



Nuclear Winter: Royal Society of Canada Report

In January 1985, the Committee on the Environmental Consequences of Nuclear War presented its report to the Royal Society of Canada. This study was undertaken at the request of the Government of Canada. Following are the summary and conclusions of the report.

"1. A nuclear winter in the wake of a major nuclear exchange appears to be a formidable threat. If calculations are correct — and the Committee believes them credible — temperatures in the interior of continents will plunge by many degrees shortly after the exchange, probably far below freezing in many mid-latitude areas. Severe damage or destruction will ensue for crops and vegetation. The winter will last for some weeks to several months, and will have lasting repercussions.

Strategic Considerations

2. Canada should consider at once the military, strategic and social consequences of such a major climatic anomaly, notwithstanding the many uncertainties;

3. A nuclear winter would globalize the potential environmental impact of major nuclear war. No country would be immune;

4. A nuclear winter would imperil the food and drinking water supplies of all survivors in mid-latitude nations, and probably the whole world;

5. An aggressor who delivered a first strike sufficient to knock out an opponent could not win. A strike on such a scale, even if there were no response, would trigger a nuclear winter even for the aggressor;

6. There would be few spectators; non-combatant nations would be the helpless victims of a nuclear winter, just as would the combatants;

7. Even if Canada were not attacked, there would be major damage to its agriculture, forests and fisheries. A summer exchange would be especially damaging to Canada;

8. The USSR is also extremely vulnerable. The nuclear winter would

affect her territories severely. Her agriculture is already very sensitive to drought and frost. It could not survive a nuclear winter.

There remain many uncertainties. We cannot be sure that these effects are certain, and we hope that they never happen. But we are convinced that the Canadian Government should include them in its strategic reckoning.

The Models

9. The models are for the most part credible as to the broad nature of the climatic impacts that will follow a major nuclear exchange, though the details are no more than plausible;

10. Although the results must be interpreted with care, a *prima facie* case has been made that a nuclear winter will follow from nuclear explosions of a wide range of severity, including those that are considered quite small in present strategic scenarios. Every effort should be made to clear up the uncertainties that remain;

11. Criticisms of the models by Teller, Singer, Maddox and others make some valid points, but do not invalidate the main thrust of the model results.

Climatic Impact

12. Although the main impact on climate would be manifest in three latitudes where the major nuclear exchange took place — presumably northern mid-latitudes — there would be substantial cooling and disturbance of the circulation in tropical latitudes and the southern hemisphere, and long-term climatic perturbations are possible;

13. To clarify the nuclear winter hypothesis, it is important that the impact of nitric oxide (formed in nuclear fireballs) on ozone levels be examined further. It has been widely assumed that decreases in ozone caused by nitric oxide produced in this manner would lead to ozone dissociation, and hence increased levels of damaging ultraviolet radiation at the earth's surface. This may be so, but other circumstances must now be taken into account. Related processes may result in substantial generation of ozone in the troposphere. The altered thermal

structure of the upper troposphere and lower stratosphere implies a possible radical change in the chemistry and dynamics of the ozone layer.

Biological Impact, including that on Agriculture and Fisheries

The Committee agrees with numerous spokesmen that the nuclear winter hypothesis implies severe threats to living communities, and thereby to the security of the human species. There may possibly be extinctions on a scale comparable with known events caused in the past by meteorite or asteroid impacts. But work on the biological impact is less advanced than that on physical events. Tentatively the Committee concludes that, in the case of a major nuclear exchange,

14. Canadian agriculture would be severely affected even if there were only small reductions in growing season temperature, and reductions in sunlight;

15. The degree of damage would depend to a great extent upon the season of attack. Damage might be extremely severe if it affected the early growing season, or destroyed seeds and rootstocks in late summer and fall;

16. Prairie agriculture would be severely affected by even small counterforce strikes, because the main US missile sites are close at hand;

17. Canadian forests are vulnerable to radiation damage from fallout. They might also suffer blow-down by blast from nearby detonations;

18. The forests might suffer extensive fire damage. A 50 megatonne detonation over forests might destroy from 13 000 to 500 000 square kilometres, depending on place and season;

19. All the above stresses would likely encourage pests and weeds at the expense of useful species, so that regrown ecosystems would be inferior in quality for many years and perhaps generations;

20. There may be damage to ocean ecosystems, and hence to fisheries. A few days of darkness could kill much of the phytoplankton, the green plants at the base of the food system. Increased ultraviolet when the sun returns would also damage phytoplankton. A wide-