The Statistics of Climate

A Vast but Strikingly Inadequate Body of Scientific Data

THE making and recording of meteorological observations, day in and day out, is a process that goes on at some 35,000 places scattered over the globe. The total number of such observations taken every year amounts to at least fifteen million. Making due allowance for the fact that a majority of weather stations are of comparatively recent origin, while a few are from one to two centuries old, it appears that the existing data of climate are the final product of *several hundred million* observations of the weather.

Such being the case, it will perhaps be difficult to believe that practical questions which cannot be answered arise every day concerning the climatic conditions prevailing in various parts of the world. This statement does not apply merely to uncivilized or sparsely settled regions. There are obvious reasons why the climatic statistics for such regions should be scarce or non-existent; but it will doubtless surprise the average reader to learn that even for those parts of the globe where elaborate meteorological organizations have long flourished, including western Europe and the eastern United States, the climatic data hitherto assembled are still very far from sufficient to meet the demands constantly made for statistical information of this character. Not only are they insufficient in quantity, but they are, too often, inferior in quality, hard to interpret, strikingly heterogeneous, and extremely difficult of access.

In order to explain this curious situation, it is necessary, first of all, to consider what sort of data are included under the head of climatic statistics and why they are so included. The kinds of data comprised in a register of meteorological observations are not very numerous, even at fully equipped observatories, while at more modest stations they may be reduced to the readings of thermometers and rain-gages, and records of the wind and the state of the sky. Nevertheless, a little reflection will show that it is possible to deduce from a series of such figures an endless variety of sums, averages, groups, combinations, and what-not.

Supposing, for example, we have only the daily records of maximum and minimum temperature for a number

of years at a particular place. From these we can obtain "normals" of the daily, monthly and yearly temperature (to say nothing of similar values for five-day and ten-day periods, weeks, seasons, and other intervals of time); mean daily, monthly and yearly "departures" from the normal; mean values of the interdiurnal variability of temperature; mean number of days having mean temperatures above or below certain limits; mean maximum, minimum and range for each day, each month and the year; averages of the absolute extremes and ranges for each month and the year, and absolute values for the entire period of observation. Such are only a part of the climatic data yielded by a simple pair of maximum and minimum thermometers. Side by side with average values the climatologist occasionally works up "frequency" values, and these are more useful for certain purposes than means. A mean is not, as a rule, the value that most frequently occurs. The fact that the mean temperature on January 1 at Blankville during the past 50 years has been 25 degrees is not inconsistent with the fact that the *most frequent* daily temperature for that date and place has been 29 degrees. If we add to the various data just mentioned the equally elaborate statistics obtainable from records of humidity, rainfall, snowfall, evaporation, barometric pressure, direction and force of the wind, kinds and amounts of clouds, duration of sunshine, etc., we shall eventually have enough statistical material concerning the climate of a *single place* to fill a ponderous volume, while the climatic statistics of a country would fill a big library.

As a matter of fact there exist monographs on the climates of individual places that comprise hundreds of pages. The criterion in the selection of the data to be included in such an array of climatic statistics is utility. It is because of the extremely varied applications of these statistics that there is need for such elaborate monographs. But this need has hitherto been met in only the most sporadic way, and it offers unbounded opportunities for fruitful labor on the part of climatologists.

What are climatic statistics good for? To this query

one is tempted to retort: What are they *not* good for? Let us set down a few typical cases in which such data are desired.

A merchant plans to undertake the sale of rubber coats in foreign markets. Hence he wishes to know all about the distribution of rainfall, both geographically and as to season. Which are the rainy regions of the globe? When do the heaviest rains occur in each of these regions? Where do the prevailing temperatures indicate the need of heavy coats, and where light?

An invalid contemplates visiting a certain health resort. What mean temperatures occur there at the season of the proposed visit? What ranges of temperature between day and night? How much does the temperature vary from day to day? How much sunshine may be expected? Is the atmosphere moist or dry? What of the winds? Such are some of the questions he is likely to ask.

A horticulturist proposes to introduce a foreign plant in this country. Where will he find the most favorable climate for it? In order to settle this question he first tries to secure certain information about the climate of the plant's original habitat—the march of temperature through the season of growth, average dates of first and last frost, normal fluctuations of rainfall, humidity, sunshine, etc. In many cases such an inquiry would be fruitless. Perhaps the alien plant hails from a region that is climatically unexplored, or the available climatic data may not be of the right sort to fit this particular problem, or, finally, such data as there are may be impossible to locate in the enormous ill-digested literature of climatology. If the desired information is obtained, the next step is to ascertain where (if anywhere) similar climatic conditions prevail in the United States, and this is generally an easy task.

An engineer is planning a sewer system. He needs data of excessive rainfall for the locality under consideration, so that he may estimate the maximum amount of storm-water the sewers will ever need to

(Continued on page 70)

An Antediluvian Monster

Is the Argentine Plesiosaurus a Fake or a Scientific Marvel?

By Leonard Matters

WHATEVER may be the opinion in scientific circles—and it is one of scornful skepticism—the fact remains that the report of the existence in Argentina of a living specimen of a race of mammoth reptiles, supposed to have been extinct for millions of years, has excited intense interest. Every scientist of note has scoffed at the idea, but, headed by Dr. Clement Onelli, Director of the Zoological Gardens at Buenos Aires, there is a large body of Argentine public opinion strongly of opinion that a member of the plesiosaurus family will be discovered, alive or dead.

Dr. Onelli has disclosed to the press in Buenos Aires the fact that some time ago he received a letter from an American mining man down in Patagonia, reporting the existence of some monster, of a type well known to paleontologists through fossil remains, but unknown to modern zoology. The American, a Mr. Sheffield, has been prospecting for gold along the Andes in the Territory of Chubut for many years, and Dr. Onelli says he knows him to be perfectly reliable. Mr. Sheffield wrote to the doctor stating that he had come across some enormous tracks near a lake. Bushes and undergrowth were trodden into the ground, and so deep were the tracks that they could only have been made by some living thing of ponderous weight. Continuing his account, Mr. Sheffield said: "I saw in the middle of the lake an animal with a huge neck like that of a swan, and the movement in the water made me suppose the beast to have a body like that of a crocodile."

Dr. Onelli has pointed out that Mr. Sheffield has given, for a layman, a remarkably accurate outline of the plesiosaurus, one of the mammoth reptiles that lived countless years before the ice-age, and became extinct during that geological epoch in the world's history. Moreover, the report recalls more than one similar story of the existence in Patagonia of some strange creature, never yet clearly identified. Patagonia was undoubtedly at some time the habitat of mammoth beasts, and prehistoric man. Extensive fossil beds have been located, and scientific knowledge has been widely enriched by the discovery of many kinds of

extinct mammals and reptiles. Professor Frederic B. Loomis conducted an expedition through the Territory of Chubut in 1911, on behalf of Amherst College, and was successful in unearthing a petrified forest and, among other interesting fossils, the skull of a pyrotherium, an extinct elephantine creature.

There has long existed a romantic sort of idea that in the comparatively uninhabited parts of Patagonia, where certain forms of vertebrates are believed to have originated, a discovery would yet be made, of a nature that would stagger science—the finding of the "missing link," for instance, or more probably the capture of an actual living specimen of some supposedly extinct creature of antediluvian antiquity. Paleontologists and scientists in general have never been associated with such a belief, but nevertheless it has been a popular fancy, and has not lacked some degree of support among men whose opinion carries weight. In announcing the latest report to the public Dr. Onelli has recalled this interesting speculation. He was personally first attracted by the idea 25 years ago when he was down in Patagonia. On the shores of White Lake there then lived a Chilean farmer who declared that often at night a strange noise could be heard, as though a cart were being dragged over the pebbly shore. It was asserted that on moonlight nights a huge beast could be seen in the lake. It had a long reptilian neck which rose high above the water, but when disturbed it would at once dive and disappear in the depths.

Ten years after hearing of the apparition in White Lake, Dr. Onelli heard of the discovery made by a Norwegian engineer named Vaag, who was a member of the commission of demarcation of the boundary between Argentina and Chile. Mr. Vaag gave the name of River Tamango to a waterway flowing from the Andes, on whose banks he found the remains of some great beast, and the tracks of a creature that probably resembled the plesiosaurus. Later on, in a cavern, further south at Ultima Esperanza (Last Hope) there were found the remains of a hide and many bones of a great quadruped. The condition of the hide and the

fact that the bones were conserved in a gelatinous condition, gave rise to the belief that it might be possible to find a similar beast alive. These interesting discoveries led to a number of expeditions, to which popular imagination at least attracted the objective of looking for a surviving specimen of the mammoth age, even if the scientists themselves had no such belief in the idea. These expeditions worked in different parts of Patagonia, and made interesting discoveries, though they found nothing to warrant any credence in the popular theory supposing the existence of zoological phenomena.

This, in brief, is the history behind the most recent report made on the authority of Dr. Onelli. Science in general utterly discredits the suggestion that a plesiosaurus, or anything like the extinct reptile, is still alive, and the many scornful comments on Dr. Onelli's report leaves it doubtful whether scientists admit even the possibility of there being in Patagonia some unknown animal of large proportions. It has been hinted that the creature with the long swan-like neck is in the same class as the sea-serpent, and is really born in a bottle. However, the refusal of scientists to take Mr. Sheffield's story and Dr. Onelli's theory as credible, has not prevented the doctor and the Argentine people getting deeply interested in a proposal to fit out an expedition for the capture of the creature, alive or dead.

So seriously has the idea been taken up that a rather amusing development has followed. Dr. Albarrín, President of the Society for the Protection of Animals, has demanded that the Minister for the Interior shall stop the expedition, under Law No. 2,786, which prohibits the hunting and destruction of rare animals. Dr. Albarrín urges that if there should still exist a plesiosaurus, then Argentina possesses a scientific marvel of immense value, and it should neither be killed nor captured, but should be allowed to enjoy to the full the liberty it has had over millions of years. The worthy doctor claims that it would be more humane and creditable to Argentine culture to leave the creature where it is and let it reproduce its species.