Roseclare, Ill., and Evansville, Ind., is reported at 6,000 tons, worth $30,000, an increase of 1,000 tons over 1887.

Infusorial Earth. — The product came principally from Maryland, and amounted to 2,500 short tons, worth, before shipment, $12,500.

Zircon. — During 1887 and 1888, 25 tons of zircon were mined, principally in Henderson County, N.C., and sold for $10,000 for the manufacture of incandescent gas-burners. About 4 tons of monazite, 1 ton of allanite, 600 pounds of samarskite, and $500 worth of yttrium minerals were produced for the same use. About 6 tons of monazite and 5 tons of cerite were also imported.

Mineral Waters. — Amount sold in 1888, 9,628,568 gallons, valued at $1,709,302. In 1887 the product was 8,259,609 gallons, worth $1,261,473.

Totals. — The total value of the minerals produced in 1888 was $591,659,931. It is recognized that this is the sum of the values of substances taken in various stages of manufacture, and hence not strictly comparable with each other; still it is the most valuable means for comparing the total products of different years. The result is an increase of nearly $50,000,000 beyond the value of the product in 1887. In that year nearly every mineral industry showed an increase, and hence an increased total was evident. But the fact that the increase was so very large was due to rather exceptional conditions in a few important industries, and it could not reasonably be expected that a similar combination of circumstances would result in even a larger total value for 1888. Nevertheless the unprecedented stimulus given to the production of copper by an artificial price increased the total value of that product nearly $13,000,000, or nearly enough to offset the decline in the total value of pig-iron. The other important factors in the increase were coal and the other fuels, which followed the increased quantity of metals. With the anticipated decline of copper to the normal demand, a decline in the total value of the product in 1889 will not be inconsistent with the natural development of our mineral resources.

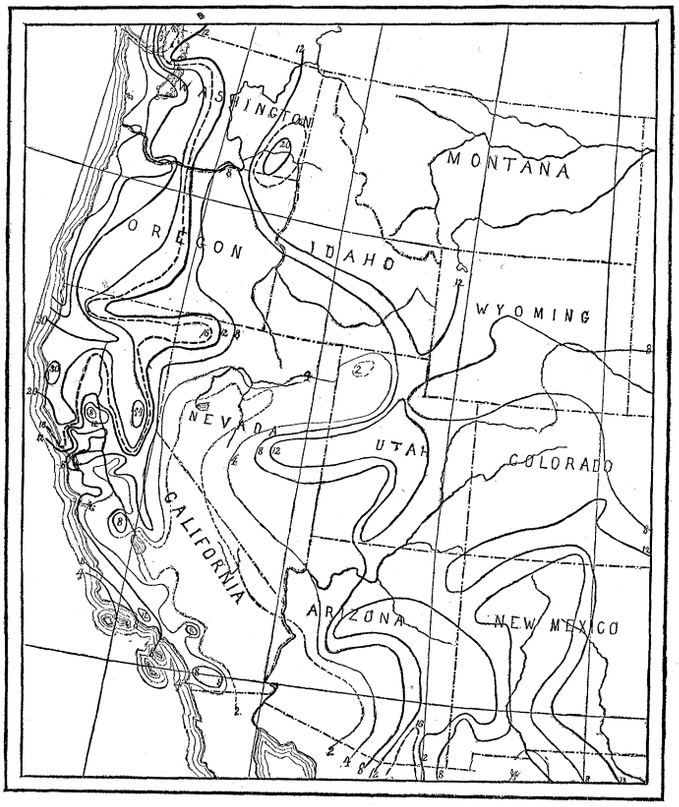
THE RAINFALL OF THE PACIFIC SLOPE.

GEN. A. W. GREELY, in compliance with the resolution of the Senate, dated Jan. 4, 1888, has compiled an interesting report on the maximum annual, minimum annual, and on the mean precipitation for each month of the year, for the Western States and Territories, the main part of which is a series of charts. The record from which these charts have been compiled aggregates 4,800 years for 661 stations, thus giving an average of seven years and three months to each station. The separate records, however, vary from two to forty years in length. The principal object of the report is to clear up the important question of the extent of the arid lands. Regarding this point, the chief signal officer says, —

"One great result which must redound to the benefit of the trans-Mississippi and trans-Missouri country by the publication of these official data will be the dispelling of erroneous and injurious impressions which have long prevailed regarding this region. In the early part of this century this territory was viewed as hardly suited for civilized man; its enormous plains and vast mountains being represented as arid and desert regions, unsuited for cultivation, and in many places even unfit for pasturage. Adventure, exploration, and circumstance have pushed the frontier westward, until the myths of the Great American Desert to the north, and of the rainless 'staked plains' to the south, have practically disappeared. It is none the less true, however, that the latest and most reliable text-book of meteorology of this country speaks of the areas between the Sierra Nevada and the Rocky Mountains, including portions of Utah, New Mexico, and California, as a region which is almost entirely destitute of rain, and that farther on the east side of the Rocky Mountains the country is a barren desert, almost without rain.

"As to the value of these charts, there should exist no reasonable doubt, since they not only show prospective settlers in these States and Territories the probable rainfall conditions, but likewise show it to parties contemplating industrial, agricultural, stock, and other investments in these extensive regions. It is evident to all, however, that the rainfall conditions for separate years vary quite considerably; and, indeed, the opinion has been put forth that these variations are not only enormous, but are so irregular as to render their prediction impracticable, and even that rain does not fall for years in certain sections.

"An examination of the charts of maximum annual rainfall and minimum annual rainfall of these regions shows clearly that rainfall conditions are considerably more equable than has been generally believed; so that the isohyetal lines are quite as regular on these charts of maxima and minima conditions as on those of average conditions. The minimum rainfall has never reached zero for any year, and annual or seasonal rainfalls less than one inch have occurred in south-western California and south-western Arizona at few stations only. These maps of maxima and minima precipitation must be of great practical value as showing the settler or investor exactly the extreme conditions which he must expect to experience in these regions. Another great value of the charts is the bringing to general attention and consideration very extensive areas of country in what has been known as the arid region, where late



LEAST ANNUAL RAINFALL ON THE PACIFIC SLOPE.

and careful observations have shown the rainfall to be far greater than has been usually attributed, and thus transfer these areas to the sub-humid districts.

"The great extent to which misapprehension as to the rainfall conditions of the arid regions has been corrected by these charts is evidenced by the fact that the area on which the mean annual rainfall is less than ten inches, shown on statistical maps of the 'Tenth Census' at 241,000 square miles, has been reduced to 126,000 square miles; while a similar reduction is shown in the area of country where the yearly rainfall is between ten and fifteen inches, which, given in the census chart at 385,000 square miles, is now limited to 259,000 square miles. In other words, the area over which less than fifteen inches of rain fall annually has been reduced almost a quarter of a million (241,000) square miles. A large area of country charted on the statistical map as having an average rainfall of less than five inches now entirely disappears in Texas, New Mexico, Utah, and Oregon, and is materially reduced in Nevada, Arizona, and California.

"Observations over a small, compact agricultural area of South Australia afford very reliable data as to the effect of rainfall upon annual wheat yields. It appears from these observations that

twelve inches of rain in the six winter months produce six bushels of wheat per acre, and that for every increase of rainfall of an inch a like increase occurs in the average production of bushels of wheat per acre."

The minimum rainfall is undoubtedly of the greatest importance to agriculturists, and we reproduce here a portion of the map of minimum rainfall. The point at which a region may be classed as arid, and unfit for successful agriculture, is believed by Gen. Greely to be fifteen inches. This amount of annual rainfall is not considered sufficient for all crops, nor on all kinds of soil, but may be assumed as an average. Exact observations upon these points are lacking in the United States; but in Australia, observations and experiments have been made, covering now quite a number of years, on wheat, which may be called a test-crop.

The fact that wheat can be grown without irrigation, in a country where the annual rainfall is less than twenty inches, is evidenced by official statistics from Dakota, which show that wheat is grown by tens of millions of bushels yearly in sections where the rainfall ranges from twenty inches downward. In that region over three million bushels of wheat are now grown annually in counties where the rainfall ranges from fifteen and one-tenth down to thirteen and eight-tenths inches.

Perhaps the most careful observations in connection with the effect of rainfall upon pasturage have been made in Australia, the question being very important owing to the immense arid regions in that country. It has been set forth, and probably with a fair degree of authority, that annual rainfall is a most reliable index as to the pastoral capacity of a country, since grass benefits by rain at any season. Australian records show that land favored with less than ten inches of rain a year is quite valueless without irrigation. In such regions only one sheep per square mile can be carried for each inch of rainfall. For from nine to thirteen inches, however, the increase is about twenty sheep per square mile, and for from thirteen to twenty inches of rainfall the increased carrying capacity is about seventy sheep per square mile.

It has been estimated that the sandy land in the San Joaquin valley, California, would feed about one sheep to the acre in its natural state; but when irrigated, and growing alfalfa, it carries twenty.

The question of the amount of minimum rainfall, and of its distribution according to seasons and years, is one of prime importance for the development of the Western States and Territories; and careful and long-continued researches on the meteorological conditions, more particularly on the precipitation, will be of the greatest value to settlers. The chief signal-officer concludes his report with a recommendation to extend observations upon the rainfall in the Western States and Territories by a gratuitous distribution of gauges to reliable voluntary observers who reside in counties from which rainfall reports are not now obtainable.

PRIMARY EDUCATION IN GERMANY.

IT is commonly held that in Germany the public-school system, beginning with the university and ending with the primary school, has reached a higher degree of excellence than has been attained anywhere else. The term "Germany" as generally used in this connection is somewhat vague; for the schools are managed differently in different parts, and the various systems are not equally good. In an article in the *Journal of Pedagogy* by O. B. Super of Dickinson College, Carlisle, Penn., a view is given of the system where it has reached its highest excellence.

The first point requiring attention is, that in Germany every thing relating to schools of any kind is done according to a regular system; and this, of course, is a great advantage, to begin with. We sometimes talk of our public school system, but it would be difficult to say what that system is. Ever since there have been white men in America, means have usually been found to give most of the rising generation some kind of an education; and this is about all we can boast of now, for, under the existing order of things, a very large number of children get no education. The census of 1880 shows that we have among us 6,239,958 children who cannot write their names, and this fact alone is enough to prove that our so-called system comes very far short of doing what it ought to do.

The German Government is careful, first, that suitable buildings are erected for school purposes, and then looks to it that they are provided with proper furniture, books, apparatus, and teachers. Before a new school-building can be erected, the law requires attention to the following particulars: the location must be central; it must be removed from busy streets and noisy or ill smelling factories; the ground must be dry and with sufficient elevation to allow of proper drainage; there must be a dry and clean yard large enough for a play-ground; and the government provides swings, cross-bars, and other appliances for out-door gymnastics. School architecture in America usually depends very much on the character or intelligence of the man who has undertaken the "job." The government further provides the following apparatus for every school: in the primary grades, alphabetical charts, abacus, the metric ruler, two black-boards, a wall-map of the province in which the school is located, a relief-map of Germany, a wall-map of Palestine, and some charts of natural history. In the grammar and high school grades there is much more, including chemical and philosophical apparatus.

But the great point of superiority of their schools lies in the teachers. A good teacher will have a good school in spite of all drawbacks, and a poor teacher will have a poor school in spite of all advantages of building and apparatus. The reason why German teachers, as a rule, are superior to ours, is that the former have been specially trained for their work. With us it seems to be a generally accepted theory that almost any one can teach, provided he knows just a little more than the persons of whom he is to have charge. In Germany, teaching, even in the primary schools, is recognized as a profession, which unfortunately is not the case in this country. Here the average teacher might with propriety be called a sort of "pedagogic tramp;" for in country districts, at least, the same teacher rarely has the same school two successive terms, and the records of some counties in Pennsylvania show that every year more than one-third of the schools have teachers that are entirely without experience, and in many cases they have just "graduated" from the country schools themselves. It will doubtless be found that the same condition of affairs prevails in every State west of Pennsylvania. A very large majority of public-school teachers, if they are men, are only using this occupation as a convenience until they are able to find something more suited to their tastes. If they are women, the probabilities are that in a few years they will marry; and, if they have any thing to do with managing children after that, it will not likely be in the public school. In either case, teaching is looked upon as something one ought to get out of as soon as possible.

In Germany no one is permitted to teach, even in a primary school, unless he has satisfactorily completed the course of study prescribed by the "Teachers' Seminary." Even private schools are subject to the same rigid supervision as the public schools, and no one is allowed to set up a school until he has demonstrated his fitness to teach. With us, private and parochial schools are not seldom worse than the public schools; for, while the former usually have some kind of supervision, the latter have no authorized overseers at all.

In order to be admitted to a "Teachers' Seminary," the applicant must be between sixteen and twenty-four years of age; must have a certificate from his former teacher, testifying to his moral character, good habits, industry, and ability; and must be able to pass an examination in what are usually called "common-school" branches, together with history of Germany, elements of natural philosophy, religious doctrine, and Bible history and music. At the seminary he studies all these, and some higher branches in addition. After completing this course, he must serve two years as assistant to an experienced teacher. If he sustains this ordeal, he is then required to pass a final examination, when he is supposed to be fit to take charge of a low-grade school; but he has now been raised to the rank of a "school-master," is recognized and honored as a member of a noble profession, with a position for life, and a salary that is not large but always sufficient to enable him to maintain his position with respectability, and with the certainty that if he does his work well he will be promoted to the