The conclusion that the full moon is generally followed by a decrease in rainfall is not as plainly marked as the above, but the following are the total amounts in inches for the two days before and the two days after full moon: —

	Before.	After.
1881–1890	36.21	27.00
Odd years	14.76	12.51
Even years	21.45	14 49
1881–1885	16.31	10.54
1886–1890	19.90	16.46

The third and fourth conclusions, that the wettest period in the lunar month is near and before full moon, and that the driest period is near and before first quarter, are distinctly marked in the several mean curves. The mean result for the ten years is that 6.1 per cent of the rainfall occurred on the day of the first quarter and the two days before, while 13.3 per cent occurred on the day of the full moon and the two days before. In inches of rainfall the results for these two periods for several groups of years are as follows: —

	Day of Full Moon and two days before.	Day of First Quarter and two days before.
1881–1890	60.80	31.78
Odd years	23.64	13.76
Even years	37.16	18.02
1881–1885	20.76	12.65
1886–1890	40.04	19.13

The distribution of rainfall at and around the time of the changes of the moon has been the element most generally studied in connection with this question. In order that the records now under review may be compared with others, the following are given for periods of one day, three days, and five days respectively. These are for the ten years 1881–1890 and in inches of rainfall.

	Day of change.	Day of change and one day before and after.	Day of change and two days before and after.
New Moon	14.62	41.77	72.69
First Quarter	9.61	32.20	60.70
Full Moon	24.59	53.43	87.80
Last Quarter	21.34	49.67	73.29

These figures, like those previously given, indicate that the maximum rainfall occurs near full moon, and the minimum near the first quarter. It is impossible indeed to avoid the conclusion that at Bethlehem, Pa., during the years 1881–1890, the distribution of the mean rainfall seems to have been arranged with respect to the changes of the moon. If the moon really influences the weather it is to be expected that a connection will also be observed in other records, but it cannot be expected that the maximum and minimum rainfall in the lunar month will be similarly situated in all cases with respect to the times of change. I venture further the suggestion that, if the moon affects the rainfall, the greatest influence will probably be found in connection with thunder storms and local showers.

II.—BY H. A. HAZEN,[1] WASHINGTON, D.C.

THERE is hardly an idea regarding the weather so firmly rooted and so widespread as this, that the moon has a rather marked effect in bringing about its changes. This paper by Professor Merriman is a very interesting contribution to the subject. I desire to add a little to what he says, as his conclusions are not the same as those reached by myself. This matter has been thoroughly investigated in England and Europe with a negative result, except that there seems to be a slight influence of the moon, or perhaps the tide, on the occurrence of thunder-storms, and that the full moon seems to have power to drive away clouds. All the feasts and festivals in Germany are at the time of full moon. This, however, may be as much for the benefit of the light as the lack of rain. In the U. S. Monthly Weather Review for October, 1885, there is a short paper, in which it is shown that over this country as a whole there is a preponderance of thunder-storms during the new moon. While in New Haven, Conn., special research on this question showed that in that place there was, from 1873 to 1880, nearly a half more rain just before and after new moon than full moon. A farther investigation for this whole country, also for 100 years at London, England, gave a negative result; that is, no effect from the phases of the moon. In 1889 an investigation on the lower California coast gave a preponderance of rain during full moon.

It has occurred to me that it would be advisable to calculate the data at Philadelphia, Pa., which is not far from Bethlehem, for this question. I first computed the data for fifteen years, 1871–1885, and afterward for the ten years 1882–1891, with the result given in the accompanying table: —

	Amount of rain day of and one day before and after.		Amount of rain day of and two days before and after.	
	1871–85	1882–91	1871–85	1882–91
New Moon	66.66	42.03	108.38	74.31
First Quarter	59.38	29.09	102.26	50.63
Full Moon	60 36	44.12	94.60	60.80
Last Quarter	55.72	47.59	101.06	64.03

It will be seen that in the first period of fifteen years there is a preponderance of rain at the time of new moon, which corroborates the result previously obtained at New Haven. In the second period, for the three days about each phase the result is similar to that of Professor Merriman, though the difference of two inches between new and full moon is very slight. When we take the five days about each phase, however, we see that the new moon has 13.5 inches more rain than the full. I do not advance these figures as proving any influence whatever. It must be almost inappreciable if there is any at all.

A word may be added regarding the influence of the moon in driving away clouds. I have detected this apparent influence many times by closely watching the moon. Of course, if this is a fact, it would show that there must be a tendency to less rain at the time of full moon. It should be borne in mind, however, that the minimum of cloudiness occurs in the evening or before midnight, and this complicates the phenomenon.

[1] As Prof. Merriman's paper has not been seen, this must be regarded as an independent discussion of the subject and not a reply to that.—H. A. H.

RECENT BOTANICAL EXPLORATIONS IN IDAHO.

BY D. T. MACDOUGAL, LAFAYETTE, IND.

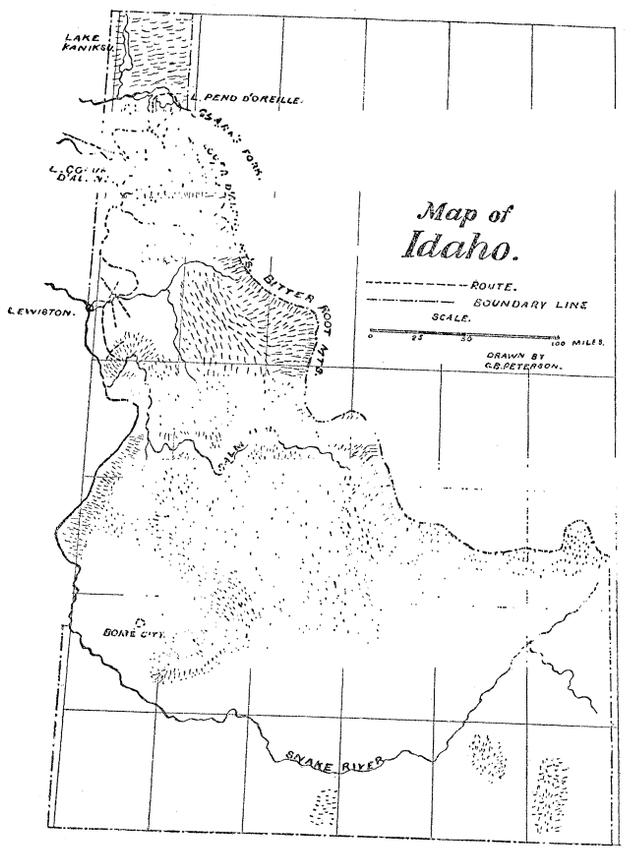
IN various parts of the region occupied by the ranges, spurs and foot-hills of the Rocky Mountains are large areas which have never been explored by the naturalist. The species of the flora and fauna of such regions can, to a great extent, be approximated by a knowledge of the contiguous territory, especially if a similarity of climate prevails, but in all cases every natural area of land, such as a river, valley, or mountain range, gives to its forms of plant and animal life certain differences from all forms found in other localities. If the differences are of sufficient importance, they will constitute new species, and in many cases whole groups or genera peculiar to a certain region are found.

The exploration of certain areas invariably brings to light numerous undescribed forms of both plants and animals besides affording valuable information on the distribution and variations of known forms.

At various times collections and observations on the flora of the Rocky Mountains have been made by attachés of geographical and geological surveys, and by the various parties engaged in the exploration and survey of railroad routes across the continent, by individual workers under the direction of the several divisions of the U. S. Department of Agriculture, by representatives of various scientific societies, and by collectors working entirely independently.

The amount accomplished in this way cannot easily be estimated, but it may be suggestive to know that "The Systematic and Alphabetic Index of New Species of North American Phanerogams and Pteridophytes," published in 1891 by Josephine A. Clark, "Contributions from U. S. National Herbarium," Vol. I.,

No. 5, shows that, during the year of 1891, 677 new species and 133 new varieties of flowering and fern-like plants were described. Perhaps one-third of these are simply old forms re-arranged, but these figures indicate that more than five hundred new forms among the higher plants, with no mention of the vast number of lower forms, have been discovered in this one year. Among the areas within the boundaries of the United States unexplored by the naturalist, may be mentioned north-western Montana, northern and central Idaho. These regions have been at various times penetrated by Hudson Bay trappers, missionaries, hunters, gold and silver prospectors, but our knowledge of the topography is comparatively meagre, and the best government maps are not even approximately correct, especially in central Idaho, with which this article is particularly concerned. In general, however, the following description obtains. (See map.) The broader southern portion consists in great part of the arid "sage" plains of the Snake River Basin. The surface is chiefly basaltic lava overlying porphyritic trachyte. This entire region is characterized by excessive changes of temperature. The central portion is a huge mountain mass upreared in places to a height of 13,000 feet, reaching far above timber-line and bearing extensive banks of perpetual snow.[1]



The jagged slopes are covered with forests of cone-bearing trees, with dense thickets of underbrush on the lower slopes. The principal formations are lava, granite, and forms of limestone and quartz.

The most prominent of the numerous short ranges comprised in this group are the Salmon River, Lost River, Clearwater, Sawtooth, Pahsimeroi, Craig, and Seven Devils Mountains. Extending northward along the eastern border and joining this central mass directly are the Bitter Root ranges passing northward into the Coeur d'Alene Mountains, leaving to the westward the semicircular basin drained by the Clearwater and Palouse Rivers and by the tributaries of Lake Coeur d'Alene.

North of the 48th parallel, Clark's Fork of the Columbia River cuts its way through the ranges and expands into Lake Pend d'Oreille, a cliff-encircled sheet of water, forty-five miles long and ten miles wide, with a depth of 1,800 to 2,500 feet. Northward, between the forks of the Columbia River, are the snow-capped mountains surrounding the elevated Lake Kaniksu.

For the season of 1892, Dr. Geo. L. Vasey, chief botanist of the Department of Agriculture, planned a survey of the basaltic basins of the Clearwater and Palouse Rivers, the country around the lakes Coeur d'Alene and Pend d'Oreille and the adjoining mountain ranges to the eastward, and, acting under the direction of Dr. Vasey, in accordance with this plan, a party of botanists composed of J. H. Sandberg, A. A. Heller, and D. T. MacDougal, with J. G. Brunswick in charge of camp, outfitted at Lewiston at the head of navigation of the Snake River, and went into camp on the north bank of the Koos-Kooskia or Clearwater River, April 23.

The camp equipment consisted of four native horses ("cayuses"), a mountain-wagon, harness, riding and pack saddles, a wedge tent for storage and sleeping-room, and a large wall tent for the routine work. To this may be added the usual number of woolen and rubber blankets, tarpaulins, cooking apparatus, medicine chest, fire-arms, etc. For the preparation of dried plants, 6,000 driers, 11½ by 17½ inches, and several times as many sheets of fine Manilla paper of the same size, were furnished; in addition, several packages of envelopes, for the reception of seeds and small plants; portfolios, tin boxes for collecting specimens, a varied assortment of picks and large knives for uprooting plants from soil and rocks; note-books for the accumulation of data concerning the habits and distribution of plants, and movements of the expedition, and an aneroid of doubtful accuracy and limited usefulness. The general plan of work was to pitch the main camp in a favorable location, generally near a stream or lake, where good forage, fuel, and water might easily be obtained. From this place as a centre, the immediate neighborhood within a radius of three or four miles would be worked over; this area would then be extended four to eight miles farther by the use of saddle animals, the collector returning to camp each day. Still more extended excursions, so far as 40 miles in some cases, were made by boats and pack-horses carrying the smallest necessary camp outfit and a minimum of apparatus.

All flowering plants collected for preservation were placed in the drying sheets on the same day on which collected, if possible, and a daily change of driers made until safely dried. These prepared specimens were then shipped to Washington whenever transportation was available.

After the region accessible to the camp had been thoroughly worked, the expedition would then move its entire equipment fifteen to fifty miles and pursue the same method. In this manner the route was carried from the first camp on the Clearwater River to the southern edge of its basin in the Craig Mountains about May 20, camp being made at Lake Waha. Up to this time the weather had been extremely unfavorable to field work and preparation of specimens, the journal showing that during the first twenty-five days rain and snow-storms had been encountered on twenty-three of them, it being, however, practically the end of the rainy season. At Lake Waha (elevation 2,500) the nights were extremely cool, and on the slopes a few hundred feet above it were huge snow-banks, in many cases a dozen feet thick. From Waha the expedition retraced its steps to the Clearwater camp, then up the Clearwater and its northern tributary, Potlatch Creek, making two camps on this stream and its branches. From here the route was through well-settled districts northward to the south-western part of Lake Coeur d'Alene, which was reached July 2, camps having been made near Moscow, Viola, and on Pine Creek. The expedition was joined at Moscow by Mr. G. B. Aiton, who participated for three weeks in the excursions made to the lower ranges on the east and isolated buttes in the basin. From the camp at Farmington Landing numerous bays and tributaries were explored by boat, and, by aid of one of the small steamers plying here, an excursion was made up the Coeur d'Alene River, and half the party ascended the St. Joseph River to near the head of navigation, forming a temporary camp near the base of Wessner's Peak at the ranch of Mr. C. P. Reid. An ascent of the mountain was accomplished July 6. Ice was found on lake near the summit, while snow-fields were numerous

[1] Dr. C. H. Merriam, "North American Fauna," No. 5.

and extensive although its highest part is far below timber-line. The expedition moved across the lake and passed Coeur d'Alene City, making a short stop on the north bank of the Spokane River, then northward, across a stretch of level prairie and the Northern Pacific Railroad, to the foot of a group of mountains whose highest peak is called Mt. Carlton. Sucker, Tesemini, and Fish Lakes were visited and some ascents were made.

In the latter part of July the camp was carried to the southwestern part of Lake Pend d'Oreille and located on the ranch of Mr. J. Lieberg, a miner and botanical collector who was of material assistance to the expedition in the excursions with packhorses made from this point to the mountains near the headwaters of the North Fork of the Coeur d'Alene River and to the top of Packsaddle Mountain on the eastern shore of the lake. The work here was carried on under great difficulties. The mountain slopes are very irregular, traversed by numerous cross cañons and covered with forests of spruce, fir, and pines, which have been in many cases invaded by fires throwing to the ground thousands of trees with the trunks lying across at every conceivable angle, forming extensive breastworks, which on the lower slopes are thickly grown with Ceanothus and higher with Menziesia so thickly as to form a nearly solid wall. A passage through such places was effected only by the liberal use of the axe — cutting small trees too near each other to permit the pack-loads to pass and logs too high to be taken by the pack animals. At times an animal would attempt to pass between rocks or trees narrower than the load, or loose its footing and roll to the bottom of the cañon below, necessitating a halt and rearrangement of loads. Such occurrences wrought many accidents to apparatus, material, and temper, and oftentimes made an advance of two or three miles a very creditable day's work.

Vast forest fires were raging at this time over northern Idaho, adjoining parts of Washington and Montana; all of the valleys, cañons, and lower levels were filled with a layer of smoke so that from the double crest of Packsaddle Mountain, the tops of the neighboring peaks, as far as the eye could reach, appeared as islands in this sea of pitchy fog. These fires are of widespread prevalence and of yearly occurrence, destroying thousands of acres of forest annually and threatening, in conjunction with the extensive snow slides that descend from the higher slopes, an almost entire destruction of the timber, forestalling, to some extent, the piratical timber-thieves that infest its borders.

The final work of the season was done from the northern end of the lake from near Hope, Idaho, and here at the end of the season the camp was broken and the corps returned eastward by rail.

Briefly summarized, the results of the expedition are as follows: The basins of Lakes Coeur d'Alene and Pend d'Oreille and of the Clearwater and Palouse rivers were explored; the botanically unknown area in Central Idaho now being limited on the south by the Snake River basin, on the west by the Snake River and the basin explored. About 25,000 specimens of dried plants were collected, representing nearly 1,000 species, many of them undescribed forms. Valuable facts concerning general distribution of plants were obtained, since the area explored is one where the Rocky Mountain flora meets and intermingles with the Pacific coast flora in a very interesting manner, while the opportunity afforded by numerous mountain slopes for the furthering of some problems of vertical distribution was not neglected.

BIRDS THAT SING IN THE NIGHT.

BY DR. MORRIS GIBBS, KALAMAZOO, MICH.

WE have no regular night-singers in Michigan, and, so far as I am able to learn, America does not equal the Old World nightingale, although we have diurnal songsters which excel. The famous English naturalist, Gilbert White, records three species of birds which sing at night in the British Isles. They are the reed-sparrow, which sings among the reeds and willows, the woodlark, singing in mid-air, and the nightingale, as Milton describes it,—

"In shadiest covert hid."

There are several species of owls which roll forth or screech out their notes at night, and also numerous shore-birds and waterfowl that issue their varied calls, and, especially these latter, are to be heard during the season of migration, as most birds are partial to night travel spring and autumn. Then, too, our well-known whip-poor-will confines his not unmusical, but monotonous jargon to the hours of darkness, while the scream of the night-hawk breaks on the ear between the setting and rising of the sun. But these birds are not, strictly speaking, songsters, although their notes undoubtedly fill their requirements as to harmony and expression.

The plain, domestic little chipping sparrow sometimes favors us with its simple reverberating chatter in the darkest of nights. The notes hardly deserve the name of song, but heard issuing from the surrounding gloom, the simple refrain commands our attention from its oddity at the unusual hour. The wood-peewee not rarely quavers forth its plaintive effort, sounding in the deep shade like a wail from a departed spirit. This favorite singer is a remarkably early riser, as he is also late in going to rest, and I have sometimes thought that his musical efforts at night were the result of an error on his part — an idea strengthened by the fact that the notes are rarely heard more than once during the night, and moreover the song is only occasional.

Two others, which are sometimes heard to burst forth in ecstatic melody, are the hermit and Swainson's thrushes. They are transients in my locality, but nest to the north of us. If I could describe the songs of birds, so that others could appreciate them as I do, I would feel that a partial acknowledgment had been made to the divine melody issuing from these birds' throats.

We often hear that the best singers are the ones of plainest plumages, but this is assuredly not so in all instances. If one is permitted to listen to the sweet song of the scarlet tanager in the night, it will be acknowledged that the brilliant coat of the songster does not compare in point of excellence to the owner's refrain.

These birds are the only species which sing during darkness, in Michigan, that I have met with, and not one of them is a regular night-songster.

NOTES AND NEWS.

THE College of Physicians of Philadelphia announces that the next award of the Alvarenga Prize, being the income for one year of the bequest of the late Señor Alvarenga, and amounting to about $180, will be made on July 14, 1893, providing that an essay deemed by the committee of award to be worthy of the prize shall have been offered. Essays intended for competition may be upon any subject in medicine, but cannot have been published, and must be received by the secretary of the college on or before May 1, 1893. The Alvarenga Prize for 1892 has been awarded to Dr. R. H. L. Bibb of Saltillo, Mexico, for his essay, entitled "Observations on the Nature of Leprosy."

— W. J. Waggener, Professor of Natural Philosophy, State University of Colorado, Boulder, writes: "During the present year, I have tried the experiment of making diagrams and pictures for projection by the magic and the solar lantern by printing the same with the ordinary printing press and engraved blocks, on sheets of transparent gelatine. The results were gratifying even beyond the expectations which I had long entertained for the process. It is safe to say that by this means excellent lantern-slides from diagrams and engravings of nearly if not quite all kinds can be made and multiplied as rapidly and almost as cheaply as paper prints. Having assured myself of the usefulness and the novelty of the process, I wish that its use may bring the unlimited benefits and pleasures of projected pictures to many who cannot afford the more expensive ones now in use. Especially I hope that all schools may soon be able to make use of this means of instruction. No patent will be asked for this process, but all are invited to make free use of it."

— Macmillan & Co. announce that the recently completed edition of Foster's "Text-Book of Physiology," in four parts, is to be supplemented by the issue of an appendix on "The Chemical Basis of the Animal Body," by A. Sheridan Lea, Sc.D., F.R.S. Dr. Lea is lecturer on physiology to the University of Cambridge, England.