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OUR CLIMATE AND OUR WEATHER

CLIMATE is one of the greatest upsetters of human plans and activities. It dictates our economy, what we wear, the kind of house we live in, the sort of food we eat, how hard we work, and even when and where we spend our vacations. Farmers and industrial magnates must bow to it; all animal life, from insect to elephant, lives and dies under its rule.

Mankind has never known a "normal" climate. We of 1949 are at the tail end of an ice age, living in a time following a period of climatic violence as great as any the earth has known. Several of these periods can be traced in the earth's crust, and between them there have been long ages of genial climatic uniformity, looked upon by geologists as "normal" times.

Climate runs in cycles. Our oldest rocks, around Rainy Lake in Western Ontario, reveal gravel deposited under physical conditions not greatly different from those of today.

We are all familiar with the daily cycle in the temperate zones: a maximum temperature in early to mid-afternoon and a minimum shortly before sunrise. The annual range is also familiar, through the variety of temperature, rain, snow and wind that makes up Spring, Summer, Autumn and Winter.

Next in significance, probably, is the widely-accepted 11-year cycle corresponding to the cycle of sunspot frequency. Records kept for more than two centuries show that sunspots wax and wane in number and extent twice in about every 23 years on the average. Since the sun is the source of our heat and the basic cause of our weather changes, it is natural enough to suppose that cycles of weather should correspond to such changes in the sun's condition, although this is not yet proven.

It is Getting Warmer

One point about which there seems to be general agreement is that the earth's surface is getting warmer. Just a month ago Professor G. H. T. Kimble and Professor F. K. Hare, both of McGill University's Department of Geography, totted up the score for this

summer, added it to their charts, and decided that we are well on our way to a new type of climate in the countries bordering on the Atlantic coast.

Summers, they say, are getting progressively hotter and longer; winters are milder. But, they hasten to add, our historical records go back only a short distance — merely for seconds on the clock of the earth's progress. The present trend, detected in the 1880's, "may be just a shiver in the world's weather, but it might also be the road back to a much different climate."

We are rising out of a cold period that had its greatest depth about 1,500,000 years ago. Glaciers all over the world are receding rapidly; the permanently frozen subsoil in northern Canada is melting slowly; ships can now reach Spitsbergen, north of Norway, during nine months of the year instead of the three months of thirty years ago. When we are entirely out of the Ice Age there will be forests in the interior of Greenland where the ice is now two miles thick.

Climate and Food

No other earthly force can so mould civilizations as a change in climate. Men are pushed forward impetuously in some regions and held back to a sluggish pace in others, both physically and mentally. We think and act because of the burning of food in our tissues, and the speed of this burning depends largely upon the type of our food and exercise. Exercise steps up the rate. If the temperature and humidity are too high, our body temperature rises quickly. We are soon prostrated. So we learn to take it easy in the tropics.

Availability of food is important. We have seen algae, a low form of plant life, thriving in hot springs at 200 degrees; there are Siberian Arctic plants whose root-systems survive short periods of 90 degrees below zero air temperature; but most plants grow within a narrow range. For each degree of latitude north of the Equator and for each 400-foot increase in height above sea level on this North American continent, the date of flowering of plants of the same species is retarded 4 days.

Weather and Health

The weather, which is a fickle actor within a changeable but less hastily changing climate, has much to do with our health. There is an undoubted connection between kinds of weather and prevalence of this or that malady. Hay fever belongs to Autumn; what is generally called "lung trouble" is more prevalent in Spring than in midsummer; cold damp weather increases the discomfort of rheumatism. A tropical climate favours the organisms that cause some diseases such as malaria and hookworm, and reduces our resistance to disease of all kinds.

We are the kind of animal that cannot live if our body temperature varies too much above or below 98.6 degrees Fahrenheit. Through extremes of temperature, from the lowest Canadian record (81 below zero) to the highest (115) the body strives to maintain a constant temperature through its own heat-regulating machinery. In cold weather it speeds up the rate of heat production, contracts its surface blood vessels and even produces extra circulation by shivering. In hot weather the surface blood vessels are enlarged to carry heat more quickly from the inside to the outside, and the evaporation of sweat has a cooling effect.

In Canada's temperate climate, where an energetic life is encouraged, breakdown diseases cause medical men their greatest worry. Diseases affecting the lungs have been found by the Prudential Life Insurance Company of America to be prevalent in Brazil, Ecuador and Colombia. In those countries there is a great contrast between the 95 to 110 degrees temperature in the afternoon and the 50 degrees to which the thermometer falls in high altitudes at night. Canadians who live in an indoor winter climate of 80 degrees and dash out into 20 below zero to gossip on the street corner are — to put it mildly — foolish.

As for the common cold, there probably is no disease that doctors know they know less about and that everyone else thinks he knows more about. Some people believe a cold comes from lack of proper food or drink; others blame their neighbours or a draught.

Pepys, the English diary writer of the 1660's, seems to have been particularly susceptible, as some amusing extracts from his diary will show; "Got a cold by sitting too long with my head bare for Mum to comb and wash my ears. . . . Got a strange cold in my head, by flinging off my hat at a dinner and sitting with the wind on my neck. . . . Caught a cold through leaving my waistcoat unbuttoned." Out of all these dire experiences he evolved a preventive device which will amaze many medicoes and laymen: "Myself in good health, but mighty apt to take cold, so that this hot weather I am fain to wear a cloth before my stomach."

Heat waves, too, bring their perils to Canadians. We may have difficulty in subduing our inner fires quickly enough to meet the sudden difficulty in heat loss. Thousands of us may develop heatstroke of greater or lesser seriousness at temperatures that would not bother tropical residents in the least. We are inclined to eat too much carbohydrate (sugar, starch and fats) and then expose ourselves to the sun. This means that we are raising heat inside and absorbing it from outside at the same time.

Canada's Climate

Canada is in the North Temperate Zone. That means, according to one wit, a climate where you can stay in one spot and get frostbite in January and sunstroke in July.

How true he is may be seen by the remarkable table at the bottom of this page. Note the length of the records — ranging from 31 years to 105 years. In all this time there is no station which has not recorded at some time below-zero temperatures, and every station has had temperatures of 95 or over, while the annual averages run from 17 degrees to 49.5.

Such variety imposes a severe discipline on both bodies and minds. To people accustomed to more equable climes Canada would appear a rough school. It does turn out men and women whose frames are braced for activity.

Long-Term Temperature and Precipitation Data for 11 representative Stations in Canada

Station	Height Above Sea	Length of Record	TEMPERATURES (Fahrenheit)			Killing Frost Average Dates		PRECIPITATION (inches)			
			Annual (Average)	Highest on Record	Lowest on Record	Last in Spring	First in Autumn	Annual Total	Annual Snow	Number Days	
										Rain	Total
Charlottetown, P.E.I.	ft. 186	yrs. 65	41.7	98	-27	May 13	Oct. 22	39.47	113.0	119	162
Halifax, N.S.	83	75	44.0	99	-21	May 11	Oct. 14	55.74	70.8	130	156
Fredericton, N. B.	164	67	40.7	101	-35	May 20	Sept. 24	42.80	95.5	108	149
Montreal, P.Q.	187	55	42.8	97	-29	Apr. 28	Oct. 17	40.80	112.3	112	164
Toronto, Ont.	379	105	45.1	105	-26	May 2	Oct. 14	32.18	61.9	109	145
Winnipeg, Man.	790	66	35.0	108	-54	May 27	Sept. 14	21.19	53.6	67	118
Regina, Sask.	1884	55	34.5	107	-56	June 6	Sept. 10	14.70	28.8	59	109
Edmonton, Alta.	2219	56	36.6	99	-57	May 30	Sept. 6	17.38	46.4	73	133
Victoria, B.C.	228	54	49.5	95	-2	Mar. 18	Nov. 27	27.13	13.4	141	144
Dawson, Y.T.	1062	41	22.8	95	-68	June 6	Aug. 19	12.61	56.2	63	117
Fort Good Hope, N.W.T.	214	31	17.0	95	-79	June 15	Aug. 6	10.63	50.0	46	106

Progress is a product of moderate adversity, not of ease and languor, and Canadians are not born with silver spoons in their mouths. We have learned more than to come in out of the rain: we have developed a constructive energy that has given us homes, factories and farms second to those of no country in the world, and a standard of living that is the envy of many.

Most of us own an overcoat, a raincoat, rubbers, an umbrella, a bathing suit, a muffler, suntan lotion, cough syrup, and a bottle of aspirin. Some, in addition, have snow boots, ear muffs, parkas, mukluks and a sun hat. With this equipment we get along very nicely.

Air Conditioning

Northern Canada is, at certain times of year, an almost perfect refrigerator. The Rocky Mountains in the west keep currents of new air from flowing easily into that region. For weeks the air lies nearly still. The sun rises for only a short period, and thus the cooling ground and the frozen lakes chill the air above them. A huge mass of uniformly ice-cold, dry, clear air stretches from the Rockies to Labrador, from the prairies to as far north as north goes. It is like a glacier of air. The weather men call it a mass of polar continental air.

Air waves, which may be 500 miles or 1,000 miles from crest to crest, are about the only travellers that can still move across national boundaries without passports, visas and permits. The polar air surges southward as far as the Gulf of Mexico; tropical air washes northward to the edge of the Arctic or farther. The action underlying George Stewart's novel *Storm* was the progress of a wave along this polar front.

Our Polar Front

Today's weather science is based on the idea that changes in weather are caused by conflict between great masses of warm and cold air along this "polar front," where the north-bound warm air meets the south-bound cold air.

Mr. A. J. Connor, of the Air Services, Meteorological Division, Department of Transport, wrote us an explanation of this year's unusual weather. He said:

In Canada we expect in summer frequent incursions of polar air into southern districts. These serve first, to lift warmer and moister air to levels where precipitation may begin, and secondly, to occupy southern regions for a day or two of cool temperatures with low humidity. This year the incursions of continental polar air have been rather feeble in central Canada, allowing the usual summery flow of warm, humid air from the south to continue largely unchecked for unusually long periods. Rainfall has therefore been scanty, and the humidity oppressive in central regions.

Last winter, major outflows of polar air preferred to follow a path along, or immediately east of, the Cordilleran region, bringing unusually heavy snows and an unusually long winter to the most westerly portion of the continent.

Wind and Weather

We have become accustomed, since our earliest days, to associate certain winds with certain kinds of weather, and it is surprising the number of times we are right. Yet, say the experts, there is no clear-cut

relation between the two. It is possible, says Dr. Kimble, to have drought as well as rain with a southerly wind, and heat waves have accompanied north winds on occasion. It is air masses, not wind directions, that are really significant.

When the difference in temperature between the equatorial regions and the polar regions sets up large-scale movements of air, they are modified by the rotation of the earth, thus establishing a system of alternating wind belts and belts of calm. There are four main belts: the doldrums, the horse latitude belts, the trade wind belts, and the belts of the prevailing westerlies.

The prevailing westerlies are north and south of the horse latitude belts. The air tends to move from the high pressure of the horse latitudes to the low pressure of the poles, deflected by the earth's rotation so that winds blow from the southwest in the northern hemisphere and from the northwest in the southern hemisphere. The greater part of Canada lies in the path of the prevailing westerlies.

Our Water Supply

When air rises, it expands and so cools to a temperature lower than at the earth's surface. Its water vapour condenses, thus forming great masses of minute droplets, and such a cluster of visible moisture is called a cloud.

Many a cloud looks as if it had been put together painstakingly after a year's work of planning and fitting. This is certainly true of the *cumulus*, thick, mountain-like masses often seen on a summer day about half a mile from the ground. The *cumulus* is the most majestic of clouds, moving in stately deliberation, with perfectly formed and sharp outlines which are yet as transitory as a dream. It is said that the great painter, Turner, declared there were only two aspects of nature he would not attempt to paint: the snow of the high Alps and a *cumulus* cloud.

Cirrus clouds are thin, feather-like formations, at a height of about three to ten miles, composed of minute ice crystals. *Stratus* clouds are flat layers often seen near the horizon early in the day, at a height of about 800 feet. *Nimbostratus* clouds, our familiar rain or snow clouds, are dull grey, with thinner spots that suggest a slowly-moving light behind the veil. They may be a few hundred feet or a mile high.

An inch of rain is the amount of precipitation on a level moisture-proof surface to the depth of one inch. When we say, for example, that the total annual precipitation at Fredericton is 42.80, that means there is enough precipitation on the surface where it is measured to cover it, if level and moisture-proof, to a depth of 42.8 inches. As a rule, about ten inches of snow is required to make one inch of water. An inch of rain is 113 short tons of water upon an acre.

Humidity

Humidity is just another word for moisture or dampness, but we mean far more than that when we say "the humidity." That means the degree of wetness of the

air. We may express it in a percentage, which represents the amount of water in the air relative to the amount which would be present were the air saturated at the same temperature. A relative humidity of 40 per cent means that the air holds 40 per cent of the maximum amount of moisture which it *could* hold at that temperature; if the air is saturated, the relative humidity is said to be 100 per cent.

When high humidity interferes with loss of heat from the body, because the air is already so moist it cannot take up all the moisture our bodies would like to throw off, we are uncomfortable. Then when a humid spell is broken by a shower our drowsiness may vanish.

It would be useful to have an absolute scale of comfort in relation to temperature and humidity. (Scientists have established 68 degrees as suiting most office workers, and say the humidity should be 60 per cent.) But the making of such a chart runs up against the difficulty that there is a marked difference in what individuals call comfortable. The work in many offices and factories would be improved if temperatures were adapted to the comfort of the normal well people, and let the complaining few put on more or less clothes.

Weather Forecasting

The Meteorological Bureau does not issue forecasts primarily for the convenience of people who are thinking of going on picnics. Weather forecasts are needed by airmen, sailors, farmers, shippers of perishable goods, forest rangers and business men. The effects of weather on the cash register can be mighty important.

Forecasting in Canada is done by the Department of Transport as a public service, and our meteorological service ranks with the best in the world. Main bureaus are in Vancouver, Edmonton, Winnipeg, Toronto, Montreal, Halifax and Gander, served by many reporting stations over the continent. When the main station has in hand all reports from its own district, from the other districts, from the United States, Alaska, Mexico, from Canada's eleven stations north of the Arctic Circle, from Europe and from ships at sea, the meteorologist has a good idea of what conditions are likely to be during at least the next 24 hours. He is helped by twice-daily soundings of the upper air.

Prediction is made difficult by the fact that so many factors must be kept in mind and weighed at one time. The public demands that a forecast shall be expressed as nearly as possible in one word: clear, fair, cloudy, rain. This does not allow a fair exercise of the forecaster's skill, because to describe what will likely happen in the next 24 or 36 hours would require a paragraph at least. There can be great differences within small areas: not long ago there was rain on St. James Street in Montreal and none on Craig Street, only a block away. No matter what the forecast said, people on one of these streets would think the weatherman was wrong—or, as they would likely say, "wrong again."

All the forecaster pretends to do is to say with reasonable assurance that if an existing trend continues, certain things will happen. The speed of the weather movement may change, hastening or delaying arrival of the kind of weather he forecasts.

Controlling Weather

During recent years many local rains have been induced by dropping dry ice on rain clouds. Mr. J. L. Orr, of the National Research Council of Canada told the United Nations scientific conference in August of successful experiments in this country. Analysis of the results showed that rain or snow reached the ground on 24 per cent of all the Canadian trials. In the applied experiments on selected clouds rain or snow reached the ground on 43 per cent of the attempts.

Mr. Orr added: "From the scientific standpoint, the results achieved are noteworthy and the ability to alter the structure of the great majority of clouds, to produce precipitation from many clouds, and even, under certain conditions to generate clouds, is remarkable."

The advance already made in knowledge and practice indicates that it may be possible to put rain-making on a firm basis shortly. At a time when rain is badly needed in some crop-growing or electric power-producing part of Canada, the financial returns could be of significant value. But, says Mr. Connor in a letter on the work of Canada's Meteorological Division, "if we ever get weather control on this earth, wars will follow, instigated by those who wish to have full control for their own country alone." Then he adds facetiously: "Domestically, the national weather controllers will need a battalion of bodyguards!"

What we should like, of course, is more orderliness in the weather. There should be some snow and ice in winter, so that we are willing to work hard enough to enjoy a little leisure when spring comes. Spring should be a poet's delight, with flowers and bees and mating birds, and it should last two months. Summer should be warm enough to thaw the frost out of our bones, give us the right tint of tan, and grow our garden vegetables and gladiolus to the right size, texture and shade. Autumn should be long enough for us to rest after a strenuous summer, colourful enough to gratify our aesthetic sense, and just cool enough to ease us gently into winter.

Every season should dignify itself by coming in on the proper date. This would enable us to make, sell and buy clothes in a reasonably stable way, and to know whether it is necessary to lay in another ton of coal.

Till these improvements can be made, the clothing manufacturer, the department store, the coal dealer and the consumer must plug along with the aid of Almanacs, the Meteorological Bureau and their own amateur efforts at forecasting. Perhaps it is better so, because if our weather ideals were achieved what should we grumble about?