. cit. 117; Oppenheimer, op. cit. 320; M. R. Kirkwood, "Appropriation of Percolating Waters" (1948) 1 *Stan. L.R.* 1; "Who Owns the Clouds", op. cit. 44. However the importance of rainfall and moisture in sustaining life seems to have been a factor in the rejection of this theory as contrary to the public interest.
133 Oil and gas reserves on land in Australia have been generally subjected to complete Crown ownership by state legislation. See A. G. Lang and M. Crommelin *Australian Mining and Petroleum Laws* (Melbourne, Butterworths, 1979) 20.

ownership of atmospheric moisture in support of an action of trespass or conversion thereof, based on a prior appropriation, or "first-in-first-served", argument.

## NUISANCE CAUSED BY WEATHER MODIFICATION

Whereas the law of trespass governs invasions of interests in the exclusive possession of land, the law of nuisance is primarily concerned with invasions of an occupier's interest in the beneficial use and enjoyment of land.[134] Fleming asserts that although there is confusion as to the meaning of the term "nuisance", it is preferable that it be used to denote the type of harm resulting from human activity or condition rather than the activity or condition itself and the description of an injury or an activity as a nuisance is thus insufficient in itself to attach liability in respect of activities responsible for the nuisance.[135]

There are two separate forms of action in nuisance, public and private. Although their origins are quite distinct, developments in the law have resulted in a convergence of their applications.[136] Private nuisance is actionable for actual damage to the plaintiff's property, or for unreasonable interference with the use and enjoyment of land[137] and any injury incidental thereto.[138] Public nuisance is a criminal offence involving a breach of a duty imposed by statute or at common law. It is actionable either by (a) the Attorney-General on behalf of the public, or (b) a private individual who sustains a "particular" damage,[139] including personal injury and other losses, although no rights in land have been invaded at all.[140] While trespass is actionable only in respect of direct physical intrusions, the interference complained of in all nuisance actions may be consequential to the activities which caused the nuisance.[141]

In the weather modification scenario, the nature of harm suffered by a prospective plaintiff is either (a) loss of, or injury to, the natural state of the weather, as a grievance in itself, or (b) loss or injury as the result of a change made to the natural state of the weather. Since damage is essential to actionable nuisance, the latter grievance would be the more likely, although damage is not insisted upon when to do so would expose the plaintiff to the risk of the creation of a prescriptive right[142] against

134 Fleming, op. cit. 393.
135 Ibid.
136 Ibid. 394-5.
137 *Halsey* v. *Esso Petroleum Co. Ltd* [1961] 1 W.L.R. 683.
138 *Walter* v. *Selfe* (1851) 4 De G. & Sm. 315; 64 E.R. 849.
139 "[P]articular damage . . . beyond that suffered by the public generally": *Walsh* v. *Ervin* [1952] V.L.R. 361, 368 per Sholl J. See P. F. P. Higgins *Elements of Torts in Australia* (Melbourne, Butterworths, 1970) 152.
140 Fleming, op. cit. 395.
141 *The Wagon Mound (No. 2)* [1967] 1 A.C. 617 where the same test of reasonable foreseeability of injury in negligence was applied to all cases of nuisance.
142 Rights to discharge rainwater on adjoining land (*Harvey* v. *Walters* (1873) L.R. 8 C.P. 162) and to pollute a water course (*Hulley* v. *Silversprings Bleaching Co.* [1922] 2 Ch. 268) have been acquired by prescription.

him. However, it is virtually impossible in the context of weather modification for a prescriptive right or easement over the plaintiff's land to come into existence, owing to the fact that there must be certainty, uniformity and continuity of the user constituting the prescriptive right or easement. To maintain such rigid and continuous control over weather phenomena is unthinkable at the present state of development of the science.

Consequently, nuisance may only be actionable in respect of loss or injury resulting from a change made to the natural state of the weather, with private nuisance being the cause of action when the injury is or results from actual damage to property or an invasion of a person's interest in the beneficial use and enjoyment of land, and public nuisance possibly being actionable where "particular" injury is suffered by the plaintiff despite there being no interference with any interest of the plaintiff in land.

*Public Nuisance*

For a nuisance to be a public nuisance it

> "must seriously interfere with the health, convenience or comfort of the public generally, and must, therefore, actually effect a not inconsiderable number of people, or interfere with the rights which members of the community might otherwise enjoy."[143]

In relation to weather modification, it is quite conceivable that climatic phenomena could be influenced so as to have an effect upon, or interfere with, the rights of a considerable number of people, for example, to use their leisure time or land in the manner they desire or to disrupt communications and mobility generally.

Standing to sue

The plaintiff in public nuisance is primarily an official such as the Attorney-General since public nuisances are criminal offences involving a breach of duty either imposed by statute or the common law. A private person may bring a civil action for damages in respect of a public nuisance, provided he has the consent of the Attorney-General or has sustained "particular damage . . . beyond that suffered by the public generally".[144] There is some ambiguity as to the nature of the particular injury that the plaintiff must have suffered in order to have standing to sue in public nuisance.[145] However in the great bulk of cases such actions would allege either personal injury or pecuniary loss.[146] In cases where someone has been forced to make a detour and been caused delay and trouble, it seems that some added expense must be involved in order to

[143] Per Greeson J., *A.-G.* v. *Abraham & Williams Ltd* [1949] N.Z.L.R. 461, 484 see also Romer L.J., *A.-G.* v. *P.Y.A. Quarries Ltd* [1957] 2 W.L.R. 770, 780.
[144] Per Sholl J., *Walsh* v. *Ervin* [1952] V.L.R. 361, 368.
[145] See Fleming, op. cit. 376-97.
[146] E.g. *Slutsky* v. *City of New York* 97 N.Y.S. 2d 238 (1950) cited and discussed in Oppenheimer, op. cit. 318, where a tourist resort owner suffered economic loss as a result of weather modification activities.

establish an injury of a different kind to that suffered by the general public, as distinct from a mere difference in degree.[147] The distinction is not clear and there is a tendency to reject it today subject to the occasioning of a more "particular" injury to the plaintiff.[148] In *Martell & Others* v. *Consett Iron Co. Ltd*,[149] the fishing rights of members of an unincorporated association were protected in respect of the pollution of a river. Similarly, it may be argued that skiing clubs could support an action in respect of the diminution of snow on ski fields caused by weather modification or cricket clubs may recover in respect of the cancellation of a major cricket match owing to the activities of rain-makers. In these cases there may also be a certain amount of economic loss suffered by clubs or individual members, which may be recoverable.

Clearly, the climatic effects of the modifier's activities must be of sufficient gravity to meet the criteria of public nuisance. The pollution analogy would normally more easily satisfy this requirement. Naturally, the mere creation of aesthetically unappealing climatic conditions would be unlikely to be of sufficient gravity unless the conditions become offensive.[150] On the other hand, the mere obstruction of a view has been held to be "special damage" sufficient for an action in public nuisance.[151]

However, a factor which would seriously restrict recovery in borderline cases of sufficiency of damage would be that many weather modification programmes substantially benefit a large sector of the community and private rights will be overshadowed in these circumstances.[152] In the case of pollution, the economic benefits of the activity to which the pollution is incidental may reside more in small groups or individuals than the general public.

*Private Nuisance*

A plaintiff in private nuisance must allege either (a) actual damage to property, which includes chattles,[153] or (b) unreasonable interference with the beneficial use and enjoyment of land.

Standing to sue

In private nuisance standing must be based upon a plaintiff's actual

147 *Blundy, Clark & Co. Ltd* v. *L.N.E. Rly Co.* [1931] 2 K.B. 334 (bargemen forced to unload wares and transport overland). Cf. *Winterbottom* v. *Derby* (1867) L.R. 2 Ex. 316 (traveller delayed) and *Walsh* v. *Ervin* [1952] V.L.R. 361 (farmer deprived of normal access to adjacent holding).

148 Fleming, op. cit. 397. The injury can be different either in kind or, possibly, in degree if it is more proximate or direct than the injury to the general public.

149 [1955] 1 Ch. 363.

150 *Kent* v. *Cavanagh* (1973) 1 A.C.T.R. 43, 53-4 where Fox J. considered that unsightliness could in some circumstances become offensive, thereby amounting to public nuisance.

151 *Campbell* v. *Borough of Paddington* [1911] 1 K.B. 869.

152 *Slutsky* v. *City of New York* 97 N.Y.S. 2d 238 (1950) (water supply to City of New York more important than resort owner's loss of custom).

153 *British Celanese Ltd* v. *Hunt* [1969] 1 W.L.R. 959.

possession[154] of an interest related to the occupation of land, including incorporeal hereditaments and tenancies.[155] Although the minimum interest in land required to provide standing for suit in private nuisance has not been clearly and authoritatively decided in Australia, it appears that a mere licensee in actual possession of land may have standing provided that the possession is exclusive and not temporary or fleeting.[156]

The nuisance alleged must be an actual injury to property or land[157] or an unreasonable and substantial interference with the beneficial use and enjoyment of land. Although there has been some suggestion that the onus of proof of reasonableness of the defendant's activities is upon him, the better view appears to be that all elements of the tort, including the unreasonableness of the interference, must be proved by the plaintiff on the balance of probabilities.[158] However, it is possible for the defendant to escape liability if he can establish that the use of his land was reasonable or "natural".[159] Nuisance arising from the ordinary user of premises may be actionable provided the nuisance could reasonably have been avoided by the defendant.[160] Thus, even if the carrying out of weather modification operations was held to be an ordinary or natural user of land,[161] liability for nuisance will attach only if the interference or damage was known or reasonably foreseeable to the defendant and could reasonably have been avoided.

154 Although a reversionary interest will be sufficient when permanent damage is being caused to the land or structures thereon or when a recognized prescriptive right or easement over the land is likely to be created.

155 Fleming, op. cit. 399, 408. Even tenants of land can maintain an action in nuisance: *Burgess* v. *City of Woodstock* [1955], 4 D.L.R. 615, but not a licensee without possession nor a member of the tenants family: *Cunard* v. *Antifyre Ltd* [1933] 1 K.B. 551.

156 *Paxhaven Holdings Ltd* v. *A.-G.* [1974] 2 N.Z.L.R. 185. For an examination of relevant authorities see S. W. Kaye, *The Nuisance Action for Pollution* (unpublished LL.B. Hons. thesis, Law Library, Monash University 1973) 67-72.

157 See *Bamford* v. *Turnley* (1862) 3 B. & S. 66; 122 E.R. 25; it was held that reasonableness of the defendant's conduct is irrelevant in relation to nuisance consisting of damage to property.

158 For a discussion as to whether reasonableness of user is a defence or an element of the tort imposing the burden of proof on the plaintiff see S. W. Kaye, op. cit. 91-6.

159 Ibid. and Fleming, op. cit. 406-8. Also *Kraemers* v. *A.-G. for Tas.* [1966] Tas. S.R. 113.

160 *Leaky & Ors.* v. *National Trust etc.* [1978] 2 W.L.R. 774 where it was held that the erosion of land due to natural causes was actionable in nuisance as the landowner was aware of the erosion and could have taken steps to prevent it. See also *Trans Mountain Pipeline Co. Ltd* v. *Nicola Valley Sawmills Ltd* (1976) 62 D.L.R. (3d) 279 where the plaintiff recovered in nuisance and *Rylands* v. *Fletcher*. It was held to be reasonably forseeable that the creation of a network of trails by the defendant's logging operation would collect the surface run-off of melting snow and could result in the washing out of the plaintiff's pipeline, and such could easily have been prevented.

161 See *Rylands* v. *Fletcher* (1866) L.R. 1 Ex. 265; affd. (1868) L.R. 3 H.L. 330 (accumulation of water in a reservoir) and *Simpson* v. *A.-G.* [1959] N.Z.L.R. 546 (accumulation of water in drains). Both have been held to be dangerous and a non-natural user of land.

## Competing Interests

The necessity that the interference be unreasonable formulates the basic function of the law of nuisance, namely, the balancing of competing interests in the beneficial use and enjoyment of land.

> "A balance has to be maintained between the right of the occupier to do what he likes with his own, and the right of his neighbour not to be interfered with."[162]

Fleming asserts: "The essential question is, is he using it [the land] reasonably, having regard to the fact that he has a neighbour?"[163] In seeking the answer to this question, various circumstances surrounding the nuisance are considered: the time and duration of the nuisance, the nature of the activities and the locality.[164] However, the basic competition is between the utility of the defendant's conduct and the gravity of the harm suffered by the plaintiff.[165]

The significance of the competition between the utility of the defendant's conduct and the gravity of the plaintiff's harm is especially apparent in actions in respect of weather modification activities since very often their purpose will be the elimination of the disastrous effects of droughts, the augmentation of snow-pack or water catchment with a view to the provision of resources for hydro-electric power or leisure activities such as snow and water skiing. On the other hand, weather modification programmes are carried out by governments for experimental purposes and by private interests pursuing primarily the goal of increased profits. In the last case, where self interest is the main purpose, liability for nuisance is more likely.[166]

As was seen above,[167] decisions in the United States have given legal recognition to the public benefit arising from weather modification activities and ordained its priority over private interests in certain cases.[168] However, since private nuisance deals with the rights of private individuals, the significance of the public benefit in the defendant's activities should not be so favoured as to inflict significant harm upon the plaintiff.[169] On the other hand, where the interference is malicious and without any social benefit, it may result in liability despite it being privileged in other

[162] *Sedleigh-Denfield* v. *O'Callaghan* [1940] A.C. 880, 903 per Lord Wright.
[163] Fleming, op. cit. 401.
[164] E.g. *Halsey* v. *Esso Petroleum Co. Ltd* [1961] 1 W.L.R. 683; *Don Brass Foundry Pty Ltd* v. *Stead* (1948) 48 S.R. (N.S.W.) 482.
[165] Fleming, op. cit. 402-5.
[166] E.g. *Penno* v. *Government of Manitoba* (1976) 64 D.L.R. (3d) 256, where a landowner in the course of constructing a flood-control system, lowered the water table under the plaintiff's land resulting in him being unable to grow crops of the same quality as before.
[167] See supra 129 ff.
[168] *Slutsky* v. *City of New York* 97 N.Y.S. 2d 238 (1950) *Pennsylvania Natural Weather Association* v. *Blue Ridge Weather Modification Association* 44 Pa. D. & C. 2d 749 (C.P. Fulton Cy. Pa. 2 February 1968) cited and discussed in Thomas, op. cit. 40.
[169] *Munro* v. *Southern Dairies Ltd* [1955] V.L.R. 332, 337.

circumstances, such as when the attempt to abate a nuisance exceeds the original nuisance.[170]

Substantial harm to the plaintiff is also an essential element of the tort of private nuisance. Minor property damage is sufficient, since it is easily measured and observed.[171] However, in cases of personal discomfort the gravity of the harm is established by asking the question:

> ". . . ought this inconvenience to be considered in fact as more than fanciful, more than one of mere delicacy or fastidiousness, as an inconvenience materially interfering with the ordinary comfort physically of human existence . . . according to plain and sober and simple notions among the English people?"[172]

As a general rule it appears that the mere instigation of an unwanted shower of rain, fall of snow or occurrence of other climatic phenomena, in the absence of other injury of a more easily ascertainable nature, would not justify a finding that substantial interference with the beneficial use and enjoyment of land has occurred. Certainly, although recurrence of the nuisance is not always essential, a slight or temporary injury may be elevated in gravity by its continuing nature.[173] Thus where weather manipulation has occurred on several occasions and created or exacerbated prevailing meteorological conditions so that considerable damage results consequentially from the total of the activities,[174] recovery may be had in nuisance.

However, in the situation where no property damage to land, crops, structures or other goods has been occasioned, and the continuous nature of the nuisance has not been sufficient to be regarded as a substantial interference with the beneficial use and enjoyment of land, can any other allegation of rights violated by weather modification activities be made?

## The Natural Rights Theory

This right to the reasonable use and enjoyment of land, protected by an action in nuisance has also been described as an established "natural right" of land.[175] As such, it is one of several "natural rights" recognized in respect of the ownership or occupation of land.[176] Although private nuisance is primarily actionable in respect of the unreasonable and substantial interference with the beneficial use and enjoyment of land, it

[170] *Christie* v. *Davey* [1893] 1 Ch. 316 (hammering against a wall to interrupt a neighbour's music lesson).
[171] *McKenzie* v. *Powley* (1916) S.A.L.R. 1, 14-15.
[172] *Walter* v. *Selfe* (1851) 4 De G. & Sm. 315, 322; 64 E.R. 849, 852 per Knight Bruce V.-C.
[173] *Halsey* v. *Esso Petroleum Co. Ltd* [1961] 1 W.L.R. 683.
[174] E.g. *Adams* v. *State of California* Docket No. 10112 Sutter County Superior Court Calif. 6 April 1964, cited and discussed in references at fn. 5 and fn. 36.
[175] *Hurdman* v. *North Eastern Railway Co.* (1878) 3 C.P.D. 168, 173 cited in *Rouse* v. *Gravelworks Ltd* [1940] 1 K.B. 489, 500-1.
[176] E.g. to the subjacent and adjacent support of land, to riparian waters, to air and light, rights to way; see Higgins, op. cit. 166-74; R. E. Megarry and H. W. R. Wade *The Law of Real Property* (3rd ed., London, Stevens & Sons, 1966) 809 ff.

is also actionable to protect various other "natural rights" of land.[177] The decisions in the *Southwest Weather* cases[178] were that the plaintiff landholders had "natural rights" to natural weather and to rainfall coming from clouds above their properties and also that the alteration of the weather so as to deprive the land of its natural benefits was sufficient injury to warrant the granting of an injunction. The decision in the *Blue Ridge* case[179] confirmed that landholders have property rights in the airborne moisture above their land. However, as was established earlier,[180] these property rights in respect of atmospheric moisture are not in the nature of rights to its exclusive or immediate possession. Similarly, the *ad coelum* doctrine does not authorize the ownership of the contents of airspace by the owner of the airspace. Thus it is unlikely that a right to airborne moisture based on it being part of airspace and therefore part of a land holding could be justified.[181] Hence, if there is a "property-related" right to natural weather and airborne moisture above land, it may be based on one of the "natural rights" inherent in the ownership or occupation of land, as suggested in the *Southwest Weather* cases.

Megarry and Wade define a "natural right" in respect of real property as "simply a right protected by the law of tort".[182] They consider that "natural rights" of landowners are to "riparian waters",[183] adjacent and subjacent support of land, but not to support for buildings, nor to light and air.[184] However, Higgins recognizes that in Australia there are rights to light and air.[185] Legal theorists in the United States assert that there is an independent "natural right" to diffused air coming onto land in a reasonably natural state, free from dust, smoke, noise, vibration and other pollution.[186] The existence of a comparable right in Australia may be founded upon (a) the common law right to air in a reasonably natural state free from pollution and (b) a "natural right" to the vertical access of air onto land. A "natural right" similar to the one suggested by U.S. theorists, may, without too much difficulty, encompass unreasonable interferences with air or atmospheric moisture including attempts by

177 See Higgins, op. cit. 166-74.
178 See supra 127 and fnn. 38, 39, 40.
179 See supra 128.
180 Supra 142.
181 Supra 141-142.
182 Megarry and Wade, op. cit. 811.
183 An owner whose land abutts a stream or river has riparian rights in respect of the water flowing therein.
184 Megarry and Wade, op. cit. 809-12, 870-4. Gale is cited by Megarry and Wade as authority for the fact that there are no general easements for light and air, though McNair, op. cit. (3rd ed. 1964) 60 cites *Gale on Easements* as authority for a "natural right" to perpendicular, as distinct from lateral, light falling onto land.
185 Higgins, op. cit. 167-70.
186 "Who Owns the Clouds", op. cit. 52, 55 citing Tiffany *The Modern Law of Real Property* (3rd ed. 1939) 717 and *Evans* v. *Reading Chemical Fertilizer Co.* 160 Pa. 209; 28 A. & I. 702 (1894). Also McKenzie, op. cit. 408, citing R. S. Hunt, "Weather Modification and the Law" in *Weather Modification Science and Public Policy* (ed. 1969) 125-8.

weather modifiers to alter the natural state of the weather. First, it should be noted that although weather may be inadvertantly altered by, for example, the construction of buildings in such a way as to create wind tunnels, causing an increase in wind velocity and resultant damage to property, personal injury or the erosion of surface soil, the primary means of artificially altering the weather is by interference with the nature, composition or existence of airborne moisture. Second, air is composed of various gases, atmospheric moisture making up a large percentage of it. Thus interference with atmospheric moisture by introducing an alien substance is interference with the air itself, in a not too dissimilar manner to pollution being an interference with the air.

(a) Air pollution

A right to sue in private nuisance in respect of (a) property damage[187] and (b) unreasonable interference with the beneficial use and enjoyment of land,[188] caused by air pollution has been established in a number of English and Australian cases. Actions in public nuisance have also been upheld.[189] Although the smells, fumes or smoke need not be so severe as to be injurious to health, for recovery in either private[190] or public[191] nuisance, it is required that, in the absence of material injury, the interference to the beneficial use and enjoyment of property at least comply with the test of Knight Bruce V.-C., in *Walter* v. *Selfe*, and be

> ". . . an inconvenience materially interfering with the ordinary comfort physically of human existence, not merely according to elegant or dainty modes and habits of living, but according to plain and sober and simple notions among the English people. . . ."[192]

There it was held that the plaintiff was entitled to an untainted and unpolluted stream of air at least not rendered incompatible with the physical comfort of human existence.

Consequently, the right to unpolluted air is recognized, but no right to the weather in its natural state is spelled out. However, it could be inferred from these cases that suit may lie when the climatic aberrations are the consequence of pollution which could have been actionable itself as an unreasonable interference with the beneficial use and enjoyment of land.[193]

187 *St. Helen's Smelting Co.* v. *Tipping* (1865) 11 H.L. 642; 11 E.R. 1483 (gases from smelting works); *Halsey* v. *Esso Petroleum Co. Ltd* [1961] 1 W.L.R. 683 (fumes from petrol depot).

188 *Walter* v. *Selfe* (1851) 4 DeG. & Sm. 315; 64 E.R. 849; *Don Brass Foundry Pty Ltd* v. *Stead* (1948) 48 S.R. (N.S.W.) 482 (fumes from iron foundry); *Kidman* v. *Page* [1959] Qd. R. 53 (dust and noise from trucks on highway).

189 *Munro* v. *Southern Dairies Ltd* [1955] V.L.R. 332 (smells from stalls); *Baulkham Hills Shire Council* v. *A.V. Walsh Pty Ltd* [1968] 3 N.S.W.R. 138 (smells from offal reducing plant).

190 *Walter* v. *Selfe* (1851) 4 DeG. & Sm. 315, 321; 64 E.R. 849, 851.

191 *Bishop Auckland Local Board* v. *Bishop Auckland Iron Co. Ltd* (1882) 10 Q.B.D. 138 (fumes from steel works).

192 *Walter* v. *Selfe* (1851) 4 DeG. & Sm. 315, 321-2; 64 E.R. 849, 851-2.

193 See supra 124.

Naturally, according to the ordinary principles of reasonable forseeability of the type of damage occasioned, established in *The Wagon Mound (No. 2)*,[194] it may be difficult to attach liability for the changing of weather phenomena or harm arising from such changes, when the climatic aberration is the result of air pollution.

However, it may not be unreasonable to infer from these cases that where property damage or the unreasonable interference with the use and enjoyment of land results not from pollution but from other activities interfering with the natural composition of the air,[195] the court will allow recovery.

(b) Vertical Access of Air

"Natural rights" in relation to land are recognized in English law as being in the nature of easements or quasi-easements, though a "natural right" exists automatically, whereas an easement is generally acquired.[196]

Easements in respect of air coming onto land have been rejected on the premise that they are incapable of precise definition[197] and on the authority of nineteenth century cases where the right to the flow of air across adjoining land has been held not to exist.[198] There is authority for the existence of air easements through a definite channel such as a ventilation shaft,[199] but such easements for the access of air through apertures have been abolished in Australia.[200]

In *Commonwealth* v. *Registrar of Titles for Victoria*,[201] the High Court held that a right to the uninterrupted access of light and air can exist independently as an easement, despite the fact that there were no reported decisions recognizing general easements for light and air.[202] Griffith C.J.

194 [1967] 1 A.C. 617.

195 See *Bernstein of Leigh (Baron)* v. *Skyviews and General* [1977] 3 W.L.R. 136, 143.

196 Megarry and Wade, op. cit. 811 and R. Sackville and M. A. Neave *Property Law Cases and Materials* (2nd ed., Sydney, Butterworths, 1975) 868-9, 901-2.

197 Megarry and Wade, op. cit. 809.

198 *Webb* v. *Bird* (1861) 10 C.B. (N.S.) 268; (1862) 13 C.B. (N.S.) 841; 142 E.R. 455; 143 E.R. 332 (general flow of air over land to a windmill); *Bryant* v. *Lefever* (1879) 4 C.P.D. 172 (general flow of air to a chimney); *Harris* v. *De Pinna* (1886) 33 Ch. D. 238 (general flow of air into a drying shed). However Megarry and Wade (op. cit. 809, fn. 15) recognize that the situation is different in Australia since *Commonwealth* v. *Registrar of Titles of Victoria* (1918) 24 C.L.R. 348 where an easement for the general access of air to a building was upheld.

199 *Bass* v. *Gregory* (1890) 25 Q.B.D. 481; and *Cable* v. *Bryant* [1908] 1 Ch. 259 where an easement for air through an aperture in the wall of a stable was upheld.

200 Legislation has been enacted in all Australian states to forbid the acquisition by prescription of easements to light through apertures e.g. s. 195 *Property Law Act* 1958 (Vic.); and similarly with respect to the user or enjoyment of the access of air through a defined aperture: s. 196. See Sackville and Neave, op. cit. 902.

201 (1918) 24 C.L.R. 348. The easement was defined on the title.

202 Ibid.; although Megarry and Wade, op. cit. 809, fn. 15 object that the three English cases mentioned in fn. 198 herein were not cited in this case, their objection to such easements as being incapable of definition seems to have been rejected here. Megarry and Wade do, however, agree that the categories of easements are not closed (op. cit. 807) and assert that Gale had listed 32 varieties of easements (ibid. fn. 83).

pointed out that the categories of easements were not closed and that easements with respect to "the sun's rays" and "a right to the free passage of moving air" were also possible.[203] Over sixty years later, Kraemer in *Solar Law* argues for the recognition of solar easements for the proper access of sunlight and heat to solar energy facilities.[204]

The *Registrar of Titles* case is at least authority for the common law existence and registration upon the title of the grant of a general, though geometrically definable, easement for the access of air. The nineteenth century English cases relied upon by Megarry and Wade were not referred to in the decison in the *Registrar of Titles* case, but rejected the right to acquire an easement for the general access of air across adjoining parcels of land, so as to prevent the exercise of rights consistent with reasonable beneficial use and enjoyment of these adjoining lands. These decisions are old and of only persuasive authority, while the decision of the High Court in the *Registrar of Titles* case is at least contemporary in its thinking. Griffith C.J. asserted that

> "In the olden days air was not thought of as a subject of property anymore than as a substance capable of being liquified or solidified. In the light of modern knowledge, however, there is no difference in principle between a right to the free passage of moving air to my windmill[205] and the free passage of running water to my watermill."[206]

It is significant to note the implied rejection of the English cases and the parallel to the water rights of a riparian landowner. However the decision does not go so far as to confirm the possibility of acquiring a right to air by prescription. On the other hand, nor do the English cases assert that the right to the *vertical* access of air cannot be acquired by prescription,[207] or exist as a "natural right" of land.

McNair suggests that a "natural right" may exist in regard to light falling perpendicularly onto land,[208] and Nicholls C.J. in *Davies* v. *Bennison* quotes Pollock as saying ". . . and it might be a nuisance to keep a balloon hovering over land even at a greater height [than the height of ordinary user]".[209] Except for the existence of the additional prescriptive right to "ancient lights" (lateral flow of light onto land) by twenty years continuous use,[210] the development of rights to light is essentially the same as with

[203] (1918) 24 C.L.R. 348, 354.
[204] Kraemer, op. cit. 33-43.
[205] This right was rejected in *Webb* v. *Bird* (1861) 10 C.B. (N.S.) 268; (1862) 13 C.B. (N.S.) 841; 142 E.R. 455; 143 E.R. 332.
[206] (1918) 24 C.L.R. 348, 354. See also the judgments of Gavan Duffy and Rich JJ., 355-6.
[207] The Torrens system of land registration may in some states of Australia and New Zealand preclude the creation of easements by prescription, though in Victoria and Western Australia this is clearly not the case. See Sackville and Neave, op. cit. 905-6.
[208] McNair, op. cit. (3rd ed. 1964) 60, citing Gale as authority and the *ad coelum* doctrine as source.
[209] (1927) 22 Tas. L.R. 53, 56.
[210] Recognized in Australia by the High Court in *Delohery* v. *Permanent Trustee Co.*

rights to air.[211] Therefore, since there is authority for a "natural right" to perpendicular light, it would seem not unreasonable for there to exist a "natural right" to air coming vertically onto land. Clearly any attempt to prevent the access of air vertically onto land must be actionable. The enjoyment of land would be otherwise impossible.

Thus despite the lack of direct authority, on the basis of common sense considerations, the analogy of the probable existence of a "natural right" to light falling vertically onto land and the authority that rights or easements for the general access of air and light, similar to the riparian owners right to the flow of water and streams across his land, exist at common law, then the proposition that a "natural right" to the vertical access of air to land exists as an independent right of property is not unreasonable.

(c) Riparian rights

Assuming that the right to the vertical access of air is a "natural right" of land, then it may be enforceable at law in a similar manner to a riparian owner's right to the natural flow of water in streams or rivers without appreciable dimunition or increase and without sensible alteration in its character or quality.[212] Thus an action will lie by a riparian owner for water pollution[213] independently of any interference with the beneficial use and enjoyment of land,[214] which is the basis for an action for air pollution.[215]

Riparian rights apply only between riparian owners[216] since persons not owning land adjacent to flowing water can possess no rights in respect of the water.[217] Thus by analogy to rights in natural air, all landholders would have the right, as air flows past each landholding, to draw upon the atmosphere for their ordinary or reasonable use provided no material

*of N.S.W.* [1904] 1 C.L.R. 283. See also *Allen* v. *Greenwood* [1979] 2 W.L.R. 187 where changes in the degree of light access were actionable.

211 See Higgins, op. cit. 166-74.

212 *John Young & Co.* v. *Bankier Distillery Co.* [1893] A.C. 691, 698; [1891-94] All E.R. Rep. 439, 441, per Lord Macnaghten. See also *Beaudesert Shire Council* v. *Smith and Others* [1966-67] 40 A.L.J.R. 211 and *Grant Pastoral Co. Pty Ltd* v. *Thorpe's Ltd* (1954) 54 S.R. (N.S.W.) 129; appd. (1955) 92 C.L.R. 317. Legislation in all Australian states (see Higgins, op. cit. 171) now controls riparian owners' water rights. Where the *Grant Pastoral* case implies that common law rights to sue for nuisance remain, the *Beaudesert Shire Council* case implies that this may not be so.

213 For a more comprehensive review of cases on water pollution see S. W. Kaye, op. cit. 29-34.

214 *Ballard* v. *Tomlinson* (1885) 29 Ch. D. 115 (sewage polluting underground waters).

215 *Lomax* v. *Jarvis* (1885) 6 L.R. (N.S.W.) 237 per Martin C.J. *Bidder* v. *Croydon Local Board of Health* (1862) 6 L.J. 778 (discharge of sewage into stream).

216 *H. Jones & Co. Pty Ltd* v. *Kingborough Corp.* (1950) 82 C.L.R. 282, 323 per Dixon J.

217 *Stockport Waterworks Co.* v. *Potter* (1864) 3 H. & C. 300, 326; 159 E.R. 545, 556 per Pollock C.B.

injury is occasioned to landholders who had not yet partaken of the benefit.[218]

Of necessity, analogies to the systems of law applicable to other "natural rights" will be superficial and subject to criticism and distinction. The recognition, however, of the parallel existence and nature of these rights is instructive in contemplating the potential protection likely to be afforded a "natural right" in respect of vertical air coming onto property.

Clearly changes to the quantity, quality and character of water are actionable.[219] Similarly changes in the temperature of water are actionable.[220] Consequently, it would not be unreasonable to suggest that a "natural right" to air coming vertically onto land includes the protection of the atmospheric moisture in its natural state, free from changes in quantity, quality and character.

The discussion in this area has been speculative, and the extent to which the courts would require substantial damage to have been occasioned to the plaintiff or the interest in land which the plaintiff must have in order to sustain such a claim is subject to even greater speculation. Nonetheless, the existence of the independent "natural right" of land to "natural" weather above it may be supportable on the grounds of common sense and established authority in respect of rights to air and its protection from pollution.

Statutory authority

Weather modification programmes may be carried out for experimental and commercial purposes by public authorities[221] and private bodies under legislative authority as well as by private bodies and individuals who may in some circumstances be in the possession of a permit under relevant legislation.[222] The significance of the possession of such a permit in ascertaining the public interest in the weather modifier's activities has been discussed earlier,[223] and it was seen that the mere possession of a permit would be insufficient to found a claim of legislative authority as a defence to an action in nuisance.

Where a statute or regulation made thereunder authorizes the nuisance complained of or where the nuisance is the direct or necessary and inevitable consequence of the activities authorized by the statute,[224] the statutory

218 See Clark and Renard, op. cit. 86-7.
219 See fn. 212.
220 *Hodgkinson* v. *Ennor* 32 L.J. Q.B. 231.
221 Public authorities enjoy a protection from liability in respect of non-feasance, i.e. failure to provide a service or benefit, and also in respect of misfeasance in drainage works or highway maintenance and repair.
222 E.g. *Farmers and Ranchers for Natural Weather* v. *Atmospherics Inc.* See unreported Civil No. 7594 (District Ct. Lamb. Cy. Texas, 3 May 1974) cited in Thomas, op. cit. 40.
223 See supra 130.
224 *Benning* v. *Wong* (1969) 122 C.L.R. 249.

authorization will generally provide a good defence,[225] unless the activities are negligently performed.[226]

## NEGLIGENT WEATHER MODIFICATION ACTIVITIES

Generally, a defendant's liability for negligent conduct is based upon

(a) the existence of a duty of care requiring the defendant to conform with a certain standard of conduct for the protection of others,[227]

(b) the failure by the defendant to conform to the requisite standard of care, thus creating a breach of duty,[228]

(c) the causation[229] by the defendant's conduct of material injury to the plaintiff,[230]

(d) the reasonable forseeability by the defendant of the kind of injury or loss caused to the plaintiff,[231] and

(e) the absence of conduct by the defendant prejudicial to his recovering full compensation for his injury.[232]

As mentioned above,[233] the grievances likely to arise in the weather modification context are (a) loss of or injury to the natural state of the weather, or (b) loss of injury resulting from a change made in the natural state of the weather. Since, as a general rule, losses as intangible as the enjoyment of the weather in its natural state are not recoverable in negligence actions, only the latter grievance will be relevant in a consideration of liability for negligent weather modification activities.[234]

### *Evidentiary Problems*

Assuming that weather modifiers owe a general duty of care to all persons who they could reasonably foresee as being likely to be injured by these operations, if such operations are not conducted with reasonable care,[235] there is still considerable controversy over the standards of

225 A court may possibly interfere with the way in which statutorily authorized work is carried out. E.g. *Kent* v. *Cavanagh* 1 A.C.T.R. 45, 54 per Fox J. "[A] Court would have to have the most compelling evidence dealing not only with the aspect of nuisance but also with the whole question of suitability of and need for the . . . [activities] before it could consider holding that, because of nuisance considerations, the [activities] should not be [performed as] planned."

226 *Benning* v. *Wong* (1969) 122 C.L.R. 249 per Barwick C.J.

227 *Donoghue* v. *Stevenson* [1932] A.C. 562 per Lord Atkin.

228 This is naturally a question of fact determined by expert testimony.

229 See supra, 126-127 for discussion of causation in weather modification.

230 Generally, economic or "nervous shock" injury not forseeably related to physical injury or property damage will not be recoverable: *Bourhill* v. *Young* [1943] A.C. 92.

231 *The Wagon Mound (No. 2)* [1967] 1 A.C. 617 (P.C.).

232 E.g. Contributory negligence and voluntary assumption of risk are not significant particularly to weather modification and will not be discussed.

233 Supra 143.

234 In view of the decision in *Caltex Oil (Australia) Pty Ltd* v. *The Dredge "Willemstad"* (1976-77) 136 C.L.R. 529, economic loss suffered without physical injury may be recoverable in special circumstances.

235 Since *Anns and Others* v. *Merton London Borough Council* [1978] A.C. 728 where it was established that new duty situations will be upheld despite the facts not conforming to a pre-existing formula: "a general duty of care, not limited to

conduct with which a reasonably competent weather modification scientist would have to conform. Because of the conflict and uncertainty in scientific opinion, and the problem of a plaintiff's inability to find competent experts not under obligations to the weather modification industry, such standards are difficult, if not impossible, to prove.[236] There is then the difficulty of establishing that the weather modifiers did in fact not conform to these standards. Evidence needed here would be peculiarly within the knowledge of the defendant, who would be unlikely to disclose his own breaches. Finally, once the non-conformity with standards is established, the factual causation between the breach of duty and the injury must be proved, as must the reasonable forseeability by the defendant of the kind of injury which was suffered by the plaintiff.[237] The decision in 1964 in favour of the defendant weather modifiers in *Adams* v. *State of California*[238] was based on the failure of the plaintiffs to prove the proximate cause of property damage and death arising out of severe flooding in Yuba City, California in 1955. The flooding coincided with a concerted rain-making programme by the Pacific Gas and Electric Corporation. In that case the defendant weather modifier ironically proved through expert evidence that his own previously made claims about the success of his rain-making programme were unreliable.

The significance of evidentiary problems in damages actions in respect of negligent weather modification activities is such that an action based on negligence would be unlikely to succeed, unless the defendant's breach of duty and the causal nexus between the breach and the injuries were obvious or the problems involved in controlling and monitoring the direction and effects of weather phenomena had been resolved. Similarly, a reliance on a presumption of negligence *res ipsa loquitur* would, as discussed earlier,[239] seem even less feasible.

## STRICT LIABILITY FOR WEATHER DAMAGE

To overcome, at least insofar as proving "fault" is concerned, the considerable evidentiary obstacles which face plaintiffs aggrieved by weather modification activities, it has been suggested that legislation should be enacted to make modifiers strictly liable for damages occasioned.[240] The first reason for such "no fault liability" would be the recognition that

particular accepted situations, but extending generally over all relations of sufficient proximity . . ." per Lord Wilberforce (ibid. 757). Cf. *Nova Mink Ltd* v. *Trans-Canada Airlines* [1951] 2 D.L.R. 241.

236 See Thomas, op. cit. and Taubenfeld, op. cit. passim.

237 *The Wagon Mound (No. 2)* [1967] 1 A.C. 617 (P.C.).

238 Docket No. 10112 (Sutter Cy. Sup. Ct. Calif. 6 April 1964). Cited in references at fn. 5 and 36 supra.

239 Supra 134.

240 McKenzie, op. cit. 423. A portion of a Pennsylvania state weather modification statute is cited in illustration.

weather modification activities are ultra-hazardous or dangerous in nature. The common law already provides limited strict liability in respect of certain such dangerous activities through the application of the principle in *Rylands* v. *Fletcher*.[241] The second reason is that one party is in a better position, by virtue of its effective control of operations and its financial status, to bear and distribute any losses.[242] It is instructive to examine first the extent to which the common law provides a "strict liability" remedy for weather modification damage.

*Rylands v. Fletcher liability*

The principle enunciated by Blackburn J. in *Rylands* v. *Fletcher*[243] was that a

> "person who for his own purposes brings on his lands and collects and keeps there anything likely to do mischief if it escapes, must keep it in at his peril and, if he does not do so, is prima facie answerable for all the damage which is the natural consequence of its escape."[244]

The application of this principle to weather modification activities is subject to several inherent limitations in regard to who carries out the activities, where, and in what way they are carried out, and in which manner harm was occasioned.

Non-natural user

The general applicability of this "strict liability" of occupiers of land for injury caused by the escape of dangerous things from their land was, upon appeal, limited in its application to the "non-natural user" of land.[245] The notion of the non-natural user of land has been further restrictively interpreted to mean a use which, other than an ordinary use for the general benefit of the community, brings with it increased danger to others,[246] and today has sufficient flexibility to allow the inclusion of public policy considerations as to the social and economic needs prevailing at any given time or place.[247] Thus the answer to the question of whether or not the conducting of weather modification activities by an occupier[248] would be a non-natural user of land may to a large extent depend upon the social utility of the purpose for which the operations are carried out. Attempts

[241] The common law recognizes the desirability of strict liability in respect of such activities e.g. the rule in *Rylands* v. *Fletcher* (1866) L.R. 1 Ex. 265; affd. (1868) L.R. 3 H.L. 330.
[242] E.g. the liability of airlines for death and injury in certain circumstances. See *Civil Aviation (Carriers Liability) Act* 1959 (Cth) Part IV.
[243] (1866) L.R. 1 Ex. 265; affd. (1868) L.R. 3 H.L. 330.
[244] (1866) L.R. 1 Ex. 265, 279-80.
[245] (1868) L.R. 3 H.L. 330, 338-9.
[246] *Rickards* v. *Lothian* [1913] A.C. 263, 280 (P.C.).
[247] Fleming, op. cit. 324.
[248] Since "act of a stranger" and "act of god" are defences to *Rylands* v. *Fletcher* actions, the application of this principle applies only to activities carried out by the occupier, his servants, independent contractors, invitees and licensees: see Fleming, op. cit. 332-3.

by a farmer to stimulate rainfall during a drought would likely be upheld while the uncontrolled climatic repercussions of a government experimental programme aimed at wind or lightning suppression, even carried out on or over crown land, may transgress the limits of "natural user".[249]

Dangerousness

The problem is compounded by the confusion surrounding the mischievous nature of that which is brought onto and kept on the land. Clearly, water in reservoirs[250] or drains[251] has been held to be dangerous. Aside from water, gas,[252] electricity[253] and a whole host of other substances including vibrations[254] may be dangerous but it may very well be that the non-natural user of the substance on the land is the factor which imbues the substance with a mischievous capacity.

Escape

The limited interpretation given to this aspect of "the rule" by *Read* v. *Lyons*[255] establishes that there must be an escape from land in the control of the defendant to a place outside his occupation, except in the case of the supply by a public utility of a dangerous substance such as gas, which escapes from public land onto neighbouring premises and causes injury.[256] This is not subject to the requirement that the defendant be in occupation or control of the land from which the escape occurs.

Application to weather modification

The rule in *Rylands* v. *Fletcher* can not be invoked unless the plaintiff has suffered either property damage or personal injury.[257] Such injury may be actionable in respect of either

(a) the escape from the defendant's land of the possible effects of weather phenomena, excess water in most cases, onto the plaintiff's land—this is otherwise called run-off—or

(b) the escape of "cloud-seeding" chemicals from the defendant's property[258] and their reaction with atmospheric moisture resulting in the impact of weather phenomena upon the plaintiff or his land, for example, after ground based cloud-seeding activities.

249 Since the rule in *Rylands* v. *Fletcher* is largely a branch of the wider law of nuisance (Fleming, op. cit. 326) the defence of legislative authority will be available, subject to reasonable care being taken, similar to its application to the law of nuisance. See supra 154.

250 *Rylands* v. *Fletcher* (1866) L.R. 1 Ex. 265; affd. (1868) L.R. 3 H.L. 330.

251 *Simpson* v. *A.-G.* [1959] N.Z.L.R. 546.

252 *Benning* v. *Wong* (1969) 122 C.L.R. 249.

253 *National Telephone Co.* v. *Baker* [1893] 2 Ch. 186.

254 *Hoare & Co.* v. *McAlpine* [1923] 1 Ch. 167.

255 [1947] A.C. 156.

256 *Benning* v. *Wong* (1969) 122 C.L.R. 249.

257 Ibid. But see *Read* v. *Lyons* [1947] A.C. 156 per Lord MacMillan.

258 Generally, therefore, the "cloud seeding" must be carried out from ground based equipment so as to emanate from land under the control of the defendant (*Read* v. *Lyons* (ibid.)). However it may be argued that a public authority is liable for

(a) Run-off

The run-off of surface waters independently of any interference by the landowner is not subject to liability.[259] However, if a landowner engages in activities which specifically result in increasing the amount of water collecting on his land and such water escapes onto the land of his neighbour causing damage, then recovery under the rule in *Rylands* v. *Fletcher* seems quite likely, subject to proof that the increase in water collected was not due to natural causes,[260] for which the landowner would not be responsible save when he interferes with the natural flow[261] and causes damage thereby.

Thus, assuming the factual causative link between the "cloud-seeding" and the existence of excess water on the land can be proved, then the nature of weather modification operations is only relevant to run-off insofar as it is necessary to prove that the conduct of such activities by the defendant is a "non-natural user" of land.[262] The proof of "non-natural user" is also relevant to actions relying upon the escape of "cloud-seeding" agents.

(b) Escape of "cloud-seeding" chemicals

As mentioned above,[263] the determining of "non-natural user" of property is the first significant question and is largely subject to public policy considerations as to the social and economic utility of the purpose for which the land is being used in the circumstances of its locality, environment and the point of time in history.[264] One point is, however, fairly clear: namely, that "non-natural" does not mean artificial[265] in the sense of sophisticated or technologically developed which resulted in such activities as a munitions factory during wartime being held to be a natural user of land.[266] Thus there would be little to be gained from an argument that the

escapes from an airplane by analogy to the decision in *Benning* v. *Wong* (supra), since the airplane has carried the dangerous substance onto public "land" (the skyways) from where it has escaped and caused damage on the plaintiff's land. Although a defence of legislative authority would likely preclude recovery unless the operation was carried out negligently.

259 *Loring* v. *Brightwood Golf and Country Club* (1974) 44 D.L.R. (3d) 161; *Trans Mountain Pipeline Co. Ltd* v. *Nicola Valley Sawmills Ltd* (1976) 62 D.L.R. (3d) 279.

260 Ibid. But it is significant to note that the defence of "act of god" has been restricted by the courts in actions based on the principle in *Rylands* v. *Fletcher*. See *Nichols* v. *Marsland* (1876) 2 Ex. D. 1 and *Greenock Corp.* v. *Caledonian Rly.* [1917] A.C. 556—where it was held that if human foresight and prudence might recognize the possibility of the harm, then "act of god" is not a defence.

261 See text accompanying fn 218, supra.

262 It is possible that even if such activities were held to be a "natural user" of land the defendant may still be liable in nuisance. *Bayliss* v. *Lea* (1962) 62 S.R. (N.S.W.) 521.

263 Supra 157.

264 *Torette House Pty Ltd* v. *Berkman* (1940) 62 C.L.R. 637, 655.

265 *Read* v. *Lyons* [1947] A.C. 156, 168-9 per Viscount Simon.

266 *Read* v. *Lyons* [1947] A.C. 156.

interference with the natural state of the weather is by virtue of its interference with nature a "non-natural user" of land, unless prevailing social norms at the time give more value to a natural environment than they do today.

The second significant question concerns whether or not damage caused, for example, by rain or hail created by the interaction of "cloud-seeding" agents and the air, is not too remote to come within the rule in *Rylands* v. *Fletcher*?

Blackburn J. considered that liability would attach for the "natural consequences" of an escape "of anything likely to do mischief".[267] There seems to be no decided authority on whether or not the processes involved when a substance like cloud-seeding chemical, which is potentially mischievous but manifests its mischievousness by interaction with a second medium, namely atmospheric moisture, before giving effect to its mischievousness on a third medium, namely the earth, will fit within the description: "natural consequences" of an escape. There has been no indication in reported decisions that similar rules of remoteness of damage as apply to negligence actions apply in *Rylands* v. *Fletcher* actions. Moreover, the intermediate reaction and the kind of damage likely to be occasioned by weather phenomena are not only reasonably forseeable but sometimes specifically the purpose for which the chemicals are allowed to escape. Further, the rule in *Rylands* v. *Fletcher* has created a "limited" strict liability of occupiers for dangerous activities, which would have little effect if this notion of "remoteness of damage" was to be strictly applied.

Wrongs Act *Liability*

It may be that statutory enactments in respect of articles falling from aircraft will facilitate claims arising out of weather modification operations. Section 31(1) of the Victorian *Wrongs Act* 1958, which has equivalents in three other Australian states[268] provides that:

> "Where material loss or damage is caused to any person or property on land or water by or by a person in or by an article or person falling from an aircraft while in flight . . . then, unless the loss or damage was caused or contributed to by the negligence of the person by whom it was suffered, damages . . . shall be recoverable . . . without proof of negligence or intention or other cause of action as if the loss or damage had been caused by the wilful act or neglect or default of the owner" [of the aircraft or charterer or hirer in certain circumstances].

To begin with it should be noted that liability under this section is imposed upon the owner of the aircraft. In an almost identical section in New Zealand, the word "article" has been broadly construed to include a

[267] *Rylands* v. *Fletcher* (1866) L.R. 1 Ex. 265.
[268] S. 2(2) *Damage by Aircraft Act* 1952 (N.S.W.); s. 5 *Damage by Aircraft Act* 1964 (W.A.); s. 4 *Damage by Aircraft Act* 1963 (Tas.).

liquid chemical[269] and there is no reason why cloud seeding chemicals should not also be included within its scope. However the New Zealand Court of Appeal in that case found it unnecessary to determine the scope of the phrase "caused . . . by or by a person in or an article or person falling from an aircraft while in flight".[270] There are clearly four alternative causes of loss or damage occurring on the surface of the earth which are within the scope of the statute: loss or damage caused:

(1) by . . . an aircraft;
(2) by a person in . . . an aircraft;
(3) by an article . . . falling from an aircraft;
(4) by . . . a person falling from an aircraft.

Loss or damage caused by weather phenomena artificially induced by the seeding of clouds and with the intention of altering the natural state of the weather would very likely be held to be within the scope of (2) or (3) or both. For damage to be caused by a person in an aircraft, it must necessarily be assumed that there will be an indirect causation of the damage, and there would seem to be no reason why a narrow interpretation should be given to these words. On the other hand, although it may be recognized that chemicals falling from an aircraft may be "an article" within the statute, it may not however be found that damage occasioned was caused by an "article . . . falling", but rather from a new medium created by the interaction of the article with the atmosphere. Finally, the statute specifically declares that "proof of negligence or intention or other cause of action" (s. 3(1)) is unnecessary and goes on to say that damages shall be recoverable "as if the loss or damage had been caused by . . . wilful act or neglect" (s. 3(1)). Thus liability is created irrespective of fault.

Aside from the desirability of legislation regulating liability for such operations,[271] there are various other factors such as the co-ordination of programmes, the setting of scientific standards, the possibility of international repercussions and the use of weather modification as a weapon of war, which foreshadow the necessity of more comprehensive research and legislation in this area.

*Statutory Reform*

Assuming that weather modification operations will develop to a significant extent in Australia and that by that time the problems of control and conflicts of opinion that exist within the science will not have been fully resolved, then it may be that a compensation system should be

269 *Weedair (N.Z.) Ltd* v. *Walker* [1961] N.Z.L.R. 153, 156.
270 [1961] N.Z.L.R. 153.
271 Such matters as annual rainfall, extent of crop damage caused by hail, drought etc., value of destruction by tropical storms and cyclones are important public policy considerations which will influence the risk involved in continuing weather modification activities.

created by legislation so that those persons who have bona fide suffered injuries as a result of either intentional or inadvertant climatic alteration may be compensated for their losses irrespective of the "fault" or "wrongful conduct" of those responsible. Since the object of such a system would be compensation, the determination of the issue of factual causation of injuries by weather modification may be better taken away from the adversary style arena of the courts so as to remedy the peculiar evidentiary advantage that defendant weather modifiers have by virtue of their perpetuation of the industry and monopolization of its information sources.

The creation of such a system in the Australian context would seem to be unlikely in the forseeable future, especially in view of the fact that the only state in Australia with legislation in respect of weather modification[272] creates wide statutory immunity from suit for loss or damages resulting from the authorized activities.[273]

## LEGISLATIVE IMMUNITY

Legislation in America and Australia with respect to weather modification has been largely concerned with the licencing of operations and the collection of data,[274] though in certain states of the United States legislative provisions have been so restrictive that operations have largely become impracticable.[275] On the other hand, some legislation in this field has granted governmental bodies immunity from suit in respect of weather modification operations.[276] The Victorian statute[277] provides a comprehensive immunity through s. 12(1):

> "Neither the Minister, any person or body authorized by the Minister to make arrangements for carrying out a rain-making operation nor any person carrying out rain-making operations authorized by the Minister . . . shall in any way be liable in respect of any loss or damage caused by or arising out of the precipitation of rain hail sleet snow ice fog or mist in consequence of the rain-making operations so carried out."

The first point to notice is that this whole statute deals with "rainmaking operations" which are defined rather narrowly as "the seeding or nucleating of clouds by artificial means from manned aircraft".[278] By comparison, the Canadian Act[279] declares that

> " 'weather modification activity' includes any action designed or intended to produce, by physical or chemical means, changes in the composition or dynamics of the atmosphere for the purpose of increasing, decreasing

272 *Rainmaking Control Act* 1967 (Vic.).
273 Ss. 12(1), 14(2).
274 E.g. McKenzie, op. cit. 413 asserts that thirty states of the U.S. have regulatory statutes. See also *Weather Modification Information Act* 1971 (Canada) Ch. 59.
275 E.g. for the granting of permits some statutes require large deposits and very detailed operational reports. See McKenzie, op. cit. 413-19; "The Weathermaker and the Law" op. cit. 112-14 for a comparative table of U.S. state legislation. Also see Thomas, op. cit. 34-7.
276 Ibid.
277 *Rainmaking Control Act* 1967 (Vic.).

or redistributing precipitation, decreasing or suppressing hail or lightning, or dissipating fog or cloud."[280]

Does the reference in the Canadian statute to activities designed to produce a diminution or redistribution of precipitation give it a wider operation than the Victorian rain-making statute?

Since the seeding or nucleating of clouds, being the definition of rain-making operations in the Victorian Act, is the process essential to virtually all intentional weather modification operations there would seem to be little possibility that the application of the Victorian statute could be limited so as to exclude activities where the purpose is the dimunition of the precipitation of rain etc., thereby restricting its application to the increasing of rainfall. The words used in the s. 2 definition of "rain making operations" are clear and, there is no indication in the statute that it was intended not to apply to cloud seeding for the purpose, or indeed with the unintended effect, of decreasing precipitation.[281]

However, the significant limitation upon the Victorian statute is the restriction of its application to operations carried out "from manned aircraft" despite the fact that various other more economical methods of weather modification are available. According to scientific advice at the time the statute was enacted[282] the Victorian definition of "rainmaking operations" covered activities as they were more likely to be carried out in Australian conditions.[283] However geographic conditions vary considerably within Australia, and it may very well be that ground based operations more suitable in mountainous terrain will not be covered by the statute.[284]

More importantly, it may be argued that the immunity clause (s. 12(1)) in the Victorian statute is restricted in its application by the words requiring that "loss and damage" be "caused by or arising out of precipitation", of rain etc. Assuming that in this immunity, the word precipitation would be construed so as to necessarily include the depositing of atmospheric moisture as well as its condensation, rather than giving a narrower interpretation than that which its clear words establish,[285] then it would be unlikely that suits alleging loss or damage arising out of weather modification activities which, irrespective of their purpose, actually prevented or diminished rainfall or snowfall, would be barred by the immunity.

278 S. 2.
279 *Weather Modification Information Act* 1971 (Canada) Ch. 59.
280 Ibid. s. 2(b).
281 In view of drought conditions existing at the time, it does not appear that the Victorian Parliament envisaged the possibility of weather modification reducing rainfall. See Cth *Parl. Deb.* H. of R. 26 April 1967, 1125; Vic. *Parl. Deb.* 1 November 1967, 1607-10; and 6 December 1967, 2995-3114.
282 See Vic. *Parl. Deb.* 1 November 1967, 1608.
283 Ibid. C.S.I.R.O. advice was that ground generation of silver oxide smoke was not effective in causing rainfall in Australian conditions.
284 See Taubenfeld, op. cit. and Thomas, op. cit. passim.
285 The Oxford English Dictionary Vol. VIII defines "Precipitation" in the sense of physics and meteorology as "Condensation and depositing of moisture from the state of vapour, . . . esp. in the formation of dew, rain, snow".

Finally, it should be noted that this immunity is only available to "persons carrying out rain making operations authorized by the Minister". Unauthorized operations are specifically excluded from protection.[286] Therefore, both unauthorized operations and operations which fall outside the scope of the statutory immunity will be subject to normal rights and remedies available to persons who have suffered loss or damage as a result of weather modification activities. Furthermore, Victoria is the only state of Australia with weather modification legislation and an immunity from suit in respect of authorized operations. Thus, there is still scope for the operation of common law principles in relation to actions arising out of weather modification activities.

## CONCLUSION

The purpose of this article has been to bring attention to weather modification activities as a potential area of civil litigation now and in the future. It is unlikely that experimentation and commercial operations aimed at influencing the natural state of weather are going to cease, and in Australia where natural climatic conditions can have disastrous effects on the economy, it would seem that the continuation of such pursuits may be of considerable benefit to the community and the country itself.

Emphasis has been given primarily to an exploration of the nature and extent of any public and private rights, especially in property, which are likely to be relied upon in litigation arising out of climatic alteration activities; and also to the causes of action which may be available in respect of invasions of interests in land and airspace or interferences with the beneficial use and enjoyment of land or with rights to natural weather conditions. Atmospheric moisture figures centrally in any discussions owing to its uncertain legal status and to the fact that its manipulation is essential to most forms of weather modification, especially when there exists a positive intention to alter climatic conditions. A secondary emphasis has been given to evidentiary problems inherent in proving both the factual causation aspect of weather modification litigation and the elements of certain torts, for example, the existence of a duty and its breach in a negligence action. Third, the impact of legislative overlay on the common law has been considered with a view to assessing the extent to which immunities from suit and "no fault" liability legislation does today affect and could, in the future, regulate the determination and satisfaction of claims in respect of loss or damage occasioned by weather modification activities.

It is yet too early in the development of the law in this area to predict with any accuracy the extent to which the rights and liabilities discussed herein will be protected by the judiciary. There is, however, ample potential within the common law for the clarification of recognizable interests and the mechanism for their evaluation and protection.

[286] S. 14(2).