Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, FEBRUARY 13, 1886.

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 528

For the Week Ending February 13, 1886.

Price 10 cents. For sale by all newsdealers.

IS OUR AVERAGE RAINFALL DIMINISHING?

This may not concern us individually, for any changes would be very gradual, but no question can be of more vital interest than the *average* permanency of our water supply. If there be evidences that atmospheric precipitation is steadily decreasing throughout the historical world, we cannot fail to recognize their importance.

We shall, for the present at least, set aside geological proofs and confine ourselves entirely to recorded history, taking as our basis the oldest consecutive record, the Hebrew books.

The earliest traces of human history carry us to Asia, in its central and southwestern parts, and the most remote national movement of which we have any clear and continuous account is the migration of the Israelites from Egypt. After many years of devious wanderings, the Jewish tribes made their appearance in the plains of Moab, on the east side of the Dead Sea, not far from B.C. 1450, that is to say, somewhat over 3,300 years ago. An expedition was sent up by Moses, and made conquest of all the rich agricultural region to the north. The land was then swarming with inhabitants who were wealthy from commerce and from the cultivation of the soil. Their walled towns were numerous and strong. We need no evidence from the Bible to show us this, for there the towns stand now, perhaps 4,000 years old, with many of their houses as perfect as in the days of Og, King of Bashan. There they stand, "waste, without inhabitant."

There must be some reason for this, independent of social considerations. Men live there now, it is true, only by the might of the strong hand, but they did so 3,000 years ago; it is not the lack of protection by established law that has caused the desolation. The simple fact is that the land cannot furnish food for so dense a population. Its characteristic richness and fertility have passed away, and for this there can be but one cause, and that is the diminution of the annual rainfall.

It is well known that in the days of Chaldean glory the most fruitful land of antiquity was Mesopotamia. What is it now? "The land of great canals is desolate and barren, without settlement, a dried-up wilderness, . . . covered with the plants peculiar to a saline soil, and all this where once was the 'garden of the world.'" These are the words of an eye witness.

A little further, and we reach Persia. The India Geological Survey says of it: "From the account given by ancient writers, it appears highly probable that the population was much greater and the cultivated land far more extensive 2,000 years ago than at present, and this may have been due to the country being more fertile, in consequence of the rainfall being greater."

Captain Burton, writing of his travels in Midian, says: "This once wealthy and commercial land has become a desolation among the nations; the area of some 3,000 square miles, which, thirty-one centuries ago, could send into the field 135,000 swordsmen, is abandoned to a few hundreds—half peasants, half nomads."

Additional proofs of this slowly progressive desiccation could be brought forward, but we prefer to turn our attention to the Western continent.

For our present purpose, we will go only to the southwestern portion of our territory, to the region west of the Rio Grande del Norte, to Arizona and New Mexico alone.

It is a fearful and a desolate region. Here and there is a running stream, but they are few, and often inaccessible, for the land is made up of *mesas* and *barrancas*. One rides across a bare plain of sun-baked earth, when suddenly he is brought to an abrupt pause by a chasm, with nearly vertical sides, perhaps 1,000 feet deep. In its flat bottom one sees, perhaps, a small stream, perhaps not, for in most of these *barrancas* there is no water whatever, except for a few weeks of the winter. The *mesa* is as dry as the heart of the Sahara. But presently one comes upon the ruins of a single house, or possibly a number of houses—a large village. And so one goes on, and finds abundant evidence of quite a dense population, long since passed away. Many of the villages were on the *mesas*, others were in the *barrancas*, and, what is most astonishing, great numbers of them were not down on the bottom land, but high up on the nearly vertical cliffs, half way and more from their base to their summit. Some of these cliff dwellings are built of quarried stone, some of them are actually excavated from the solid rock, like those of Petra in Edom.

Mr. W. H. Holmes says, in respect to their age: "So great has been the erosion, that many of the caves have been almost obliterated." And again: "At the base of the cliff there is an almost total absence of debris, so that the period that has elapsed since these houses were deserted must equal the time taken to undermine the solid rock plus the time required to reduce this mass to dust; considering also that the erosive agents here are unusually weak, the resulting period would certainly not be inconsiderable."

We might adduce abundant quotations from the various surveys, notably the later ones of Hayden, all showing this one thing, that an abundant population once occupied the wide land which is now given up to barrenness and desolation. The region was then evidently "well watered, like the garden of the Lord," and this it certainly could not have been without a rainfall greatly in excess of that which now prevails.

One collateral fact is worthy of note, as a possible guide to the duration of time involved. One characteristic feature of the barren wastes stretching from Nevada southward is the nut pines, called commonly pinon. They are scattered here and there, and the nuts afford much food to the Indians. The trees are never large, but every one of them has the look of being very old. They are ragged, and battered, and torn by the storms of ages. But the point concerning them of interest to us now is this: there are no young trees among them. The nuts fall and never germinate, for lack of moisture. Where the pinons occur in mountain canons, supplied with water, the nuts take root as usual, but out on the desert plains the old ones are alone, and most surely when they are gone, there will be none in their place.

The inference, then, is plain that the nuts from which these present aged trees took their origin dropped on no such dry and barren earth as lies there now. It is no more certain that the cave dwellers of New Mexico and the men of the *mesas* must have had abundant water than that these pine nuts had it, and yet there stand the trees whose period of growth goes back to better days.

CARBONIC ACID AS A FIRE EXTINGUISHER AT SEA.

The steamer Crystal, of the Arrow Line, from Dundee, Scotland, recently came into New York Harbor with a fire in her hold, which had been raging for ten days. The vessel is divided into four water-tight compartments, separated by iron bulkheads. The one in which the fire was in progress is forty feet long, and extends from the upper deck to the keelson. Under the most favorable circumstances, a fire at sea is a terrible experience; the captain, however, maintained an admirable presence of mind, and at once ordered all the openings to be closed up and the hatches battened down. The cargo in that part of the vessel consisted of bales of jute, carpets, paper stock, and burlap, the smoke from which permeated the entire ship, and kept the crew outside for the greater part of the time. The decks are of iron, covered with wood, and great anxiety was felt lest the heat should fire the planking, and the whole vessel burst into flames.

Another source of grave anxiety was the possibility of the fore and aft bulkheads giving way, and permitting the fire a full sweep from bow to stern. When the fire was first discovered, the vessel was 700 miles east of Newfoundland. It was, however, with a full understanding of the danger that the captain decided to make straight for New York in preference to Halifax or other near ports, since it was only here that he could hope to secure such assistance as would enable him to save the vessel. The harbor was made at night, and it was not until the following morning that the patrol and fire boats could be summoned. After a fight of several hours, the fire was finally extinguished and the charred and water stained cargo discharged into lighters. Being of iron, the vessel itself suffered little damage from its temporary conversion into a furnace.

Though happily both crew and vessel were rescued, ten days of continuous apprehension made an experience almost as terrible as actual shipwreck. Such an occurrence forcibly brings up the question of suitable fire extinguishers for use at sea, for in this age of chemical and mechanical progress, it seems nothing less than gross carelessness that a large number of lives and an amount of valuable property should be placed at the mercy of preventable accidents. The laws of combustion are now well understood. Fire is no longer the mysterious element of the ancients. It is to us simply one of many chemical reactions which we represent by a series of formulæ with the same facility that we describe the rusting of iron or the action of respiration. All three operations belong, indeed, to the same class of reactions. It is the combination of their elements with oxygen. In the case of fire, the combination of the carbon and hydrogen with oxygen is attended with the production of heat, and the particles of the combining body, by means of this heat, are rendered luminous, giving us the accompanying phenomenon of flame.

Opposition to this reaction means simply cutting off the supply of oxygen. Ordinarily, water is used for this purpose. It is opposed to fire only because it shuts off the atmosphere, the source of supply of the free oxygen. Water itself contains a large amount of oxygen—88·88 per cent—but it is not available for supporting combustion, since the combining power of the oxygen is already exhausted; water is itself the product of the combustion of hydrogen. For the same reason, steam is also used for putting out fires. It becomes so soon condensed, however, and so soon diluted with air, that it is only effective when applied near at hand. A number of other substances might be mentioned which would be similarly fatal to combustion, but few of them are practicable until we come to carbonic acid gas.

This was proposed years ago for use as a fire extinguisher, but though it possesses many of the best qualities for such a purpose, it has never come into general use. It is readily procured, and cheap. It is heavier than air, and can therefore be poured over a fire very much as one would pour water. It is not only incapable of supporting combustion, but is itself perfectly incombustible, being the product of the complete oxidation of carbon. Even when diluted with three volumes of air it will still extinguish fire. These qualities would seem to recommend it highly for a more extended trial than it has yet had. It shares one of the disadvantages attending the use of steam or any other gas. It soon becomes mixed with the air and dispersed, unless applied very near at hand, or from above, under such circumstances that it can be poured into the scene of the fire without having too many vent holes below for its escape. This limitation for the present prevents its general introduction in place of water, but there are certain conditions under which it is the extinguisher par excellence.

In the hold of a vessel, for instance, nothing could be better. It would not affect the buoyancy of the ship, it would not damage the cargo in the slightest degree, and it would extinguish the fire as perfectly as an equal volume of water. In several instances it has been applied to this purpose. The perfect inclosure of the hull makes it possible to fill the hold with carbonic acid gas up to the very port holes, and, if these be closed, to the deck itself. The gas is readily produced by the action of acid upon fragments of marble or upon sodium carbonate. One plan proposed for the application of this extinguisher on shipboard consisted of having boxes with perforated sides for the escape of the gas, placed in different parts of the hold and connected by means of copper tubes with a carbonic acid generator. On the detection of smoke or fire, the acid is admitted to the marble or other carbonate in the generator, and the resulting gas permitted to flood the hold or such parts as are in danger. As it is half again as heavy as air, the carbonic acid gas would sink immediately to the bottom, and conflagration could soon be made impossible. The entire apparatus is simple and inexpensive. The materials for generating the gas are always easily obtainable, and cost very little. Had the Crystal been supplied with such an outfit, it is probable that the fire in her compartment could have been put out a few minutes after its discovery.

New Kind of Brick.

Messrs. Bleininger and Hasselmann, two German chemists, have, it is said, recently patented a method for obtaining products that will be more resisting to humidity, etc., than ordinary bricks and tiles. After drying and grinding the clay, they make a mixture as follows:

Clay	91½	parts.
Iron filings	3	"
Table salt	2	"
Potash	1½	"
Elder or willow wood ashes	2	"

The whole is heated to a temperature varying from 1,850 to 2,000 deg. C. (3,362 to 3,632 deg. F.). At the end of from four to five hours the argillaceous mixture is run into moulds, then rebaked in the ovens (always protected from the air) at a temperature of 842 to 932 deg. F. The product may be variously colored by adding to the above 100 parts: 2 parts of manganese for a violet brown, 1 part of manganese for violet, 1 part of copper ashes for green, 1 part arseniate of cobalt for blue, 2 parts of antimony for yellow, and 1½ parts of arsenic and 1 part oxdie of tin for white. These products resist the action of acids, and are well adapted for sewers, etc.

ACCORDING to the *Fireman's Journal*, some one advertised in a certain German local paper that another locality possessed a thrashing machine which was also very effective as a fire engine. The next number of the paper contained the following explanation: "Any one who advertises that at this locality we have a thrashing machine which can also be used as a fire engine is a liar, and even more, though he be as black and sooty as the devil himself; said advertisement is only for the purpose of ridiculing a mistake our noble fire brigade made at the late fire. They were in a great hurry, and in place of hitching their horses to the fire engine, they hitched them to a thrashing machine standing near, and drove quite a distance before they found out their mistake." And so it turns out not to be a combined fire engine and thrashing machine after all.

THE Holly Manufacturing Company, of Lockport, N. Y., have just completed the water works at Fond du Lac, Wis., and they have been very satisfactorily tested. The engines are two compound Gaskill engines, of 3,000,000 gallons each per 24 hours, and pump through 14 miles of pipe to 140 hydrants, etc. The water is taken from 4 six inch artesian wells 600 feet deep. The surplus from the wells is stored in an impounding reservoir of 2,500,000 gallons capacity, which is to be used for fire purposes only, and consumers are supplied direct from the wells. The contract test of throwing streams 120 feet high was perfectly successful.

PHOTOGRAPHIC NOTES.

The Best Temperature for Coating and Developing Dry Plates.—From some experiments recently made, which we find detailed in the *Photographic News*, we take the following interesting facts. Says the *News:*

It is a theory that has been often insisted upon by others as well as ourselves, that, the emulsion once evenly spread on a plate, the more quickly this sets the better; and there can be no doubt that slowness in setting produces deterioration in quality, probably because the bromide of silver has time to settle somewhat while the emulsion is still fluid on the plate, leaving an insensitive film of gelatine on the surface and a film of precipitated bromide against the glass, the latter wanting the protecting gelatine, and therefore liable to fog.

In coating in a room whose temperature was but little above the freezing point, we found that the emulsion at 100° F., a temperature about as high as we usually work at, poured on cold plates, set long before it was evenly spread.

In such a case, two alternatives are open to the operator. He may warm his plates and keep his emulsion at the normal temperature, or leave the plates cold and heat his emulsion to (say) 130° F. At this temperature it will readily flow over very cold plates.

We tried experiments to discover whether any difference in quality would be found in working by the two methods. We were astonished at the result. The plates coated on the glass slightly warmed were all that could be desired; those coated with the emulsion at a high temperature on cold plates were much slower in development, and showed a decided inclination to fog.

The time taken for the emulsion to set was about the same in both cases—probably not more than from one to two minutes—so time of setting cannot have been the factor which produced the deterioration of the plates. Nor can the emulsion itself have been spoiled by the mere raising of the temperature, because it was *after* the cold plates were coated with warm emulsion that, the emulsion being allowed to cool, warm plates were coated with comparatively cold emulsion.

It appears to us that the deterioration is produced by the contact of the atmosphere—probably not of either the oxygen or the nitrogen, but of some impurity in it—with a thin film of hot emulsion.

The more we work at plate making, the more convinced we become that the mere production of a satisfactory emulsion—one capable of giving plates of a high degree of sensitiveness, and possessing all other good qualities—is the easiest part of the process. The coating and drying of the plates form in reality the most difficult part of the work. The following few points may be laid down as established maxims in connection with plate coating and drying.

The plates should be coated with the emulsion at as low a temperature as will allow it to flow readily. After the plates are coated, the emulsion should be caused to set on them as quickly as possible. The drying should be conducted in a brisk current of dry air at a moderate temperature, and should never take more than twenty-four hours.

We were recently developing plates with the solutions very cold—probably the water was not above the maximum density point, say 40° F.—and, as was to have been expected, we found development exceedingly slow. This, however, we had not considered a disadvantage up till the time of our experiments, but we determined to try, by exposing two plates under the sensitometer, and by developing them with cold and comparatively warm solutions, to discover whether there was any real difference in result beyond the difference of time taken.

Here, for a second time, we were much astonished at the result of our experiments. We used iced—or rather snowed—water to mix the developer for the first experiment. It was quite a quarter of an hour before the developing action seemed to cease. Of course, we kept the plate carefully protected from light during all that time.

The second plate was developed with a solution of the same strength as that used for the first, but the temperature was raised to 60° F. The development in this case was complete in about two minutes. The two plates were fixed, and compared. The comparison was instructive. The plate which had been long in the cold solution was afflicted with stains and color fog to such an extent that, on placing it on a piece of white paper, the paper could not be seen at all through the parts that should have been transparent; the plate which had been developed rapidly in the comparatively warm solution showed the protected parts quite clear, and without stains of any kind. A temperature of 60° appears to be the best for all purposes.

With regard to the amount of detail brought out by the cold and the comparatively warm solutions, we may say that the advantage is slightly in favor of the latter, but not much, except when it is compared with solutions at a temperature so near the freezing point as is not likely to occur in practice. Solutions at 60° give an advantage of about one figure of the sensitometer over those at 40°.

Packing Exposed Plates.—Says Mr. Wm. Brooks on this subject in the *British Journal of Photography:*

For a long time past I have been making experiments with various materials for packing plates, which I think are successful. I am of the opinion that plain paper is bad for the purpose. For successful packing, the material used must be non-absorptive. By way of experiment, I perfectly dried some gelatin plates, and then placed between them some pieces of *papier* Joseph, and bound them together, and in twenty-four hours I exposed a plate and developed it, when it gave the structure of the paper, and I came to the conclusion that it was caused by the different degrees of humidity of the paper and the gelatin film, the humidity being equalized between the two; other papers also caused markings of a different kind under the same conditions. I then tried rendering the paper non-absorptive, by passing it through a thin alcoholic solution of shellac, using thin brown paper for the purpose, and then passing it through a rolling press, with good pressure to flatten it; this I found a great improvement; after plates being bound tightly together for a whole week, on developing no marking occurred.

I have tried various other substances successfully, namely, tin foil, lead foil, thin sheet gutta-percha; the latter seemed to answer the purpose better than any other material, being perfectly non-absorptive of moisture, and I should say perfectly inert to the most sensitive of films; it can be purchased at the chemists' sundrymen or at the gutta-percha warehouses in almost any large town, and can be used over and over again. I do not for a moment suppose that plate makers would adopt this mode of packing, but for photographers, both amateur and professional, it will be of great service, for, as a rule, plates *en route* are changed at night in the bedroom with but very little accommodation, and whatever method may be adopted, it must be expeditious. In summer time (dry weather), thin sheet gelatin can be used, such as is used for bonbons, without any color. Using gelatin is going to the other extreme, as it absorbs moisture with a vengeance; but I have found it answer, but give the preference to either the gutta-percha tissue or the shellac paper. I always prefer to cut whichever material I use as near the size of plate as possible. With care I have packed many plates with nothing between them without any damage occurring, but have kept them entirely under my own charge. The sheets can be carried in a flat tin box or a small portfolio of the size, or between two thick pieces of cardboard. I have every reason to believe that many plates are packed by the makers, in the pressure of business, almost hot, the outside papers they are packed in being of a much lower temperature, and any moisture given off flies to the films and causes stains, which seem unaccountable at times.

Appointment of a New Trustee for Stevens Institute.

We learn with pleasure that President Henry Morton, of the Stevens Institute of Technology, Hoboken, N. J., has been appointed to fill the vacancy in the Board of Trustees of the same institution caused by the death of Mr. Wm. W. Shippen.

In his letter announcing this appointment, Mr. S. B. Dod, president of the board, says:

"I feel that this is only your due as a recognition of your services and generous gifts to the institute."

President Morton has been at the head of this institution since its foundation, by a bequest of Edwin A. Stevens, in 1870; and, in addition to other smaller donations, he, in 1881, fitted up a new workshop at a cost of over $10,000, and presented the same to the institute; also, in 1883, he provided funds for establishing a department of applied electricity, devoting $2,500 to the purchase of new electrical apparatus and paying the salary of the professor appointed to take charge of the new department.

The Rabbit Plague in Australia.

Some time ago we published a statement of the ravages of rabbits in Australia, they having become so numerous and destructive that the authorities were alarmed, and puzzled to know how to get rid of the pests. It was stated that one of England's colonies had already lost two millions of sheep by them. One flock owner, it was stated, had trapped five thousand of the troublesome creatures, but that they were so numerous they must be killed by the million to perceptibly check the rapid multiplication of these prolific and devouring pests. In a recent English newspaper we see that, although Queensland has not as yet been afflicted by the rabbit plague, attempts are being made to prevent their ingress into their territorial limits by erecting rabbit-proof wire fences on their boundary line. Tenders have been accepted for 2,550 miles of fencing wire and 450 miles of wire netting of small mesh. The order will be shipped from England forthwith. A route has been laid out, running for a distance of 300 miles to the intersecting angle of Queensland and New South Wales, and thence northward for 100 miles. The Queensland government have voted £50,000 for this purpose. It is estimated that 1,300 miles of fencing will have to be laid in New South Wales; while in Victoria so great is the demand for wire that the authorities have signified a willingness to forego the duty upon it.