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MAY, 1897.
VOL. XI, No. 2.

# THE OTTAWA NATURALIST.

Published by the Ottawa Field-Naturalists' Club

CONTENTS.



OTTAWA, CANADA.
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Remember excursion to Pickanock June 19th. Special Train leaving C.P.R. Station at 9.15 a.m., returns at 8 20 p.m. Fare: Members, $1.00; non-Members, $1.10; Children, half rate.

*Entered at the Ottawa Post Office as second-class matter.*

# THE OTTAWA NATURALIST.

VOL. XI. OTTAWA, MAY, 1897. NO. 2.

## REPORT OF THE BOTANICAL SECTION.

*To the Council of the Ottawa Field-Naturalists' Club :*

### FIELD WORK.

In the Botanical Branch there has been some good work done. Some of the leaders have attended all the excursions and delivered addresses. Sub-excursions were also held during the spring months until the schools broke up. Two large sub-excursions of the botanical class attending the Normal School, consisting of about 60 ladies and gentlemen, were held. The first one to Rockliffe on May 9, where large collections of spring flowers were made, including *Viola Selkirkei* in splendid condition. The addresses at this outing were delivered by Dr. Fletcher and Mr. Sinclair. On the following Saturday an equally large party visited the beaver meadow at Hull, under the guidance of the President, Mr. Sinclair and Dr. Fletcher. Here they were met by Prof. Macoun, who gave an excellent address, speaking particularly of forest trees, and showing how some of the species usually troublesome to beginners could be separated and distinguished. The first excursion to Chelsea on 23rd May added one new species to our Ottawa list, *Stellaria uliginosa,* found by Dr. Fletcher in several places through Gilmour's Grove. This is thought to have been introduced ; but how such an inconspicuous plant could have been introduced and have spread so widely seems strange. A sub-excursion which was much enjoyed by a few of the members was to the Mer Bleue on May 28, when Mr. J. B. Goode, of Montreal, accompanied the party. This gentleman's success in cultivating our native orchids is well known. Fine specimens of *Arethusa bulbosa* and the rare *Listera australis* were collected. At a sub-excursion in October *Elatine* *americana* was found by Prof. Macoun along the shore of the Ottawa near Tetreauville.

BOTANICAL ARBORETUM AT CENTRAL EXPERIMENTAL FARM.

A matter of much interest to the members of our club is the advantage we now have in free access to the Botanic Garden at the Central Experimental Farm. This garden is now assuming the position of a valuable educational adjunct to the City of Ottawa. Begun in 1887 by the botanist of the experimental farms, Dr. J. Fletcher, it has been added to year after year and is now well worthy of a visit by all interested in botany or gardening. It is now in charge of Mr. W. T. Macoun, the foreman of forestry, who has published several interesting notes in the OTTAWA NATURALIST. The collections have been increased from all available sources, the chief effort having been to gather together and have properly labelled a reference collection of all plants which would grow in this climate. Last year a great deal was done to get the perennial border in order and there are now no less than 907 species and varieties of perennials included in 222 genera. This number too will be very much increased next year, as seeds of nearly 400 additional species have been procured, which will be forced in the greenhouse early this spring and many of which will flower next autumn.

At the end of 1896 there were nearly 2,000 different kinds of trees and shrubs in the arboretum, most of which have been there, or in the nursery rows, for one or more winters and will probably be found hardy at Ottawa. This question will be pretty well tested by the severe winters we have experienced this year and last. Arrangements have been made for increasing several of the groups next spring. The collections of some of the groups of flowering and otherwise ornamental shrubs are now very complete, as for instance, the genus *Syringa* called in English Lilac, is represented by 88 different named forms, Spiræa by 71, and Lonicera by 84. All the plants and trees in the arboretum and botanic garden are planted in duplicate, and records are kept of the time of planting, the source from whence derived and how they have fared from year to year. Visitors are cordially invited to visit the gardens, and Mr. Macoun will be glad to give any information concerning the plants in his charge.

An interesting botanical fact brought to the notice of the leaders during the past summer by Mr. H. B. Small was the value of the tubers of the Marsh Wound-wort (*Stachys palustris*) as a vegetable; these have been tried and found excellent, equalling in size and quality the cultivated *Stachys affinis* from Japan now cultivated to some extent in the gardens of the curious. *S. palustris* is found in abundance in Manitoba.

PRESERVE OUR BEAUTIFUL WILD FLOWERS.

The leaders of the Botanical Branch wish to direct attention to a somewhat important feature bearing upon the preservation of the flora of our fields and swamps. It is this, many species of the more beautiful and showy native flowers, notably orchids, are becoming somewhat scarce in the immediate vicinity of Ottawa, owing to the depredations of mere pot-hunting botanists. We can sympathise with those who have a genuine desire to introduce into their gardens the best types of our most ornamental wild flowers, but view with much disfavour the indiscriminate distruction of beautiful wild plants by pseudo-botanists and other people who are seized with a momentary desire to cultivate these flowers in their own gardens, but who fail, after uprooting the plants, to carry their good intentions into effect. *Cypridpedium pubescens* has become almost extinct in this locality. *C. acaule* is not to be found in Dows' swamp, where it was formerly abundant, and we might mention many other examples equally deplorable.

REGIONS NOT WELL EXPLORED.

We would draw the attention of the members of the Club to the fact that on account of transportation facilities our excursions bring us each year over nearly the same ground and therefore there are other parts of the country comparatively unexplored—that is in the modern sense of the word. For instance, between Gatineau Point and Templeton there is an interesting region which has been worked but little. The locality between Billings' Bridge and Metcalfe, Dr. Fletcher reports as being but hastily worked over. The Lièvre River region offers also an interesting field to the botanist.

ADVANTAGES OF SPECIALIZING.

We would urge also that it is desirable that we should have within the Club's ranks as many specialists as possible. In the botanical field there is ample opportunity afforded for special investigation in many of its departments. The services of the specialist are now indispensable in the identification of doubtful species. The eye of the specialist notes variations and detects differences at first not apparent to the general student. Among the rich fields open for investigation are the sedges, water plants and willows. We trust that some of these botanical branches will be taken up by enthusiastic naturalists during the coming year.

*Leaders in Botany*, { R. B. WHYTE. JOHN CRAIG. J. M. MACOUN.

## NOTES.

To the members of the Ottawa Field-Naturalists' Club and of the Ottawa Literary and Scientific Society who had the pleasure of listening to Prof. James Mavor's lecture on "Iceland," as well as to the readers of THE OTTAWA NATURALIST who were not present on that occasion, we have much pleasure in stating that a detailed account of Prof. Mavor's tours and studies in Iceland has appeared in the Transactions of the Glasgow Philosophical Society for 1890-91. The amount of valuable information contained in the very interesting and extended account of Iceland and its inhabitants cannot be overestimated. From a socialogical standpoint, Prof. Mavor's contribution to the study of Iceland, its people and their history, is one of intense interest, and will be read with delight and satisfaction.—H. M. A.

## BOTANICAL NOTES.

With the breaking up of the winter many eyes are turned to the coming of the birds, the opening of the buds and the advance of spring generally, but too few record their observations. On account of this lack of making a record scarcely any two observers agree as to the lateness or earliness of any particular spring, and the writer asks that any botanical notes considered worthy of insertion should be sent to one of the editors of the NATURALIST, who will see that they are published, if deemed worthy of publication.

Two causes have power to produce an early spring with us. The chief one is a light snow fall, which requires only a few comparatively warm days to take it all off the ground. The second is the absence of severe cold at night which checks the expansion of the buds and retards the melting of the snow and the heating of the soil. Both these causes have worked together the past month and the result is an early spring without any warm days.

In noting the first appearance of flowers in the early days of spring we have always selected the same tree and for Hepaticas the same bank, so that although others may have noted things earlier our observations refer to absolute heat. Up to the present time of writing the following flowers have been seen :—

Hepatica triloba (May flower), April 7, 1897 ; April 14, 1896 ; Acer dasycarpum (Silver maple), April 8, 1897 ; April 16, 1896 ; Alnus incana (Common alder), April 11, 1897 ; April 18, 1896 ; Acer rubrum (Red Maple), April 23, delayed by cool weather ; Ulmus americana (American elm), April 23, delayed by cool weather ; Salix candida (Hoary willow), April 26 ; Populus tremuloides (American aspen), April 26 ; Populus grandidentata (Large-toothed aspen), April 26 ; Negundo aceroides (Box elder), April 27.

JOHN MACOUN.

## BIRD NOTES FOR APRIL.

It is very gratifying to find that those who promised to help in making our observations of birds more reliable and complete, have heartily co-operated in the work. The result is that we are able to publish this month notes on no less than fifty-one species of birds, and we trust that throughout the summer continued interest will be manifested. Let all be accurate and certain of their records, as otherwise they will be misleading.

*Downy Woodpecker*—Observed by Mr. Lees on the 1st.

*Blue Bird*—Both Mr. White and Dr. Fletcher recorded this bird on the 2nd. The blue-bird is becoming very rare at Ottawa; it was heard at the Experimental Farm on the 5th, but has never been seen there this spring. Miss Harmer has not seen one since 1895 until this spring.

*Tree Sparrow*—This very pretty sparrow was quite abundant at Ottawa during the month of April. Miss Harmer recorded the arrival of this bird on the 2nd. On the 4th it was observed by Mr. Lees and Mr. White.

*Meadow Lark*—Was seen by Mr. H. S. Marsh on the 3rd, and by Mr. Lees on the 6th.

*Cow Bird*—Was seen by Mr. Lees on the 4th; by Miss Harmer on the 5th, and by Mr. White and Mr Macoun on the 6th.

*Phoebe*—Observed by Miss Harmer on the 4th.

*Herring Gull*—Mr. White saw four on Deschenes Lake near Aylmer on the 4th. On the 6th they were seen flying over Carling's Lake near the Experimental Farm.

*Vesper Sparrow*—Although Dr. Fletcher reports having seen one specimen of this bird on the 23rd of March, it is not recorded again until the 5th of April, when one was heard by Miss Harmer, but not seen by her until the 8th. Other records are later.

*Golden-crowned Kinglet*—Observed by Mr. Lees on the 6th.

*White-rumped Shrike*—Observed by Miss Harmer on the 10th.

*Chipping Sparrow*—Miss Harmer saw this bird on the 11th of April, but the next date on which this bird was recorded was not until the 18th, when it was seen by Mr. Lees.

*Red Poll*—A flock of from three to four hundred was seen by Miss Harmer on the 11th.

*Marsh Hawk*—Seen by Mr. Lees on the 11th.

*Goshawk*—One specimen was observed by Mr. White on Wurtemburg street on the 11th.

*Blue Heron*—Seen by Mr. White on the 13th.

*Yellow-bellied Woodpecker*—Seen by Mr. White on the 13th.

*Killdeer Plover*—Miss Harmer saw this bird on the 14th; the next record is Mr. White's on the 19th.

*Kingfisher*—Seen by Mr. White on the 14th.

*Savannah Sparrow*—Observed by Mr. White and Mr. Lees on the 15th.

*Wood Duck, Black Duck, Mallard, and Buffle head*—All seen by Mr. White on the 16th.

*American Bittern*—Seen by Mr. White on the 16th.

*Golden-winged Woodpecker or Flicker*—Seen by Mr. Marsh on the 16th, and by Miss Harmer on the 18th.

*Brown Creeper*—Seen by Dr. Fletcher on the 17th.

*Barn Swallow*—Seen by Mr. White and Mr. Lees on the 1[illegible]th.

*Fish Hawk*—Seen by Mr. Lees on the 18th and by Mr. White on the 19th.

*Sparrow Hawk*—Seen by Mr. White on the 19th.

*Pine Grosbeak, Wax-wing*—Dr. Fletcher writes: "An interesting record is the following: The weather during the first part of the month and until the morning of the 19th of April, was very mild indeed. At 8 o'clock a.m. the thermometer stood at 54° Far. About that time an enormous flock of Pine Grosbeaks suddenly appeared and remained on the trees around my house for about an hour before they flew away; with them were upwards of 100 wax-wings, which remained all that day and the next. During the morning of the 19th a high northerly wind sprang up and the thermometer ran down to 17° Far. and everything was frozen solid again as in winter. The wax-wings clustered together closely on the trees, breasting the gale in compact flocks remaining motionless for over an hour at a time."

*Wilson's Thrush*—Seen by Mr White on the 21st.

*Ruby-crowned Kinglet*—Seen by Mr. White on the 21st.

*Pewee*—Seen by Mr. Small on the 21st and by Dr. Fletcher on the 24th.

*Myrtle Warbler*—Mr. Small observed this bird working on the elm trees on the 21st.

*House Wren*—Seen by Dr. Fletcher on the 21st.

*Chimney Swift*—Mr. White observed this bird an the 22nd and Mr. Small on the 23rd.

*White throated Sparrow*—This bird was seen by Mr. White on the 23rd and by Miss Harmer and Dr. Fletcher on the 25th.

*Spotted Sandpiper*—Seen by Mr. White on the 24th.

*Great Crested Flycatcher*—Seen by Miss Harmer on the 24th.

*Cedar Birds and Bohemian Wax-wing*—A flock of about thirty Cedar Birds was seen feeding on the fruit of the high bush cranberry at the Experimental Farm on the 24th of April by Mr. Macoun. One specimen of Bohemian wax-wing was observed with flock. Dr. Fletcher and Mr. Marsh also saw this bird. The Cedar birds fed for several days on the high bush cranberry.

*Winter Wren*—Prof. Macoun saw this bird in the woods near Ottawa on the 24th.

*Hermit Thrush*—Seen by Mr. White on the 25th.

*Bank Swallow*—Seen by Mr. Lees on the 25th.

*Baltimore Oriole*—Seen by Dr. Fletcher on the 25th.

*Sharp-shinned Hawk*—Mr. White is the first to record this bird on the 27th, but one was seen early in March near the Experimental Farm.

*Brown Thrush*—Seen by Mr. Macoun at the Experimental Farm on the 26th. Perched on the topmost bough of some tree this delightful songster filled the air with melody in the early morning during the month.

*Greater Yellow Legs*—Mr. White saw this bird on the 27th, and one was shot by Mr. Marsh on the 29th.

*Loon*—Seen by Mr. White on the 30th.

*Orange Crowned Thrush*—Seen by Prof. Macoun on the 30th.

*Fox Sparrow*—Seen by Prof. Macoun on the 30th.

*Yellow-billed Cuckoo*—Seen by Prof. Macoun on the 30th.

W. T. MACOUN,
*Associate Editor, Ornithology.*

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## WEATHER NOTES.

*April 19.*—High south warm wind all previous night culminating to heavy n.w. gale in forenoon, the thermometer falling from 50 to 34 in 30 minutes. Sharp frost set in and during night of 19th temperature fell to +12°, with ice an inch thick on water pails next morning.

*April 25.*—Heavy thunderstorm at 3.15 a.m., with bright fork lightning in the south.

*April 26*—Heavy thunderstorm at 4.30 p.m., with bright lightning and heavy rain, turning to a downpour, gale from north and temperature + 34°.

*May 1*—Thunder at 6.30 a.m.

*May 9*—Heavy thunderstorm, dividing off north and south at 11 p.m.

*May 14*—Heavy thunderstorm with bright lightning at noon. Vegetation about one week in advance of ordinary season.

H. B. SMALL.

## Abstract of Meteorological Observations at Ottawa for the Year 1896.

| | Jan. | Feb. | Mar. | April | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average height of barometer at 32° and reduced to sea level | 30.210 | 29.914 | 30.016 | 30.123 | 29.981 | 29.944 | 29.985 | 30.008 | 30.044 | 30.084 | 30.150 | 30.224 | 30 057 |
| Highest barometer | 30.732 | 30.720 | 30.730 | 30.629 | 30 431 | 30.257 | 30.365 | 30.360 | 30 421 | 30.661 | 30.739 | 30.969 | 30.969 |
| Lowest barometer | 29.612 | 29.068 | 29.379 | 29.567 | 29.497 | 29.573 | 29.565 | 29.660 | 29.414 | 29 606 | 29.412 | 29.442 | 29.068 |
| Monthly and annual ranges | 1.120 | 1.652 | 1.351 | 1.062 | 0.934 | 0.684 | 0.800 | 0.700 | 1.007 | 1 055 | 1.327 | 1.527 | 1.901 |
| Average temperature of air (Fah.) | 11.89 | 12.97 | 18.69 | 43.81 | 59.15 | 64.08 | 68.94 | 66.99 | 56.08 | 43.07 | 34 81 | 16.99 | 41.46 |
| Difference from average | +2.29 | +1.37 | -2.91 | +6.51 | +4.65 | -1.32 | -0.66 | +1.89 | -1.12 | -0.73 | +3.31 | +1.19 | +1.21 |
| Highest temperature | 38.6 | 43.0 | 45.0 | 82.8 | 90.5 | 87.4 | 92.8 | 92.1 | 89.0 | 64 0 | 61.0 | 41.0 | 92.8 |
| Lowest temperature | -25 0 | -30.7 | -9.2 | 13.0 | 37.1 | 42.5 | 43.5 | 41.0 | 30.0 | 25.8 | 8.2 | -15.0 | -30.7 |
| Monthly and annual ranges | 63.6 | 73.7 | 54.2 | 69.8 | 53.4 | 44.9 | 49.3 | 51.1 | 59.0 | 38 2 | 52 8 | 56.0 | 123.5 |
| Average maximum temperature | 17.8 | 21.4 | 28.0 | 54.5 | 70.7 | 75.2 | 79.5 | 78.6 | 65.9 | 51.0 | 42.2 | 24.9 | 50.8 |
| Average minimum temperature | 4.0 | 4.5 | 9.4 | 33.1 | 47.6 | 52.9 | 58.4 | 55.4 | 46.3 | 35.2 | 27.3 | 9.2 | 31.9 |
| Average daily range | 13.8 | 16.9 | 18 6 | 21.4 | 23.1 | 22.3 | 21.1 | 23.2 | 19.6 | 15.8 | 14.9 | 15.5 | 18.9 |
| Average pressure of vapour | 0.077 | 0.085 | 0.099 | 0.240 | 0.451 | 0.434 | 0.498 | 0.472 | 0.357 | 0.215 | 0.178 | 0.096 | 0.267 |
| Average humidity of the air | 89 | 84 | 79 | 75 | 79 | 66 | 67 | 67 | 75 | 76 | 83 | 83 | 77 |
| Average temperature of dew point | 11.0 | 12.0 | 17.4 | 39.2 | 56.1 | 55.1 | 58.9 | 57.4 | 49.7 | 36.4 | 31.6 | 16.5 | 36.8 |
| Amount of rain in inches | 0.00 | 0 22 | 1.32 | 0.57 | 2.26 | 3.34 | 3.04 | 3.91 | 3.42 | 1.07 | 1.79 | R | 20.94 |
| Difference from average | -0.55 | -0.24 | +0.48 | -0.95 | -0.17 | +0.40 | -0.12 | +0.78 | +0.84 | -1 32 | +0.17 | -0.78 | -1.46 |
| Number of days of rain | 0 | 1 | 2 | 6 | 11 | 9 | 11 | 12 | 12 | 7 | 10 | 0 | 81 |
| Amount of snow in inches | 23.0 | 38.1 | 20.5 | 2.7 | ...... | ...... | ...... | ...... | ...... | 1.7 | 5.3 | 12.5 | 103.8 |
| Difference from average | -2.3 | +16.0 | +5.8 | -2.0 | * | ...... | ...... | ...... | ...... | +0.8 | -4.1 | -9.8 | +4.4 |
| Number of days of snow | 8 | 12 | 9 | 2 | ...... | ...... | ...... | ...... | ...... | 2 | 4 | 7 | 44 |
| Percentage of sky clouded | 77 | 65 | 52 | 50 | 53 | 45 | 60 | 54 | 59 | 63 | 74 | 60 | 59 |
| Number of days completely clouded | 13 | 11 | 7 | 1 | 1 | 2 | 4 | 3 | 3 | 5 | 8 | 8 | 66 |
| Average velocity of wind (miles) | 7.71 | 9.31 | 11.40 | 5.93 | 8.01 | 5.51 | 5.60 | 5.03 | 5.80 | 6.35 | 8.87 | 6.61 | 7.18 |
| Number of auroras | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 |
| Number of thunder storms | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 7 |
| Number of fogs | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 6 |
| Number of days without rain or snow | 16 | 13 | 14 | 21 | 19 | 21 | 20 | 18 | 17 | 20 | 20 | 15 | 214 |

Days of rain and snow only reckoned when 0.01 inch or over fell.

## Frequency of the Different Winds from Observations at 8 a.m., 3 and 8 p.m., Ottawa, 1896.

| | N. | N.E. | E. | S.E. | S. | S.W. | W. | N.W. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January ....... | 8 | 7 | 37 | 2 | 2 | 8 | 14 | 10 | 5 |
| February ...... | 2 | 7 | 24 | 3 | 4 | 12 | 21 | 13 | 1 |
| March ........ | 3 | 9 | 10 | 3 | 9 | 13 | 27 | 19 | 0 |
| April ......... | 4 | 7 | 20 | 7 | 9 | 10 | 12 | 7 | 14 |
| May. ........ | 10 | 4 | 14 | 5 | 15 | 15 | 15 | 11 | 4 |
| June.......... | 5 | 6 | 13 | 4 | 7 | 15 | 19 | 13 | 8 |
| July .......... | 4 | 1 | 9 | 3 | 10 | 19 | 22 | 25 | 0 |
| August.... ... | 5 | 3 | 4 | 1 | 9 | 15 | 20 | 18 | 18 |
| September..... | 3 | 5 | 6 | 7 | 18 | 14 | 11 | 20 | 6 |
| October.... .. | 8 | 22 | 8 | 6 | 11 | 19 | 9 | 10 | 0 |
| November..... | 5 | 21 | 5 | 7 | 21 | 14 | 12 | 5 | 0 |
| December..... | 10 | 13 | 7 | 10 | 16 | 14 | 13 | 10 | 0 |
| Year.......... | 67 | 105 | 157 | 58 | 131 | 168 | 195 | 161 | 56 |

January 3—Stormiest day of year, mean velocity 27.7 miles.
" 24—Heaviest snow storm of year, depth 15 inches.
February 17—Coldest day of year, mean temperature—22°.5.
April 4—Last snow of season.
" 16—First thunder of year.
" 22—Last frost.
June 9—Heaviest rain storm of year, depth 1.97 inches.
August 11—Warmest day of year, mean temperature 80°.35.
" 16—Last thunder storm of year.
Sept. 22—First frost.
October 20—First measurable snow of season, a few flakes on 18th.
Dec. 2—First record below zero—1°.5.

## ANNUAL MEETING: OTTAWA LITERARY AND SCIENTIFIC SOCIETY.

The Annual Meeting was held in the Library of the above Society on Friday evening, April 30th. The reports of the Secretary, Treasurer, Librarian, and President were presented and adopted. The finances of the Society were shown to be in a good condition, and the membership somewhat increased, now numbering about 350.

The Library and Reading Room have been more extensively used than for many years previously.

The need is felt of securing a permanent location and one convenient to the patrons of the Society—a building which might be used by other societies would be preferred. There was a general expression of opinion at this meeting that the Society should secure a suitable building, and if possible, induce kindred societies to join them in such an enterprise.

The officers elected weie :—

President—Otto J. Klotz.
First Vice-President—Rev. Dr. Saunders.
Second Vice-President—W. D. LeSueur.
Secretary—O. J. Jolliffe.
Treasurer—W. J. Barrett.
Curator—J. H. Bronskill.

Members of the Council :—

M. J. Gorman.
Lt.-Col. J. Pennington MacPherson.
J. Ballantyne.

O. J. JOLIFFE,
*Secretary.*

Ottawa, May 25th, 1897.

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Correction.—"*The Lyrical Poetry of the Elizabethans,*" was the exact title of Mr. Duncan C. Scott's paper presented on Feb. 4th, 1897, at the course of lectures given under the auspices of the Ottawa Literary and Scientific Society. In the March issue of the OTTAWA NATURALIST (p. 226) another title was given.

# "WEATHER."

BY OTTO J. KLOTZ, D.L.S.
President of the Ottawa Literary and Scientific Society.

The mathematician's definition of weather would be differentiated climate, and of climate integrated weather. A boy at school once gave the explanation that weather lasted only for a few days, while climate lasts all the time.

Of all phenomena in nature undoubtedly the varying daily atmospheric conditions were the first to attract the attention of primeval man.

Meteorology is the science which treats of the conditions of the atmosphere, its changes in condition, and the causes which give rise to these conditions and changes. It may be said to be the youngest of the sciences and awaiting much developement; but the consciousness of knowing what we do not know, is knowledge too.

The discovery of the law of gravitation has enabled the astronomer to marshal the celestial bodies, but for the meteorologist such a universal law, explaining all the atmospheric movements, must be denied. Prediction is a natural sequence to the discovery of nature's laws, and in this respect astronomy furnishes us with its crowning glory. The conditions presented in meteorology are subject and due to so many modifying influences that the problem becomes highly complex and has taxed the minds of the ablest physicists. The too patent benefit resulting from weather predictions has enlisted public support and stimulated investigators in unraveling the intricacies of atmospheric phenomena. The ultimate result of all science must tend towards the amelioration and benefit of mankind. In this field meteorology already has and will yet have a greater *role*. However, any theory of weather predictions based on other than sound reasonings and accurate study of physics must be considered one of the worst forms of empiricism.

For the study of phenomena accurate observations are necessary. In meteorology we have to deal not with one phenomenon but with many, each adding its quota to form the aggregate which we term weather. As the instruments used for observing the phenomena are fairly familiar to you I will confine my remarks to a few salient points. The instrument of first importance is the barometer, by means of which the pressure of the atmosphere is measured ; we might call it the lead line or sounding rod of the atmospheric ocean. Although there are the two forms of barometer—mercurial and aneroid—yet for accurate and precise work the former only is used. Air, in common with all other forms of matter, is acted on by the attraction of gravity, and consequently possesses weight. The pressure of the air is a necessary consequence of its weight, and is equal, at the level of the sea, to about fifteen pounds to the square inch.

If we take a glass tube of about three and a-half feet in length, filled with mercury, and hermetically sealed at one end, while the other end is bent like a syphon, or is inverted into a cistern of mercury, we have a means of measuring the pressure of the atmosphere and its consequent fluctuations. Here in Ottawa, less than 200 feet above mean sea level, we are subject on all sides to a pressure of nearly 15 lbs. to the square inch to prevent us from bursting, which we undoubtedly would, were that pressure removed.

The barometer responds to the fluctuations and pulsations of the atmospheric pressure.

Suppose now we have taken barometric readings at the same absolute time at various stations from Halifax to Vancouver ; these readings, although correct, would not give us the true measure for comparison of the various pressures, from the fact that they would not be taken from the same plane—the level of the sea—to which all observations must be reduced before comparisons can be instituted and inferences drawn. The fluctuations of the atmosphere make themselves felt on our Great

Lakes as shown on tide guages. In passing, it may be mentioned that both solar and lunar tides are observable too on the lakes. A high barometer at one end of the lake would tend to press the water towards the other end and consequently raise it there. Besides the readings of the barometer at stated intervals there is a continuous record made too by means of photograph at the chief meteorological observatories. The instrument is then called a barograph..

Let me tell you of an interesting record of the barograph at Toronto on August 27th, 1883. You all recollect the frightful cataclysm of Krakatoa, a small island in the strait of Sunda between Sumatra and Java. In this catastrophe over 30,000 lives were lost, and the eruption was followed by extraordinary atmospheric phenomena—notably the peculiar red sunsets of the following year—visible over the whole globe and attributed to the presence of volcanic dust. As soon as the news reached England—science ever on the alert—the Director at Kew immediately sent to the various head meteorological stations in the numerous colonies for the barograph reoord of that and succeeding days. That terrific and awful explosion launched an atmospheric wave on its journey around the world, which not ouly recorded its passage at Toronto, but after its concussion, presumably at the antipodal point of Krakatoa, left its record on its return, on the mercurial column, and a second rebound too was recorded. I had the pleasure of examining the original record at Toronto. From an examination of this record I infer that the atmospheric wave must have travelled at the enormous rate of about 800 miles an hour, being about the velocity of sound.

The thermometers ordinary used for exact observation are the dry, wet, maximum and minimum. The wet thermometer is only a dry bulb covered with soft muslin well wet with rain or clear water drawn from an attached cup by a wick, and is used for determining the relative humidity of the atmosphere. Evidently, the drier the atmosphere, the greater will be the evaporation from the muslin, and the heat necessary for evaporation is abstracted from the mercury bulb, with a consequent fall in temperature. From the difference in temperature of the dry and wet thermometers a measure of the relative humidity of the air is obtained.

The instruments used for recording the wind are; the vane, for direction; the anemometer, for velocity and the anemograph, which registers both direction and velocity. Add to the instruments named the hygrometer and rain guage and we have the necessary ones for a meteorological station.

When from any cause the air at any part of the atmosphere is cooled below its dew point, a portion of the vapour suspended in it becomes condensed and converted into minute drops of water, forming what is called a fog, or a cloud, according as the condensation takes place near the ground or in some higher region. The numberless forms of clouds make it difficult to so classify and name them as to secure easy recognition and ensure uniformity of record. The classification introduced at the beginning of the century obtains to the present day. In it three simple or primary and four compound forms are recognized. The cirrus is the high fleecy cloud; the cumulus of moderately low elevation and its simpler form the shape of conical heaps rising from a horizontal base; the stratus is the lowest of all, generally gray masses or sheets of clouds with ill defined outlines. The compound ones fall intermediate between the primary ones described. The highest cirrus cloud recently measured at Toronto was about seven miles high, while some European observers claim to have obtained fully double that height. Observations on the motions of upper clouds are of great importance, since from these movements can be gleaned the only possible information as to the prevailing direction of the upper air currents. At the late international meteorological congress held at Paris it was decided to make cloud measurements during the coming year. At each international bureau, daily if possible, two observers at the same instant from fixed points, being at the ends of a measured base line, take observations on the same point of a cloud, and within two minutes again on the same point. This is about the longest time that a given point will remain identifiable.

In another manner the nature of the upper strata of the atmosphere is being explored by means of kites. They are flown tandem, i.e., several kites on one string or rather fine steel wire, as the latter is far more suitable. Self registering instruments are attached to the kites.

Of the observed phenomena of the dynamics of the atmosphere up to the last century none impressed itself so much on physicists as being subject to law as the "Trade Winds." Experience had shown navigators that once they got their ships into the paths of these regular winds, they could be depended on with almost as much confidence as we now place in steam. The primary cause of the atmospheric motions is the unequal distribution of the temperature on the earth's surface produced by the solar heat. We know from observations that there is a large, but not constant, difference in the temperatures of the air at the poles and equator, amounting, at an elevation of but a few feet above the earth's surface, to about 81° F. for the average for the entire year. The heating up of the air at the equator causes its expansion, and consequent increase of bulk, but does not increase its weight or pressure at the earth's surface, it does however elevate the successive isobaric surfaces, i.e. surfaces of equal pressure, and this causes differences of level or gradients, which cannot exist in fluids without a motion ensuing in the direction of the lowest level. The levels of these gradients are measured with our atmospheric sounding rod, the barometer.

From the greater heat at the equator the mass of air there rises to a greater altitude than at the pole, and in consequence we have a current of air in the upper regions moving from the equator to the pole. But just as soon as this flow has commenced there is a decrease in the actual weight of the atmosphere at the equator, and a counter current sets in along the surface of the earth from the pole towards the equator. Vertical currents connect these two horizontal currents ; the one at the equator being ascending and that in the region of the pole descending.

From the revolution of the earth on its axis, there is a force arising from this rotation which causes a free moving body to depart to the right of its original direction in the northern hemisphere, and to the left in the southern hemisphere. It is this condition which mainly gives to the existing circulation of the atmosphere its complex character. In the vertically moving air masses dynamic heating and cooling take place as a consequence of the compression and expansion of the air. We have in British Columbia and extending to the east slope of the Rocky Mountains a phenomenon—the Chinook wind—dependent on this property. The Chinook is similar to the Foehn of the Alps. Dry air in passing over a mountain range would not differ in temperature on the two sides of the range. As the air ascended it would be cooled dynamically. As it descended it would be warmed just as much. But if the air is moist, in ascending it cools, and the moisture is condensed and falls as rain or snow. The latent heat released by the condensation raises the temperature of the air, and in descending to other side of the mountain it is warmed up dynamically still more. This is the action of the Chinook wind and the explanation of its warmth and dryness, the moist warm winds from the Pacific being aspecially favorable for its creation.

Atmospheric disturbances are easily divided into two classes—cyclonic or low area storms, and anti- cyclonic or high area storms. By a cyclonic storm is not necessarily meant a cyclone or a hurricane, but simply a storm characterized by an atmospheric pressure below the average, and having a wind system blowing spirally inward, as do the winds of a genuine cyclone. The fluctuations of the atmospheric pressure as indicated by the barometer amount to about four inches. The position of these areas of high and low barometer, especially the latter, is the chief factor in weather forecasts.

The circulating air-currents at the surface of the earth move contrary to the hands of a watch. From this cyclonic action the phenomenon so often observed of the wind blowing in an opposite direction before and after the passing of a storm becomes obvious. In the area of low barometer we have an ascending current of warm air around which gyrates the anti-cyclone of cold air with an inflow at the earth's surface. Although far the greater part of the action of all and the whole of some storms takes place within a mile of the surface of the earth, yet the movement of upper clouds and occasional attendant peculiar phenomena indicate quite clearly that the origin and most important phases of atmospheric changes must be assigned to the upper strata of the air. The formation of depression or low area is probably due to precipitation or formation of cloud, or is at least very closely related in some way to the condensation of aqueous vapour. The motion of the low area probably depends on the prevailing direction of motion in the great body of upper air in the vicinity of the low area.

By plotting the isobars of mean annual pressure over the northern hemisphere two areas of low barometer are found, one over Iceland and the other over Bering Sea. The one over Iceland is the one towards which our Canadian barometric gradients flow. An area of low barometer may be looked upon as a vast caldron towards which and into which the atmosphere is flowing. From this analogy we can see in a measure how the atmospheric currents flowing over Canada toward the sink hole, so to speak, about Iceland behave, and it is this secondary or gyratory motion especially that gives us storms. It appears that the valley of the St. Lawrence has the largest number of the storms of any section of the globe, i.e. areas of high and low barometer passing over it The greater number of American storms originate in the Saskatchewan country or on the south-eastern slope of the Rocky Mountains. A minor number are developed in the Caribbean Sea and the Gulf of Mexico. Our worst storms in summer are traceable to Texas, whereas the winter ones come mostly from the North-west. The Rocky Mountains are such a barrier that it is seldom that a storm of the Pacific crosses them and reaches us. The ultimate course of low area storms is somewhat north of east. The number of well defined low area storms which cross the United States and Canada average eight in each month from May to August inclusive ; nine from September to November and in April ; eleven in February, March and December, and twelve in January. The average velocity of low area storms fluctuates for the different months between 25 and 38 miles per hour, the maximum being in January. To summarize, low area storms have a wind circulation inward and upward, are elliptical in form, are characterized in their eastern quadrants by cloudy weather, southerly and easterly winds, precipitation, temperature oppressive in summer, and abnormally high in winter, falling barometer, increasing humidity ; and are followed by clearing weather, rising barometer, decreasing humidity, and falling temperature in the western quadrants.

Areas of high barometer, or anti-cyclones, in which the barometric pressures are defined by isobars successively higher toward the centre, are about forty per cent. less frequent than low area storms. In winter the advance of these high areas, though always attended by a decided fall in temperature, is for the most part characterized by clear skies, by calms near the centre and light or fresh winds on the outskirts of the area. This condition of affairs permits rapid nocturnal radiation and tends to lower the temperature of the air at the centre of an anti-cyclone.

*(To be continued.)*

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