

climate, such as agriculture, &c. It should follow from this that whether the annual result of the presence of a forest be an excess or a defect of heat, the one or the other should, thanks to the winds, be communicated to a greater mass of air, and be less sensible in the stratum close to the ground. The thermic properties of other surfaces are more immediately available in the lower stratum, and consequently, from the practical point of view, exert a greater influence on the temperature of the earth and of its immediate vicinity.

"If, then, we confine our consideration to that which from the practical point of view is perhaps the most important, the influence of forests on the state of temperature in the stratum in which man generally lives, in so far as this can be determined in the ordinary way by thermometers, I think that our reply for this country (Sweden) will be less uncertain, and it is as follows:—

"In the districts of our country which are open and are cultivated, during the annual interval of cultivation, a forest lowers the temperature of air and soil during evenings and clear nights, restricting the period of daily insolation; and thereby checks vegetation.

"The other influences of forests on temperature are either so slight that they possess no practical importance, as, e.g., the moderation of cold in winter, or else are of such a character that they elude the ordinary mode of observation by thermometers. Among the effects of this nature we may mention the well-known fact that forests afford shelter against cold and violent winds to vegetation which would suffer from these winds, or to objects whose temperature is higher than that of the environment, as for instance the human body. It is in this last respect that the Swedish saying is true, namely, that 'the forest is the poor man's cloak.' In certain cases it may also yield protection against the cold air or fog which on cold nights comes from districts in the vicinity which are visited by frost. The advantages on the score of temperature derivable from the forest may therefore be considered to resemble that obtainable from a wall, a palisade, a hedge, or any object of that nature.

"On the one hand a forest, where it is close at hand, offers mechanical protection against cold and violent winds. On the other hand, it does injury either by retaining the solar heat required by crops, or by lowering the temperature of the soil during clear nights, and thus favouring the development of hoar-frosts. At a distance forests have no sensible influence on the climate of Sweden.

"If we wish to put these results to a practical application, it is impossible to say in general whether one should, or even could, clear the forest without injuring agriculture. But it appears that as regards the temperature, if we disregard the utility of forests in other directions, we might make extensive clearances without any prejudice to agriculture. It is certainly not a mistake to say that our best cultivated districts are the freest from wood, nor is it a mere chance that the harvests are, on the whole, more sure in the open country than in the forest. In the event of a bad harvest it is, as I well know, the wooded districts which have suffered most. At the same time I must at once admit that these provinces are also influenced by other powerful physical factors, possibly even more active than forests, such as an elevated situation, a bad soil, the presence of swamps, &c. But nevertheless it appears to me, after all that has been said in the preceding pages, that the forest has some bearing on the subject.

"At the present day, the words spoken 130 years ago by Pastor P. Högström, and at that time member of the Swedish Academy, are very generally applicable, inasmuch as it has been found that cultivation can to a great extent remove from a district its tendency to hoar-frost; this same result has frequently been obtained by draining or by clearing the forests, particularly those of deciduous timber, where the fogs, especially those which bring on

frosts, appear to have their origin and their aliment. On the contrary, a pine forest is an excellent shelter against cold, especially when it can stand between the country and marshes or surrounding districts where the cold has its rise. If, however, the forest interferes with sunshine and with wind, it should be cleared. It results, therefore, that while in some districts the clearing of a forest has been beneficial in averting hoar-frost, in others the result has been directly the opposite."

*RESULTS DEDUCED FROM THE MEASURES OF TERRESTRIAL MAGNETIC FORCE IN THE HORIZONTAL PLANE, AT THE ROYAL OBSERVATORY, GREENWICH, FROM 1841 TO 1876*

SIR GEORGE AIRY has recently published a valuable and extensive series of diagrams representing the diurnal changes in the magnetic forces in the horizontal plane at Greenwich between 1841 and 1876. In an introduction, the ex-Astronomer-Royal gives a short statement of the circumstances under which the magnetic work was undertaken at Greenwich, and the various changes which have taken place. With regard to the curves here brought together he writes as follows:—

The form of the curves, and the position of the points on them corresponding to hours of solar time, leave no doubt that the diurnal inequality is due mainly—and, as far as I can judge, entirely—to the radiant heat of the sun; and, it would seem, not to its heat on the earth generally, but to its heat on points of the earth not very distant from the magnets. In the hot months of the year the curve, though far from circular, surrounds the central point in a form which, as viewed from that central point, never crosses itself, and is, generally speaking, usually symmetrical with regard to E. and W. But in the cold months the space included in the curve is much smaller, in many cases probably not one-fifth of what it is in the summer months; and the curve often crosses itself in the most bizarre fashion, with irregular loops at these crossings. In the summer months there is a certain degree of symmetry; but here is, constantly, a preponderance on the west side, which leads me to imagine that the magnetic effect of the sun's heat upon the sea is considerably greater than the effect on the land.

To obtain some numerical basis for a report which, though undoubtedly imperfect, may convey some ideas on this wonderful subject, I have adopted the following course. I have confined myself to the months of June and July as probably the two hottest, and the months of December and January as probably the two coldest. In each of the curves applying to these months I have laid down a system of rectangular co-ordinates corresponding to the Greenwich astronomical meridian, and the line at right angles to the meridian (the geographical E. and W.). The extreme north ordinate and the extreme south ordinate were measured, and their sum taken, and interpreted by a scale of measure formed in accordance with the theory of the instruments, and this interpretation forms the "range of meridian force in terms of the mean horizontal force." In the same manner, the "range of transversal force" is measured. As the time of each two-hourly or hourly result is marked on the curve, there is no difficulty in fixing approximately on the solar times corresponding to the extreme N. and S. values and the extreme E. and W. values mentioned above. These are all the elements of the magnetic record which are included in the table.

*MOVEMENTS ON THE SUN'S SURFACE*

M. A. BELOPOLSKY, of the Moscow Observatory, states in *Astronomische Nachrichten*, No. 2722, some considerations of much interest regarding the solar