

the year that Salton Sea was formed, than before, with the exception of the dry year of 1910. The data are, however, not strictly homogeneous, since the number of reporting rainfall stations in later years was much increased and, moreover, the proximity of the Gulf of California to Arizona, a body of water vastly greater than Salton Sea even at its maximum, seems to vitiate the argument that the presence of Salton Sea materially affected the rainfall of Arizona.

In the case of Minnesota the yearly averages for a period of 32 years does not show any progressive increase in the rainfall of that State; on the contrary, the greatest deficiency in precipitation during the period occurred in 1910, several years after the completion of the reservoirs.

A consideration of the probable effect of the Great Lakes led to the conclusion that an increase of 2 or 3 inches in the annual precipitation might reasonably be ascribed to the moisture supplied by the Great Lakes.—*A. J. Henry.*

#### THE DESICCATION OF AFRICA.

Review reprinted from *The Geographical Journal*, Feb., 1919, vol. 53, pp. 122-123.]

Papers on the increasing aridity of areas in the south and west of Africa have recently been noticed in this *Journal* (vols. 50, p. 30, and 51, p. 404), and a recent Johannesburg publication by Prof. E. H. L. Schwarz, which we have received, dealing with the continent as a whole in the same relation, will at least be useful in bringing into prominence a variety of interesting questions, geographical, meteorological, and engineering. The evidence is held to be incontestable that the Sahara Desert within the historic period and the Kalahari Desert much more recently were well watered and thickly peopled, and that the change to present day conditions has been brought about by alterations in the river system of the continent through headstream erosion of the short, rapid coastal streams, which by cutting back into the coastal mountain rampart have captured the waters of great inland rivers. In this way, it is held, has the Niger been diverted from a straight northerly course across the Sahara, fertilizing a wide extent of border country, into the bent curve which the river describes today with disastrous consequences to northwest Africa. That local desiccation of parts of the continent is in progress as a result of its peculiar physical structure is no doubt possible, and its explanation by headstream erosion altering the drainage systems is more plausible than one which attributes it to progressive decrease of rainfall—a supposition difficult to admit on climatological principles in default of indisputable evidence. Having considered the apparent facts of desiccation and their causes, the author goes on to discuss somewhat ambitious schemes for the amelioration of climatic conditions in the waterless regions of Africa which are alleged to be steadily gaining in area in consequence of the pernicious hydrographic régime under which the continent lies. The measures outlined consist of engineering schemes for enlarging the areas of Lake Chad in the Sahara and Lake Ngami in the Kalahari to something like former dimensions. The project for North Africa of diverting Congo waters at Stanley Pool is dismissed as too costly to be

feasible at the present time, but that for South Africa (to which reference was made in the *Journal* for May 1918, p. 337) is urged as being quite practicable and of pressing importance. Were we disposed to grant the possibility of creating an artificial reservoir some 15,000 square miles in area (as to which opinions will certainly differ), the author's contention that it would add greatly to the humidity of the air over South Africa and so tend to mitigate the destructive character of desert winds is no doubt sound; but one can not give unqualified assent to his further contention that the evaporation from such an inland reservoir must necessarily "supply rain clouds for the whole of South Africa," rendering sterile tracts fertile. The primary *raison d'être* of the African deserts, both north and south, is their location in the belt of trade winds which, whether they blow over land or sea, are rainless winds except where their course is obstructed by a range of mountains, as in the case of the Drakensberg system on the eastern side of South Africa itself. In South Africa the really droughty region with less than 10 inches of rain per annum extends from about the middle of the Bechuanaland Protectorate westward right to the shores of the Atlantic; and no estimate of the capacity of a large "evaporating dish" for increasing either the local or general rainfall of the country would be of much value that was not based upon a very intimate local knowledge (of which evidence is not produced in the paper under notice) of the precise conditions in which such rain as does fall is generated.

#### THE PROGRESSIVE DESICCATION OF THE COLONY OF SENEGAL.

By CHARLES RABOT.

[Abstracted from a discussion of the memoirs of Henry Hubert, *Progression du dessèchement dans les régions Sénégalaises, Annales de Géographie*, Paris, 1917, No. 148, in *La Géographie*, 1918, No. 2, pp. 111-113.]

Important researches in the variation of climate in Senegal, the French colony in West Africa, have been made by Henry Hubert. The geological deposits are of such a nature as to indicate that the climate in comparatively recent times has been wet; but the deposit of sand which covers the sandstone indicates that at present the tendency to dryness is increasing. The dry river valleys, old fords, the remains of crocodiles and fishes far inland, the decreasing distance from the mouth to the head of navigation of the rivers, and the decreasing commercial activities of the colony are current testimony of the progressive desiccation of the land. Towns which formerly were thickly populated are now deserted, sand dunes which formerly were quite permanent now show a tendency to shift, and water holes are disappearing.

The apparent advances and recessions of glaciation in the Alps within historic times, indeed in very short periods, are evidences of successive climatic changes which can be more easily manifest in the high mountains than in the plains country. Nevertheless, the relation between such periods in the Alps and the changes in Senegal can be traced, although of far less amplitude in Senegal. This would indicate that the present era of dryness may be again followed by one of wetness.—*C. L. M.*