Chinook

VOL. 3 NO. 1 FALL 1980

INSIDE *CALCULATING HOME HEAT SAVINGS*
SUNFLOWER MOTHS RIDE THE WINDS
SNOWROLLERS

PROMINENT AUTHOR SEEKS PHOTOS

You may know my book, *The Elements Rage* (Chilton, Philadelphia, 1965). I am now working on a new edition of this book to be illustrated with colour photographs.

May I ask, please, if you know of any colour photographs showing hail damage in Canada. I should be glad if you would let me know. Incidentally, should you know of any other first class colour photographs of the meteorological subjects in my book, I would be pleased to hear from you.

Frank W. Lane
Pinner, England

(Readers wishing to contact Mr. Lane concerning his request should send their letters to Chinook, PO Box 427, Brampton, Ont., Canada L6V 2L4 to be forwarded. Ed.)

FRONTS MADE VISIBLE BY LOCUSTS

The photograph of an approaching cold front revealed by blowing snow published in your Winter 1980 issue (Hage: 'An Edmonton Chinook'), reminded me of a photograph in my possession in which a cold front was visibly delineated, not by blowing snow, but by desert locusts in flight. The photograph was taken by Mr. A. J. Wood in August, 1960, at Hargeisha Airport in what was then British Somaliland.

I no longer have copies of the synoptic charts for the day in question but the circumstances in which this phenomenon arose recur each year and can be described in fairly simple terms, although in practice, day to day situations are very much more complex. In the latter part of the year, the Inter-Tropical Front, lying approximately east-west and flunctuating in position from day to day, but nevertheless gradually retreating from its summer position over north Africa and north Arabia, passes from southern Arabia, across the Gulf of Aden and southwards over Somalia. At this stage it is often a true front, marking an air mass density discontinuity between warm, dry NE'lies (the developing North-East Monsoon) and cool, moist S'lies (the retreating South-West Monsoon). Showers, thunderstorms or periods of rain occur in association with the system, but vary enormously in intensity, extent and duration from month to month and year to year.

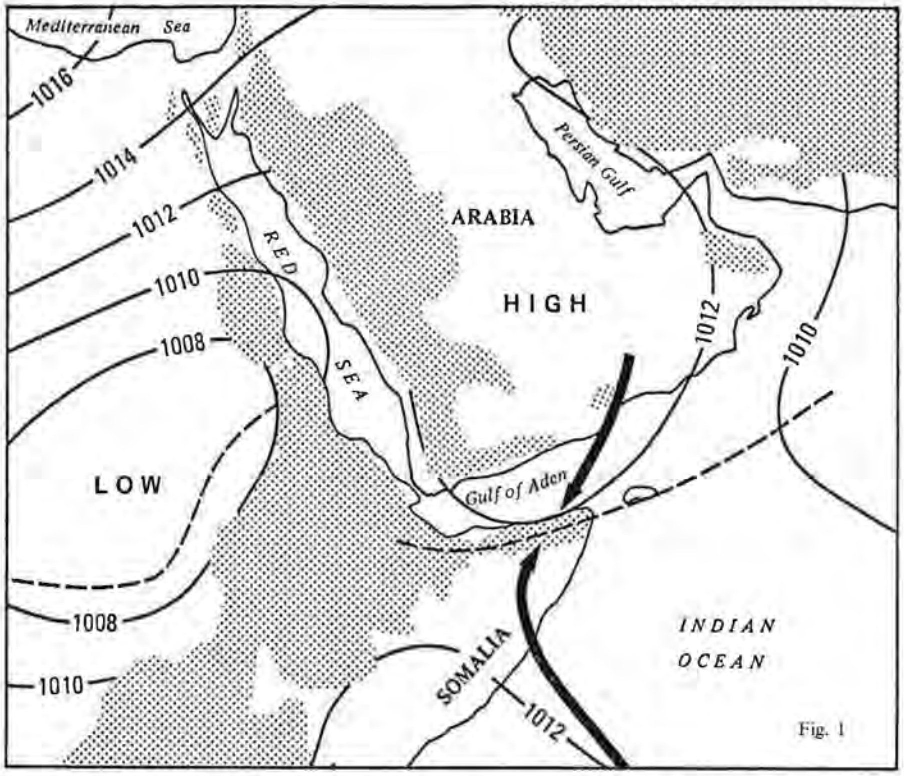

FIG. 1 THE INTER-TROPICAL FRONT (dashed lines) over northern Somalia in the September-October period.

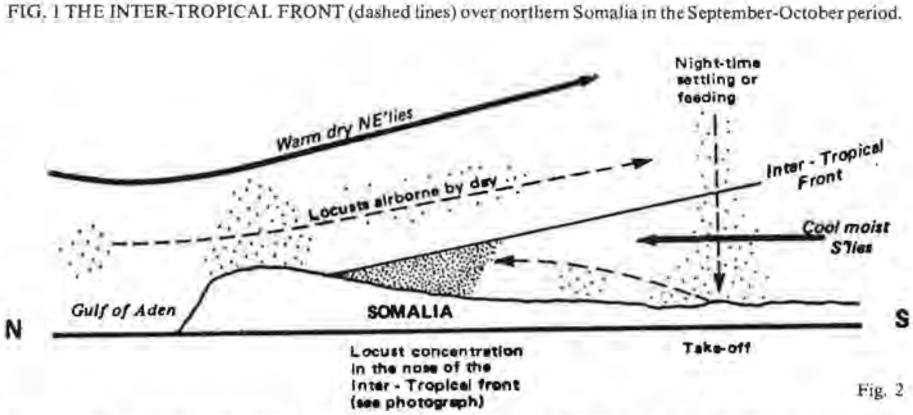

FIG. 2 A NORTH-SOUTH CROSS SECTION THROUGH THE INTER-TROPICAL FRONT showing the manner of development of locust "super-swarms".

The effect of seasonal rains on the desert landscape is remarkable. Hardy bushes send out new green shoots and new grasses and flowers soon carpet the ground. Desert locust eggs, dormant in the sand, are also hatched, and the 'hoppers' which emerge feed on this vegetation. With fairly heavy and widespread rains enormous numbers of hoppers were likely to hatch; if the rains were poor and isolated, naturally far fewer would emerge. The initial population thus varied within very wide limits according to the amount and distribution of rainfall. Since the average incubation period of desert locust eggs is of the order 10-14 days and the rains over south Arabia and north Somalia occur irregularly during the period August to November, the potential hopper emergences were obviously liable to be enormous. The use of the past tense in the previous sentences is deliberate since hatchings became very much smaller in the sixties and seventies because of the effectiveness of control measures taken over the previous two decades.

At this stage of their life the emergent hopper bands are likely to be widely scattered over this vast, largely trackless and uninhabited region, and although hoppers are gregarious so that the bands remain cohesive, concentrations of insects, though occasionally bad enough, are not normally of the size they are liable to become later.

continued p. 3

Chinook

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Articles

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THE COVER

Sunflower crops are now being planted, particularly on the Canadian prairies, as an alternative to the more traditional crop of rapeseed. Sunflowers are prone to attack by the larvae of the sunflower moth *Homoeosoma electellum* which is believed to migrate northwards from Texas borne by favourable wind currents.

For more on this topic, see **Sunflower Moths Ride the Winds to Saskatchewan,** page 10.

Photo courtesy of **Dr. Alfred P. Arthur,** Agriculture Canada.

Fronts Made Visible cont'd.

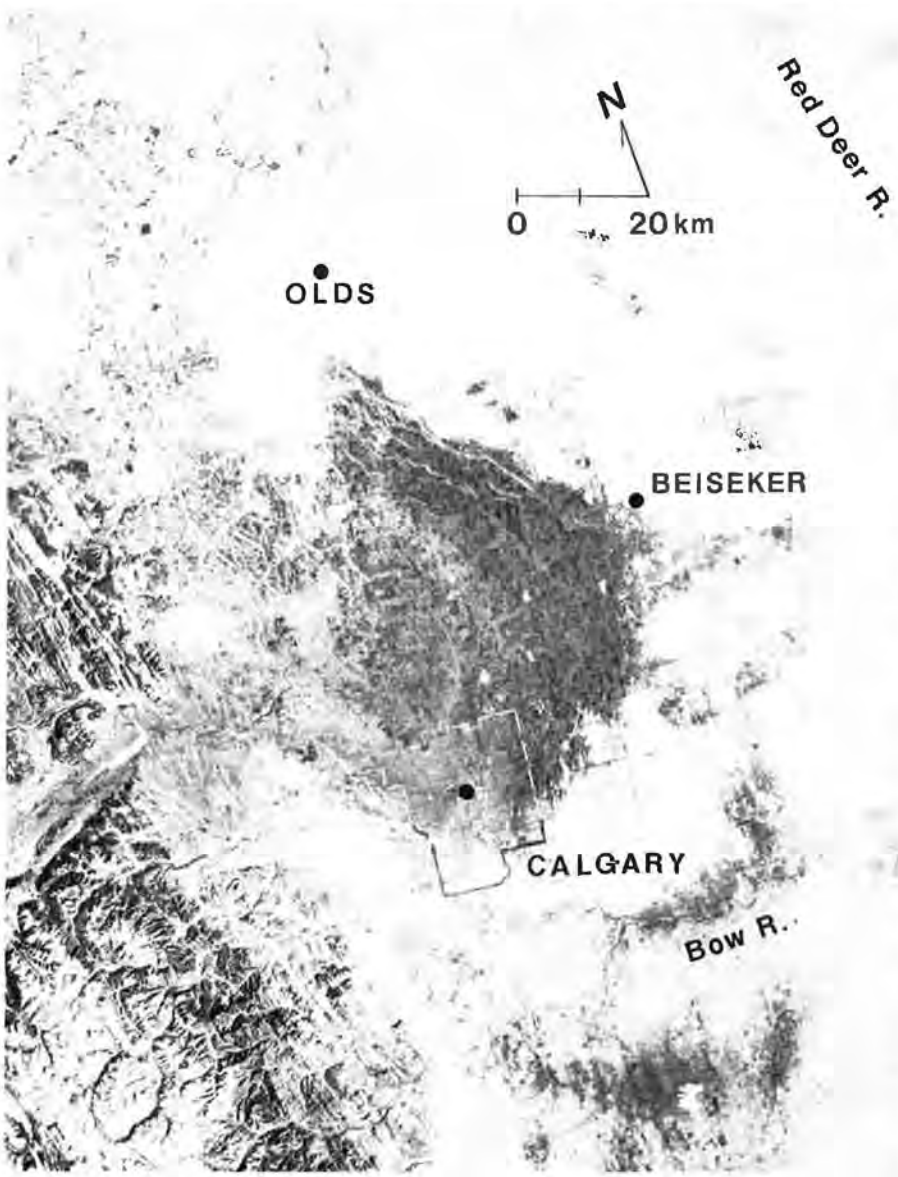
After some weeks, and providing the food supply has remained sufficient, the hoppers develop wings and eventually take to the air as desert locusts. They can expect a normal life span of some six or more months. From now on meteorological factors come to play a principal part in locust behaviour and lead ultimately to the plagues of insects which used to be so common and destructive a feature of life in eastern Africa. Once the desert locusts are airborne, the separate bands, still remaining cohesive, set out in search of food. Although individual locusts have a still air flight speed of some 15 km hr^{-1}, and can thus make some headway against light winds, nevertheless in the long term the whole body of locusts in a band is inevitably drifted in the general wind direction. The locusts, of course, do not remain continuously airborne; they settle to consume food by day and they remain grounded by night when temperatures fall below about 20°C.

Fig. 1 shows a typical low level synoptic situation over the region in late September or October and Fig. 2 is a corresponding north-south cross-section over Somalia and the Gulf of Eden which shows the process which now ensues. Locusts north of the front become airborne by day and drift slowly southwards in the general NE'ly flow, many insects often being lifted to high levels by convective currents. When they reach the front they ride up and south of its surface position but when they now land, either for food or by night, they are no longer in the NE'ly flow, but in the low level S'lies. An inversion at the top of the S'ly current means that upward air motion there is damped and no lift exists likely to carry the flying locusts back into the NE'lies. They are thus drifted back northwards in the S'ly flow and over a period of time hundreds of separate bands become concentrated in the frontal nose. Such swarms used to comprise unimaginable numbers of insects. The photograph (page 4) depicts this stage. It is of course an admirable opportunity to attack the insects with pesticides.

The final part of this story is the 'break-out'. By late October the S'ly flow has become very weak and the front has advanced to southern Somalia and northern Kenya. Abruptly, usually in early November, the gradient changes, S'lies finally die out and NE'ly flows develop simultaneously over the remainder of Somalia, southern Ethiopia, Kenya and northern Tanzania. The locusts are swept rapidly into these regions. One swarm described by Rainey (1963) in Kenya in

continued p. 4

A LOCUST "SUPER-SWARM" OUTLINES THE INTER-TROPICAL FRONT



Fronts Made Visible, cont'd.

1955 contained about 10^9 locusts and covered an area of 20 km^2; several hundred square kilometers of such swarms existed. By the mid-sixties, knowledge of locust behaviour, the possibility of forecasting the weather events which lead to swarming, and a network to control and support the search and spray aircraft, had almost eradicated the desert locust. An essential feature of the operation was international agreement and cooperation which permitted freedom of access of all personnel engaged in control measures to all the areas where the hoppers or locusts might be found. Unfortunately, international amity in this region has not been maintained, and the possibility of eliminating the desert locust, foreseen in the sixties, is probably no longer so close as was then hoped by many political optimists.

Further Reading

Rainey, R.C. 1963: **Meteorology and the Migration of the Desert Locust.** W.M.O. Technical Note Number 54.

B.W. Thompson, Professor,
Department of Geography,
Brock University,
St. Catharines, Ont.

CHINOOK WINDS MELT SNOW

Please accept the enclosed Landsat—2 satellite image (bottom left) with my compliments. Where better to send an image of the effect of a chinook on the Calgary area than the Chinook magazine?

The image date is March 3, 1977 and the snow covered ground outlines the vegetation exposed by the chinook near Calgary, Alberta.

Mrs. B. Fisher
ISIS Ltd., Prince Albert
Sask.

(At the time of this picture the skies were clear and the temperature at Calgary was 5° C. Previously, a chinook had spilled out of the Rockies through the Bow River Valley raising the air temperature 10° C in 2 hours in a triangular area of 4150 km² from Carstairs (near Olds) to Beiseker to Calgary. The snow on the ground melted leaving a "footprint" of bare earth as mute testimony to the passing of the warm winds of the chinook. Say we assume the earth had been covered by an average 5 cm depth of snow, then a total of about 2.075 × 10^{10} kg (23 million tons) was melted in the area, and the chinook did the City of Calgary the favour of melting about 1.615 × 10^9 kg (1.8 million tons) of snow. Ed.)

CALCULATING HOME HEAT SAVINGS

by Henry Stanski

Since moving to Brampton, Ontario in October 1977, I have kept a record of the natural gas consumption used to heat my house. In common with many other homeowners, I have made improvements to the original insulation as well as taking other energy saving measures (see Table 1). Difficulties arise however, when trying to determine how effective these improvements have really been. For example, how do you screen out the effects of the climate on fuel consumption? Obviously a mild winter results in fuel savings which may mask the savings due to better insulation installed the previous summer.

The number of heating degree-days (HDD[1]) is a useful indicator of how mild or cold a winter has been because they are cumulative and are directly related to the severity of the season. In other words, the larger the total number HDD's for a season, the colder it has been; the smaller the number, the milder it has been. Tabulations of the annual number of HDD's for many locations across the country are available from Environment Canada[2], as well as tabulations of the long term average number.

An examination of the annual number of heating degree-days calculated for Toronto International Airport indicates that the winters since 1976-1977 have been progressively milder in my area (see Fig. 1). This alone could account for the fact that my natural gas consumption fell each year from 1038 Ccf in 1976-77 to 409 Ccf in 1979-80 (see Fig.2).

There are two steps by which any householder can take the climate trends into account when calculating the change in fuel consumption. First, obtain the annual HDD summary for the nearest weather station and calculate the ratio of the annual fuel consumption to the annual number of HDD's. This ratio gives the amount of fuel used for heating in relation to the weather. In my case, 1038 Ccf of gas was used in 1976-77 when there was an annual number of 2604 HDD's. Thus, gas consumption divided by HDD's equals 1038/2604 or 0.399 Ccf of gas per heating degree-day. By 1979-80 this value had decreased to 0.201 (see Fig. 3).

The second step is to calculate the normalized fuel consumption each year. In effect this allows you to calculate your fuel consumption while keeping the weather constant. Simply multiply the ratio obtained in the first step by the normal or long-term average number of HDD's for the season. For example, the normal total number of heating degree-days at Toronto International Airport for the period October 1st., to February 1st., is 2113.6. Hence the fuel requirement had it been an 'average' or 'normal' winter (Oct. 1 to Feb. 1) is obtained by mulitplying the ratio for each season by 2113.6 (see Fig. 4).

The decrease in fuel consumption shown by Figure 4 is now obviously due to my measures to increase home heating efficiency. In fact I have saved 416 Ccf this year over the previous owner, and 1055 Ccf during the past three years. At the present cost of 34.69¢ per Ccf, this amounts to a saving of $144 this past year alone, and as the price of fuel inflates, my savings will be even larger.

---

[1] A heating degree-day occurs when the average daily temperature at a location is less than 18°C. The number of heating degrees for the day is found by subtracting the average daily temperature (the mean of the maximum and minimum) from 18°C. The cumulative total each year is referred to as the annual number of heating degree-days.

[2] Write to Environment Canada, AES Canadian Climate Centre, 4905 Dufferin St., Downsview, Ont., M3H 5T4 to request copies of the annual "Heating Degree-Day Summary" (cost $2), and the free CDS publication which gives the normal degree days during the period 1941-70 for locations in various provinces.

Table 1. THE HISTORY OF HOME IMPROVEMENTS completed each year to help make my home more energy efficient.

1976-77	House occupied by previous owner.
1977-78	Caulking of cracks; ceiling insulation increased from R12 to R32; window blinds installed; thermostat setting lowered.
1978-79	Storm windows installed; half the basement insulated to R12.
1979-80	Remainder of basement insulated to R12. Storms installed on picture windows.

Fig. 1

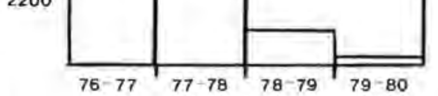


Fig. 2

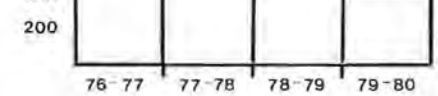


Fig. 3

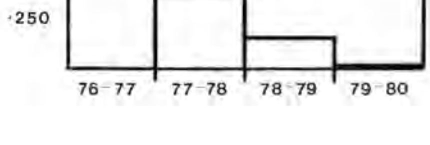
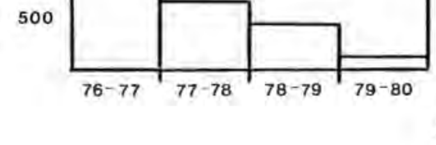
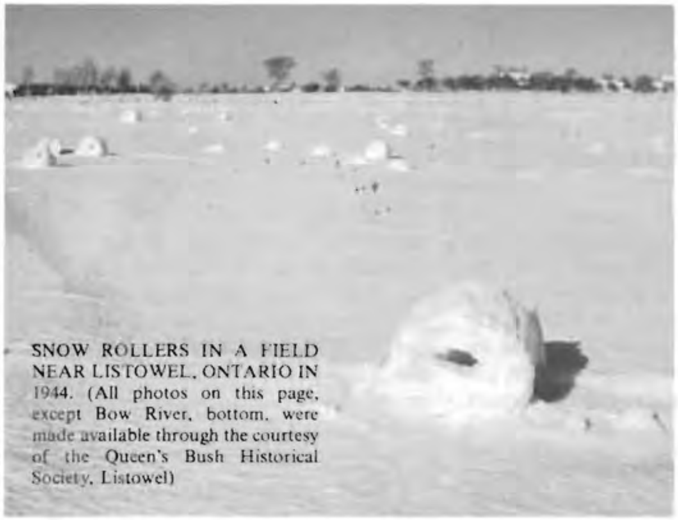


Fig. 4





SNOW ROLLERS IN A FIELD NEAR LISTOWEL, ONTARIO IN 1944. (All photos on this page, except Bow River, bottom, were made available through the courtesy of the Queen's Bush Historical Society, Listowel)

J.G. Kirk

TRACKS LEFT BY SNOWROLLERS near Listowel, Ontario in 1944.

J.G. Kirk

KIRK SISTERS DISPLAY SNOW ROLLERS near Listowel, Ontario in 1944.

J.G. Kirk

HARRY ROGERS (formerly with with the *Listowel Banner*) DISPLAYS SNOW ROLLERS.

J.G. Kirk

SNOW ROLLERS ON THE BOW RIVER, ALTA., IN 1919. This is believed to be the earliest photo of this phenomenon in Canada.

Photo courtesy AES

SNOWROLLERS

by D.G. Schaefer

On the morning of December 24, 1978, Mrs. Kathy Whipple awoke to find her gently sloping orchard, located just to the east of Woods Lake in British Columbia's Okanagan Valley, littered with numerous large, rarely seen, snowrollers. Details of the occurrence were forwarded to the Atmospheric Environment Service by the Local Anglican parish priest, Rev. E. Dexter (retired Chief, Weather Services, A.E.S. Central Region, Winnipeg), along with photographs taken by Mrs. Whipple.

The conditions required for the formation of these "jelly roll" like structures include a crust of old snow, a surface layer of wet new snow and strong winds. All were present on December 24th. Records from Kelowna Airport, 14 km to the south, indicate that a layer of snow some 10-15 cm in depth had undergone a number of daily freeze-thaw cycles prior to the event.

In the early morning hours of December 24th, a front accompanied by a thunderstorm passed through the area. Rev. Dexter reported that "two or three peals of thunder and flashes of lightning were seen by my parishioners". About 5 cm of wet snow was deposited. Winds at Kelowna Airport reached speeds of 28 km/h from the south-southeast at 2:00 a.m. and gusted briefly to 52 km/h from the north at 5:26 a.m.

The rollers on the Whipple orchard (photo this page) had generally moved from the southeast. In some cases, a series of holes in the snow seemed to indicate the path made as a "snowball" bounced along. In other instances, a roller would be found lying on its side. Rev. Dexter commented on one of the larger rollers that Mrs. Whipple had carried to her back door and placed on a picnic table. When he saw it, later in the day, it was still about 30 cm deep, although it had sunk to about half its original depth. When new, the sun shone through its crystalline centre and the folds of snow (like a jelly roll) were clearly visible".

SNOW ROLLERS NEAR WOODS LAKE, B.C. IN 1978. K. Whipple

A second unconfirmed report of rollers came from a location about 4 km to the south on an area of steep open rangeland sloping from the southeast. Rev. Dexter concluded his account with the statement that "in his years as a meteorologist and as Chief of General Weather Services of Central Region, this is the only first-hand occurrence of snowrollers" that he had experienced. We are pleased that he made the effort to share the experience with us.

D.G. Schaefer is the Chief of Scientific Services Division, Pacific Region, Atmospheric Environment Service, Vancouver, B.C.

SNOWROLLER FACTS

Although Canadian literature concerning snow rollers is sparse, these quirks of nature have attracted the attention of European and American writers from time to time since early in the 19th century. While it is true that an individual very rarely sees them, nevertheless they probably develop somewhere in Canada each winter and are therefore a relatively common phenomenon. When they do occur, hundreds will form at a time and they can be found strewn through fields or other open snow covered areas which are exposed to the wind.

Characteristically, they develop during the passage of vigorous winter cyclones. At first, several centimetres of snow falls which becomes sticky and wet as the air temperature rises to the plus 1°C to 3°C range. At this point, strong southwesterly winds develop for a short time as the warm sector of the cyclone passes. This is followed in turn by an outbreak of cold air driven by strong northwest winds. The snow rollers can be formed both in the warm sector and for a short time after the switch to northwesterlies while the snow is still somewhat sticky. Wind gusts of at least 45 or 50 km/h appear to be necessary.

The physical conditions of the pre-existing surface also seem to be important. Usually the fresh snow falls onto an older, crusted snow surface. This situation allows the wind to scoop down and peel away a wafer of new snow, the nascent roller, and start it moving. Secondly, rollers are often reported to have formed on sloping terrain where obviously the force of gravity is added to the force of the wind exerted upon the rolling body of snow.

Rollers have been reported in Canada as follows: Toronto, Ont., April 10, 1897; Bow River, Alta., March 17, 1919; Toronto, Ont., Jan. 12, 1929; Listowel, Ont., Feb. 29, 1944; Queens County, N.S., early spring 1948; Norton, N.B., Feb. 25, 1950; Quebec, 1952; Fort William, Ont., Jan. 23, 1967; Lakeburn, N.B., April 5, 1972; Woods Lake, B.C., Dec. 24, 1978. Without doubt, there must be many more observations of these oddities than indicated by the list. Ed.

Further Reading

Hornstein, R.A., 1951: **Snow Rollers.** *Weather*, June 1951.

Payne, F.F., 1897: **Snow Rollers.** *Monthly Weather Review*, April 1897. Canadian Meteorological Service.

Perry, M.J., 1972: **Snow Rollers — Lakeburn, N.B. April 5, 1972.** *Atmosphere*, vol 10, no 4. CMS.

Edmonton Sun

Photos courtesy OMNR

1

2

DUST DEVILS A Photo Feature

During the early summer of 1980, drought conditions prevailed in the prairie provinces. The hot dry weather was favourable for dust devil formation and they were a common sight skittering across the fields. The remarkable pictures on the opposite page were taken by Bill Brennan at the Northlands racetrack in Edmonton, Alberta at about 1630 MST, May 10, 1980. For about 5 minutes he watched the dust devil approach, then suddenly it went through the stands. He found himself blinded by dust and sand with dirt hitting him in the face and mouth. In a moment it passed, but not before he aimed his camera to catch two pictures of it hitting the next group of spectators.

The series of pictures on this page were taken by Jim Divers in June 1976 at 1500 CDT while on a forest fire patrol mission. Flying at an altitude of about 100 m over northwestern Ontario, he could see the dust devil lashing its way through stands of trees. When it moved across cleared patches, ash and sandy soil roiled skywards as it re-intensified over the hot ground.

3

4

SUNFLOWER MOTHS RIDE THE WINDS TO SASKATCHEWAN

by D.J. Bauer and Alfred P. Arthur

The sunflower moth, *Homoeosoma electellum* caused extensive damage to early blooming sunflowers near Saskatoon, Saskatchewan in 1975. In 1976 considerable damage was done by the moth to sunflower fields near Weyburn and Herschel, Saskatchewan. While the pest is known to overwinter as a mature larva within a hibernaculum in the ground in Texas, it is considered highly unlikely that this pest overwinters successfully in Western Canada (Arthur 1978). Thus, it was assumed that the moths must migrate from the southern United States if significant numbers are to be found in Saskatchewan. This assumption seems quite reasonable since other species of moths such as the diamond back are known to have made non-stop migrations over even greater distances over a relatively short period of time.

The female sunflower moths deposit their eggs on newly-opened sunflower blooms. The first and second instar larvae feed on pollen and the corollas of the flowers where they are exposed to spray applications. The older larvae, however, feed inside the head where they cannot be killed by recommended pesticides. Thus, any control measures must be taken within about a week to ten days of the arrival of the moths. Since the sunflower moths are small (approximately 10 mm long) and not easily noticed, it would be advantageous to be able to warn growers of anticipated arrivals so that fields could be monitored closely to determine whether or not spraying was warranted.

Data on the arrival of the moths in Saskatchewan were available for the 1975 and 1976 influxes from the Canada Agriculture Research Station in Saskatoon. Using these data and surface weather maps at 6-hourly intervals, backward trajectories were computed for the two influxes, mid-July in 1975 and early July, 1976. Analyses of these series of maps showed that the moths could have been transported northward from Texas to Saskatchewan, non-stop, on the air currents in approximately forty-eight hours. The maps were further examined to determine the type of pressure distributions most likely to produce the required winds. It was concluded that a large high pressure system over eastern United States, followed by a low or trough over or just east of the Rockies produced the warm southerly flow conductive to the northward migration of the sunflower moths.

Examination of upper air data for the migration period showed generally unstable conditions suggesting that the moths utilized rising air currents to keep airborn. Even at night when conditions near the surface usually become stable, there were regions a few hundred metres above the surface where these vertical currents persisted. Surface maximum temperatures in Texas at the time the migrations were expected to have begun were usually in the low to mid 30's.

Hoecker (1965) and others have reported low-level southerly jet winds associated with flow patterns similar to those described above. Therefore, wind and temperature profiles for the 1976 migration period (June 30 to July 2) were analyzed and it was found that indeed there was evidence of a low-level southerly jet which could have greatly assisted the northward migration of the sunflower moths and made it possible for them to complete the migration more rapidly than originally estimated.

An examination of the literature showed that suitable populations of sunflower moths in Texas might be expected to be ready for migration in late June or early July. Therefore, current and prognostic weather maps were monitored daily from mid-June to the end of July. When it was found that the typical eastern high followed by a low over the mountains was developing and was forecast to continue for the next 36 hours, a potential influx was forecast.

In 1977, pheromone type traps baited with virgin females were placed near sunflowers at Outlook and Saskatoon. These traps were monitored weekly by Canada Agriculture staff. In 1978 the network was increased by distributing traps to cooperating growers and in 1979, traps baited with a synthetic pheromone developed at the N.R.C. Prairie Regional Lab in Saskatoon were used in addition to traps baited with live females. During the summer of 1978 and 1979 the traps were examined every two days. Growers were not advised of expected influxes, but were instructed to report any significant increase in catch.

On June 30, 1977 a potential influx was forecast for by late July 2 or July 3. When checked, the traps which had been exposed June 30 to July 7 did contain substantial numbers of moths. In 1978 two influxes were predicted, June 28 to July 1, and July 9 to 11, and in both cases farmers reported increased numbers of moths caught in their traps. In 1979 two influxes were successfully predicted as well, July 5 to 7, and July 15 to 17. There was an earlier influx in late June of 1979, which was not predicted.

Results to date indicate that it is possible, with a reasonable degree of accuracy, to identify and predict situations favourable to influxes of sunflower moths into Saskatchewan. Growers can be alerted to possible influxes so that they may monitor their fields closely to assess the severity of the influx and decide on what actions they wish to take.

The criteria necessary for an influx of the sunflower moth into Saskatchewan have been identified as:

(i) A large population of sunflower moths in Texas or Nebraska ready to migrate (this usually occurs in late June or early July).
(ii) A high pressure system over the eastern half of the United States and a low over the mountains forecast to persist for a few days.
(iii) Warm temperatures (daytime highs 30-35°C) in the source region.
(iv) A generally unstable air mass.

Further Reading

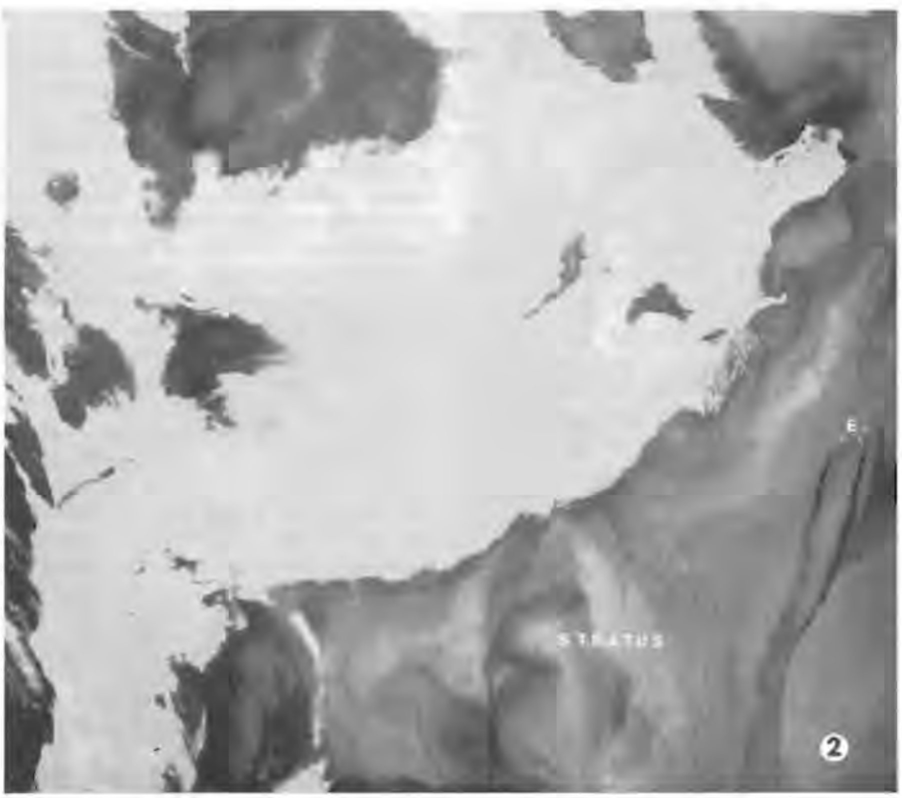
Arthur A.P., 1978: **The occurrence, life history, courtship and mating behaviour of the sunflower moth, Homoeosoma electellum (Lepidoptera: Phycitidae), in the Canadian prairie provincies.** *Can. Ent.* 110; 913-916.

Hoecker, W.H., 1965: **Comparative physical behaviour of southerly boundary layer wind jets.** *Mon. Wea. Rev.* 93: 133-144.

Dr. Alfred P. Arthur is a specialist in insect behaviour at the Agriculture Canada Research Station, Saskatchewan.

Donald J. Bauer is the Officer-in-charge of the Environment Canada Weather Office, Saskatoon, Saskatchewan.

BLACK IS THE SAME AS WHITE By David Etkin



These photographs, both taken by the NOAA 6 weather satellite on March 28, 1980 at 0807 AST, reveal an extensive area of stratus cloud obscuring portions of the Atlantic provinces, the Gulf of St. Lawrence and the Atlantic Ocean. In Figure 1, photographed in the near infrared (NIR) section of the spectrum (0.75 to 1.11 microns) which overlaps the visual wavelengths (0.55 to 0.90 microns), the cloud appears white, the water is dark while land areas are an intermediate shade. Use of the NIR wavelengths, rather than the visual, serves to sharpen the contrast between land and water. In this picture, considerable fine detail can be discerned, such as Lake Manicouagan (A), the Magdalen Islands (B), and strings of sea ice along the Quebec shore (C), through the Strait of Belle Isle and into the Atlantic offshore from Labrador and northern Newfoundland (D). Over the land areas however, the clouds tend to merge with the terrain due to the lack of contrast.

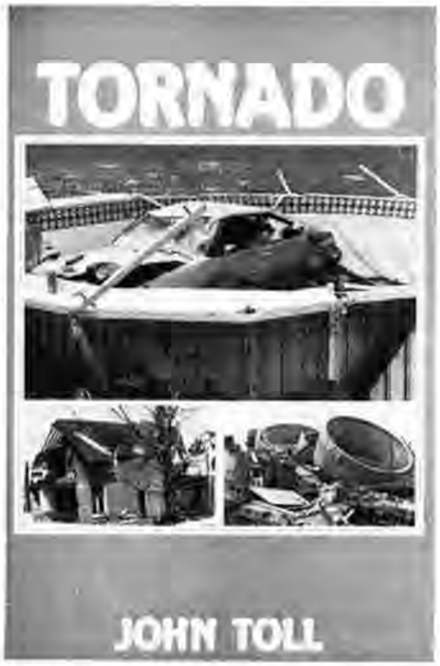
In Figure 2 the reverse is the case. This photograph of exactly the same area, at the same time, was taken utilizing the 4 micron waveband. At this wavelength, the satellite sensor detects energy (emitted by the surface beneath) which is a combination of long wave radiation (a function of temperature), and the albedo of the surface, or its ability to reflect the sun's rays. Because the tops of clouds are good reflectors of insolation, they return a large amount of energy to the satellite sensor in the 4 micron waveband and the cloud areas now look black. The water areas, on the other hand, are poor reflectors when the angle of incidence of the light is larger than 15°, and so too is the land unless it is snow or ice covered, so they return very little energy to the satellite sensor and hence appear as a light grey shade in the photograph.

The advantage of using this wavelength to take photos is demonstrated by the clarity given to the cloud areas. There is no doubt where they are. Even their texture is enhanced, and it is interesting to speculate that the 3 trails which appear near the lower left edge of the picture (E) may be smoke plumes from ships at sea.

Upper air soundings taken at 0800 AST at both Shelburne, N.S., and St. John's, Nfld., indicate that the cloud top temperature was minus 11°C and the top of the cloud layer was between 1000 and 1400 m above mean sea level.

Perhaps this is the only case where it can be argued that black is the same as white.

BOOK REVIEW



TORNADO by John Toll. Published jointly by the author and Stonehouse Publications, PO Box 523, St. Catharines, Ont., 1980. Hardcover. 136 pages. $9.95.

August 7, 1979! The day will be long remembered by the residents of some southern Ontario communities, for it was the day that two tornadoes churned their way across the countryside between Stratford and Waterford. John Toll, in his recently published book, *Tornado*, has taken on the task of relating how and why the events of that day affected the lives of some of the people in the path of what is known as the Woodstock Tornado.

Throughout the book he has attempted scientific explanation and interpretation without much success. While some of the analogies he uses are good, on the whole, he is on shaky ground. Certain statements he makes when dealing with the forecasting and formation of tornadoes as well as interpretations of physical causes of certain specific damage, or lack thereof, indicate less than adequate research on the subject and are likely to mislead or confuse the reader. In addition, he has had obvious problems in coherently organizing the explanations, the historical background of tornadoes in the area, and the large number of personal accounts. Without an index, a table of contents is all the more necessary, but curiously this has been omitted. A more detailed map than the one included, perhaps showing the locations of the individual farms and roads to which he frequently refers, would have been welcome. Numerous photographs showing damage help the reader grasp the extent of the devastation, but unfortunately there is not a single photograph of the Woodstock Tornado itself, a number of which are available.

These critcisms notwithstanding, the personal accounts are fascinating. They are stories of miraculous escapes from death as the tornado roared by overhead; of houses exploding as if bombed and debris falling around the ears of the occupants; of farm animals and furniture being picked up as if they were feathers and propelled through the air, along with cars and uprooted trees; of people losing what had taken a life time to build; and of strangers reaching out to help them start over. The people who were involved in any way with the events of that day have no doubt of what a tornado can do, and after reading the book, neither will you. **Carole E. Klaponski.**

HOW TO SAVE THE WORLD by Robert Allen. Prentice-Hall of Canada Ltd., 1870 Birchmount Rd., Scarborough, Ont., M1O 2J7. Softcover. 144 pages. $5.95.

This book is sub-titled *Strategy for World Conservation* and is a popularized version of the *World Conservation Strategy* published in 1979 by the International Union for Conservation of Nature and Natural Resources (IUCN), with the collaboration of the United Nations Environmental Program (UNEP) and the World Wildlife Fund (WWF).

How to Save the World is a tightly-packed compendium of information on the present state of global environmental degradation taking place in our natural resource sectors, in our productive lands for agriculture and forestry, and in our food and other natural products from the marine world. Effects of man's encroaching activities on animal and plant species on land and in the oceans are detailed. The book is replete with specifics, for example the number of tonnes of soil annually lost to erosion, the number of dollars paid out to dredge the silted Rio Plate estuary, which represents the real cost of poor watershed management, and the loss of 320 ha of Canadian agricultural land for every 1000 person increase in urban population. Examples are drawn from all parts of the world and the regions of particular concern are identified, linked, and ranked according to such factors as, the importance of the resource to regional and global economies, the relative danger of irreversible degradation and the far reaching impacts on all of us if the resource is destroyed. While the inventory of problems facing the world's resources (i.e. overexploitation, habitat destruction, incompetent management, and lack of planning) is impressive alone, the value of this book goes beyond problem identification. We are presented with suggested mechanisms to develop plans and strategies to offset deteriorating forces, and told how to put these into action through government policy, and private sector organization. This, of course, provides the conservation-conscious individual with the frustration-removing power of doing something about a situation that he knows is wrong.

Items of particular interest to readers of ***Chinook*** are the statements regarding the effect of massive forest removal on increasing carbon dioxide in the atmosphere which is forecasted by some to produce significant warming of our climates within a century; progressive desertification of semi-arid lands by overgrazing which causes increased wind-blown dust in the atmosphere; the effects of pollutants such as acid rain and air-borne heavy metals such as mercury which ultimately end up as toxins in fish and plant communities. The role of the atmosphere in propelling impacts of man's environmentally destructive practices is less clearly explained in the book than land-based processes such as streamflow. This is in part related to lack of knowledge, which is itself a perplexing aspect of the entire problem. We are far from fully conscious of all effects of human actions on the environment. The reviewer recommends this book for its rich educative qualities, but advises the reader to exercise critical judgement on the material being presented. The popular writing style puts emphasis on sensation in order to sell ideas and keep reader interest strong. In brief, the book unequivocably destroys the popular misconception that "conservation is an obscure peripheral activity perpetrated by bird watchers."

B.F. Findlay

JUMBLE-WORDS (#14)

by Sandra Newark

UTRAOPTSWE
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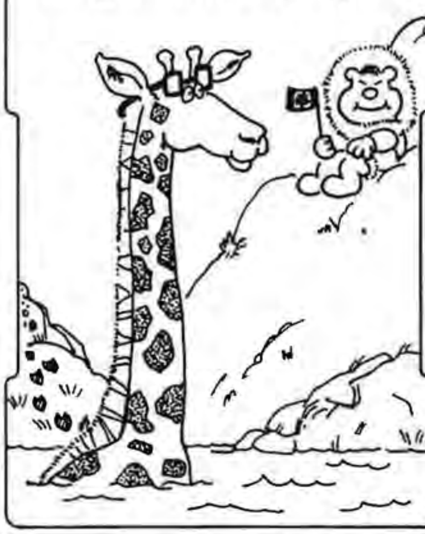
□□□ □□□□

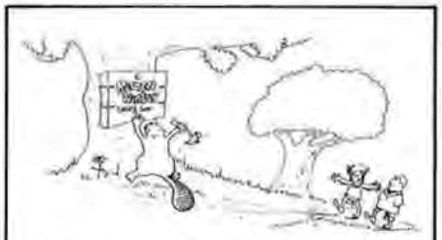
Your Answer

Unscramble the words in each box. Re-arrange the letters which fall in the circles to find the answer to the clue illustrated on the right.

What the giraffe thought of the north pole.



Here they are, the answers you sent in response to Arch Puzzle assignments 11, 12, and 13. **Walter Zeltmann** of Brooklyn N.Y., rose to the challenge with the following forecast for election day (#11): *A rising electorate followed by falling politicians.* With regard to misplaced meteorological items (#13) he wrote *"the best place to find a chinook is in my library"*. **K. Hamilton** of Lindsay, Ont., entered a number of rhyming definitions (#12). He defined cirrus as *feather weather,* stratus as a *flat mat,* nimbus as *rain gain,* cumulus as *puff 'n' stuff,* cumulonimbus as either a *tower shower* or a *power shower,* while a storm is *tower shower power.* Among others he defined drizzle as *spit-a-bit,* a blizzard as a *white plight,* while sleet *gets frozen then blows in.* His wind vane is *wind spinned.* As far as misplaced items (#13) are concerned, Mr. Hamilton thinks that *Ballot's Law may be found in any electoral returning office.* **J. Walker** of Niagara Falls, Ont., forecast a *low blow* for Boxing Day (#11). Perhaps, he wrote, this was predicted by the forecaster who was in a deep depression, all knotted up and ready to throw in the trowal. Prizes are on their way to these three entrants.



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TRADE WINDS Edited by Claude Labine

A VISIT WITH THE LARGEST USER OF METEOROLOGICAL EQUIPMENT IN CANADA

Trade Winds visited the headquarters of the Atmospheric Environment Service (AES) in Downsview, Ontario to chat with Mr. Larry Wiggins who is head of the Sensor and Observing Section of the Instrument Branch. AES is probably the country's major user of meteorological equipment, and Mr. Wiggins described the internal structure of the Service as it applies to instrument design and manufacture. He explained that the Instrument Branch responds to requests for specialized instrumentation initiated by the Research Directorate. Research projects in fields such as air quality, radiation, or agriculture, to name a few, sometimes need measuring and monitoring systems which cannot be bought off the shelf and which must be specifically designed and developed. The actual manufacture however is contracted out to private firms. One or more production units of the new equipment are then built, and used for testing and evaluation. These initial production test units might well be made by a small manufacturing concern whereas the full production may be handled by a larger firm. "At times, the large production run will be awarded to the same small manufacturer if the firm can prove its ability to expand to meet increased production demands," said Mr. Wiggins.

One problem has been the underestimation of the total cost of the final working model. Mr. Wiggins said that he has seen final costs which are 3 to 20 times the original estimate.

When dealing with private industry there must be good communication between the manufacturer and AES so that developmental ideas are successfully translated into a working unit. Mr. Wiggins admits that AES is constantly looking for good manufacturers to handle their work, and at times it has been necessary to go outside the country to find the proper firm.

A further advantage gained from using the private sector is that equipment can go back to the factory for repair, thus avoiding in-house work. Another point of interest is the fact that AES can advise other countries about equipment that is being built to meet AES standards and specifications which, in turn, allows Canadian industry to sell to foreign markets. At times it does cost more to use private industry than to do the work internally, but this is considered to be an investment by the government in the private sector. From time to time instrument development contracts have been awarded to universities in order to deal with the more theoretical stage of the research problem. In Mr. Wiggins' opinion this is an important first step, but further progress is required within private industry in order to bridge the development gap between pure research and a practical solution.

Where are some of the problems in the field of instrumentation? Mr. Wiggins answered this by saying that sensor technology and development is an ongoing requirement. Also, some of the present network equipment is becoming outdated and needs to be replaced. One area where AES is rethinking it's approach is in the field of data acquisition. Instead of trying to build a data logger to meet certain field requirements, the emphasis now will be placed upon dealing with the whole concept of data acquisition. One of the main difficulties has been the rapid growth within the electronic and microprocessor fields. This has sometimes meant that by the time a unit reaches full production it is outdated.

AES has an immense station network to maintain and update in order to meet its obligations in providing weather and climate information. After meeting with Mr. Wiggins it is clear that this will provide a continuing opportunity for established private industry to do business with AES. But more than that, there is also room for creative newcomers who can develop practical instrument systems for the needs of pure research.

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