

SECTION 3

The Effects on Potential for Wind Erosion of Soil

Just as drought severity and frequency and biomass productivity are affected by climatic change (Section 2), so is soil degradation. Wind erosion of soil is considered here as it is a major soil degradation process in Saskatchewan. About 60% of the total annual soil loss due to wind and water on the Canadian Prairies can be ascribed to wind erosion (PFRA, 1983). Considering that soil is one of the principal basic resources for agriculture, such a threat to the soil is of great concern. The objective of this study is to evaluate the effects of climatic changes on the potential for wind erosion of soil. Effects, controls, and modeling of wind erosion of soil are discussed, a comparison with records of blowing dust is made, and a sensitivity analysis is presented. Then the wind erosion potentials of the climatic scenarios are examined. Suggested research directions and policies can be found in Section 6.

The effects of wind erosion are numerous, ranging from the physical to the economic (*Table 3.1*). The physical effects range from soil and crop damage to traffic fatalities. Not only is the more productive soil removed from the field (Bennett, 1982), but increased erosion results in the risk of the saline layer found in some soils coming closer to the surface (Mermut *et al.*, 1983). Fertilizers or herbicides incorporated into the soil may also be lost from the field or harmfully redistributed in the soil, air and/or water. Fields can also be damaged by being buried by drifts of coarse textured soil (Brady, 1974).

The economic and sociological impacts on the farming community of drought and wind erosion have been severe (Section 1). Farm abandonment during the 1930s was common and wind erosion of soil contributed to this migration. Soil drifting even rated ahead of drought for crop destruction in at least one year of the "dirty thirties" (Gray, 1978).

There are many techniques available for attempting to control the problem. They range from the use of shelterbelts, conservation tillage, strip farming, nurse crops, fall-seeded crops and crop rotations to more esoteric methods such as the

Table 3.1. Some physical and economic effects of wind erosion and deposition.

<i>Physical effects</i>	<i>Economic consequences</i>
<i>Soil damage</i>	<i>Soil damage</i>
(1) Fine material, including organic matter, may be removed by sorting, leaving a coarse lag.	(1-4) Long-term losses of fertility give lower returns per hectare.
(2) Soil structures may be degraded.	(3) Replacement costs of fertilizers and herbicides.
(3) Fertilizers and herbicides may be lost or redistributed.	
(4) Soil may be buried by deposits of poorer quality soil.	
<i>Crop damage</i>	<i>Crop damage</i>
(1) The crop may be covered by deposited material.	(1-7) Yield losses give lower returns.
(2) Sandblasting may cut down plants or damage the foliage.	(1-3) Replacement costs, and yield losses due to lost growing season.
(3) Seeds and seedlings may be blown away and deposited in hedges or other fields.	(5-6) Increased herbicide and pesticide costs.
(4) Fertilizer redistributed into large concentrations can be harmful.	
(5) Soil-borne disease, weed seeds and pests may be spread to other fields.	
(6) Herbicides and pesticides redistributed into large concentrations can be harmful and losses from original location reduces effect.	
(7) Rabbits and other pests may inhabit dunes trapped in hedges and feed on the crops.	
<i>Other damage</i>	<i>Other damage</i>
(1) Soil is deposited in ditches, hedges, along fences, on roads, in reservoirs, lakes and streams.	(1) Costs of removal and redistribution.
(2) Fine material is deposited in houses, on washing and cars, etc.	(2,3) Cleaning costs.
(3) Farm machinery, windshields etc. may be abraded, and machinery "clogged".	(4) Loss of working hours and hence productivity declines.
(4) Farm work may be held up by the unpleasant conditions during a "blow".	(5) Costs of a decrease in transportation and communication efficiency – costs of accidents and fatalities.
(5) Visibility is decreased – transportation and communication interruptions and accidents can result.	(6) Adverse effects on human health from dust inhalation – costs of health care. Non-point source pollution of water bodies – costs of water treatment. Environmental degradation from air pollution. ^a
(6) Air pollution.	
(7) Changes in the earth-atmosphere energy budget such as increases in the rate of radiative cooling of the atmosphere. ^b	

Adapted from Wilson and Cooke (1980, p. 218) with additions by E. Wheaton.

^aHeathcote (1980, p. 43).

^bGuedalia *et al.* (1984).