# SCIENCE

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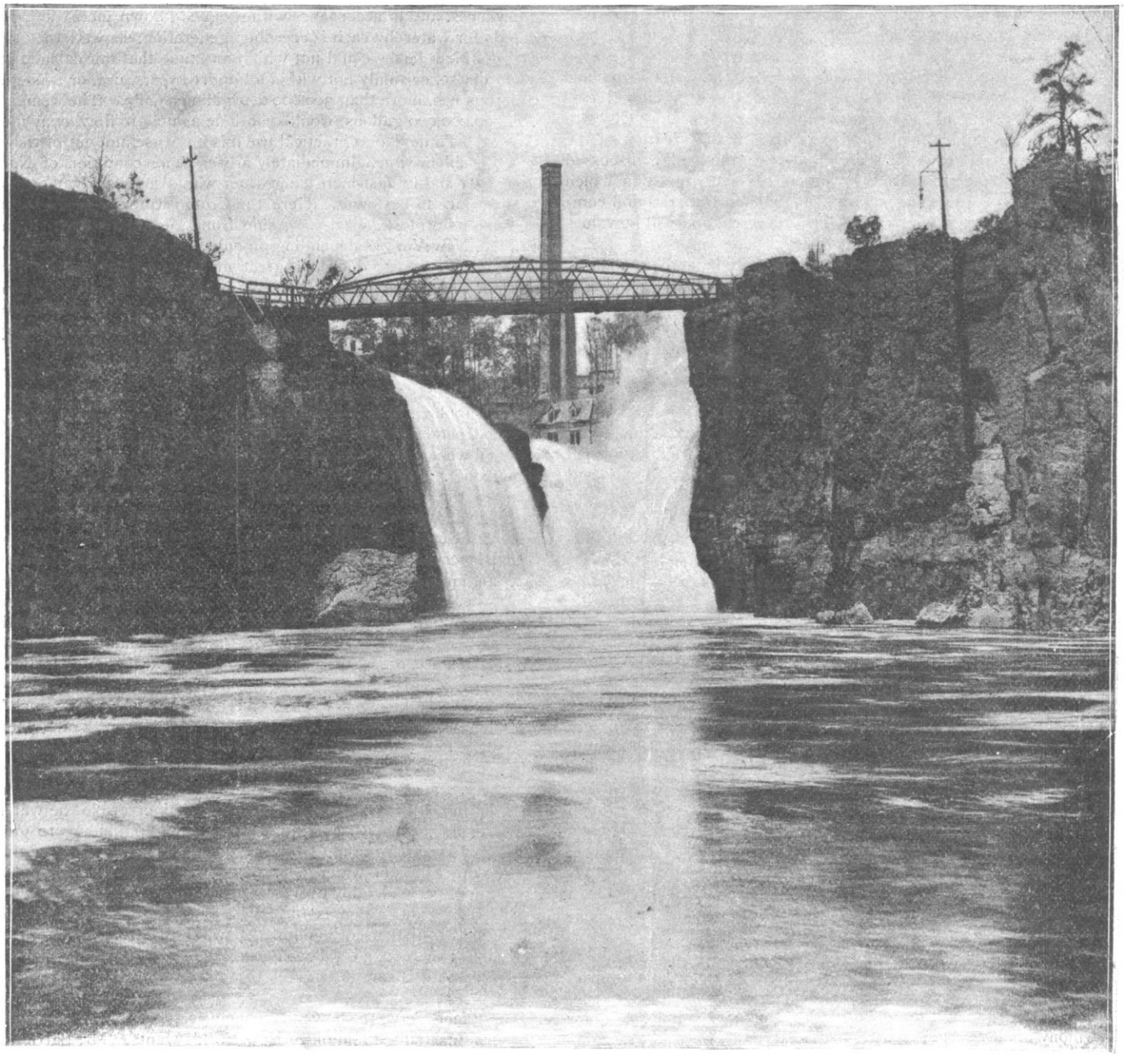


THE GREAT FALLS. ON THE PASSAIC RIVER, IN PATERSON, N.J., 15 MILES FROM NEW YORK, SHOWING WASTE OF WATER INTO THE SEA. [See p. 208.]

## THE WATER PROBLEM OF NEW YORK.

THE water problem before the city of New York, how to meet the increasing demands of the vast and fast-growing population for water for domestic use, sanitary purposes, and for the requirements of commerce and manufacture, has been answered by Mr. John R. Bartlett. While engineers and politicians have been speculating with the limited possibilities of the Croton watershed, and with visionary plans for diverting the waters of the upper Ramapo River, and for getting an additional supply from the Adirondacks or Lake Erie, and have reduced to despair sanitarians and all others acquainted with the really critical condition of the city's affairs on the water question, Mr. Bartlett has been quietly maturing plans which meet the emergency practically and conclusively. He offers to furnish the city with not less than 50,000,000 gallons of pure water daily, under a head pressure of three hundred feet. He and associates have the water to sell, the unquestioned right to sell it, and will pour it into the city ready for use without demanding of the city a single dollar before the water has been delivered.

These plans have been recently presented to the sinking-fund commissioners of the city, and are elaborately set forth in a folio volume of a hundred and seventeen pages. The water is to come from the Passaic watershed, situated in the States of New Jersey and New York; and the quantity supplied to New York City will not more than equal the amount of rainfall in that portion of the watershed which lies in New York State. In the book is discussed every phase of the problem. It anticipates every question which the extent of the plans suggests, and abounds in statistics and comparative calculations which show deep research, and will be valuable for reference for all cities.

In order to properly appreciate the magnitude and the beneficence of this project, an outline of its inception and progress is necessary. The data which follow are furnished by Mr. Bartlett's book and the recent well-known history of New Jersey. They tell a story of successful enterprise, on whose completion the State of New Jersey and the entire metropolitan district are to be profoundly congratulated.

Mr. Bartlett first directed his attention to the crying demand for pure water raised by the cities and towns east of the Orange Mountains in New Jersey. Newark and Jersey City, the chief municipal centres of this region, and incidentally the suburban and adjacent towns, had been agitating the question for years. Official inquiries of engineers and health-officers instituted by these plans had evoked on each occasion the startling result that the water furnished their people was unfit for use, and was a constant menace to the health of the communities. The various examinations showed a steadily increasing danger. This was made manifestly logical and necessary by the fact that the water for this region was taken from the lower Passaic River, a tidal stream, and at a point in the river where the pollution from the fast-growing cities and increasing factories was all deposited.

The only remedy lay in getting water from a source above the point of pollution. The State was manifestly helpless, because of its inability to legislate to any particular locality rights to which all places had a just claim; nor could it attempt a general relief, because of the immense amount of money which would be required to pay for the condemned land and the taking-away of individual rights. Even if this should be accomplished by a vote of the people of the State, other serious constitutional objections interposed, and difficulties of a practical and business nature which were well-nigh insurmountable. The helplessness of the cities themselves was even more pronounced, as added to the State's difficulties were individual indebtedness and political imbroglios, which have been fully ventilated during the last year.

A unification of all interests was essential, — a harmony of action on the part of all the water companies and corporations having rights below the point designed for the source of supply, a similar harmony of all riparian owners, and a harmony of all legal rights to the water, — in fact, a condition was essential which seemed beyond the reasonable power of human energy to bring about, and this is the condition which Mr. Bartlett has successfully worked out.

The detailed story of how the history of this entire section, from its original granting to the present time, was mastered, in order to ascertain beyond peradventure the absolute rights of every claimant; how the records of judicial action during this time were all consulted to justify these rights; how the engineering problems, as many as anticipation of any diverse plans might ever involve, were all solved; how the legal aspect of every phase of the work was fully understood at each step; how the immense business manipulations of purchasing the many acres of property and satisfying all owners were accomplished, — how all these things were done will be an interesting chapter of a future history of New Jersey. Suffice it here to note with amazement and pride that it all has been done.

The immense Passaic watershed of the States of New Jersey and New York was at command, and the water was ready to be poured into the houses of the long-suffering people. Here developed the most interesting phase of the project. The extent of the watershed is about 877 square miles. The average daily capacity is 700,000,000 gallons. A computation based on the most generous allowances, and in accordance with the well-known increasing demands for water by each succeeding generation, showed that the State of New Jersey could not within any time that fair calculation could devise, certainly not within a hundred years, use, or waste in generous use, more than 300,000,000 gallons daily. The remainder, 400,000,000 gallons, would continue as now to flow away into the sea. To devote to practical use this immense amount of water was a problem which immediately arose. The condition of New York City and its fast-increasing water wants suggested at once a proper place to bestow it. Here the Croton watershed was being taxed to its utmost capacity. Aside from the danger to a great city like New York of depending on only one source of supply for water, — a danger which all great municipalities recognize and guard against to the utmost limit, — this source was showing evidence of soon becoming insufficient to supply the requisite amount of water. Its whole capacity, with Quaker Bridge dam and every other storing contrivance utilized, would be only 250,000,000 gallons daily. To estimate the future by the records of the past, within ten years the wants of the people of New York City could not be supplied.

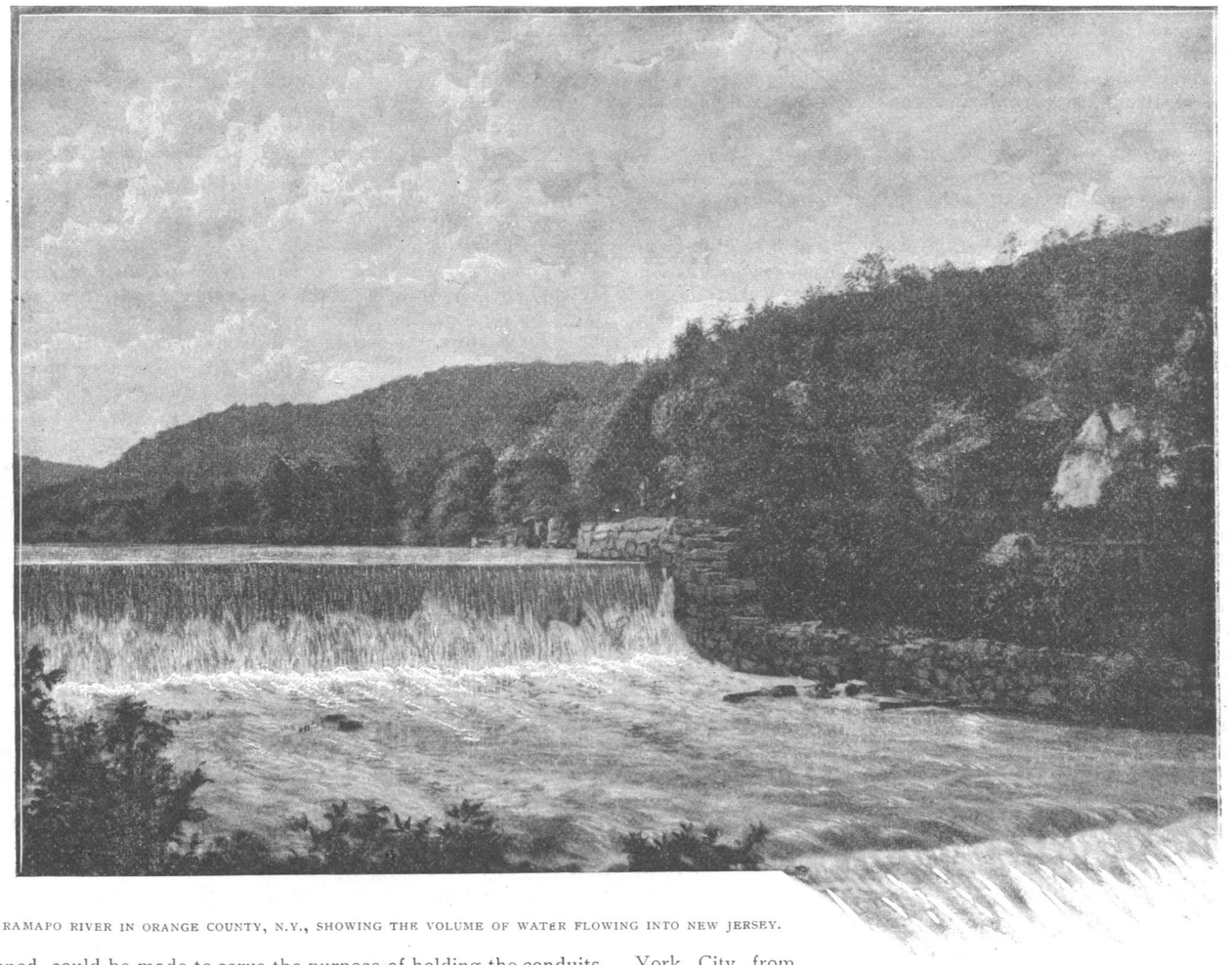
The dependence on a bountiful supply of water of a city's progress and welfare is so well known that it need not be argued. It is an axiom. In small towns, where the chief consumption is confined to the direct uses of the inhabitants, the amount of water used *per capita* can be small; but in a large municipality people are not the only consumers. The onward march of steam, and the various succeeding inventions of civilization, have rendered necessary an immense amount of water for their assistance. Large cities, therefore, have this quantity included in the *per capita* use of water; and, besides the other considerations of better health and greater security, a larger *per capita* use of water indicates an advanced state of prosperity. A ridiculous argument has been used in New York against increasing the water-supply. "Let the waste of water be stopped," it said: "we are using too much." The fact is, that a generous use of water could not be indulged without a generous waste. The permanent necessity of the former renders the latter not an evil, but a desirable condition. Moreover, statistics show that the ratio of increase of population does not in any degree determine the ratio of increase in the water wants of a city; because, whereas in a small community 10 gallons daily *per capita* might be sufficient, in a large community the various other uses of water mentioned above would render the *per capita* needs considerably over 50 gallons.

A striking illustration is furnished by the city of Philadelphia, where in 1810 they used 7 gallons of water *per capita;* in 1830, 17 gallons; in 1860, 36 gallons; in 1880, 68 gallons; in 1886, 80 gallons; and it is said the figures of this year will show 100 gallons.

These facts serve to show more conclusively the imminent necessity for immediate attention to New York's wants. Mr. Bartlett's efforts had brought an available quantity of water from a pure source to the opposite banks of the Hudson, where he was confronted with a new series of problems, legal and mechanical. He meets all the questions as to the right to bring the water through and out of the State of New Jersey with opinions giving specific

and unqualified indorsement from ex-Chancellor Benjamin Williamson, ex-Gov. J. D. Bedle, ex-Gov. Leon Abbett, Henry C. Pitney, Garret A. Hobart, A. Q. Keasbey, William Pennington, Henry C. Andrews, ex-Chancellor Theodore Runyon, Barker Gummere, and decisions of the courts of last resort of both States. Thus arrayed, is the best legal talent in New Jersey.

The formidable task of crossing the Hudson with absolute confidence, he also solved, and in a most remarkable manner. Instead of presuming on a plausible theory, many of which abound, Mr. Bartlett set to work on the best theory, and worked it out at a cost of nearly $200,000. This was done for the purpose of ascertaining whether a certain opinion he held was correct or not. His opinion was that the Hudson River Tunnel, at that time practically abandoned, could be made to serve the purpose of holding the conduits, the great water-mains. In this way he built a large section of the tunnel from the New Jersey end, and the fact was thoroughly demonstrated that the rest could be built the same way, and that the water-way was secure.



RAMAPO RIVER IN ORANGE COUNTY, N.Y., SHOWING THE VOLUME OF WATER FLOWING INTO NEW JERSEY.

Accompanying the proposition of Mr. Bartlett and his associates is an indorsement, confirming all that Mr. Bartlett says of his project and its possibilities, by all the companies or societies which have any controlling water-rights below the point of diversion in the State. These are the Society for Establishing Useful Manufactures, the Lehigh Valley Railroad Company, the Dundee Water Power and Land Company, the Acquackanonk Water Company, the West Milford Storage Company, and the Montclair Water Company.

A committee appointed by the New York Board of Fire Underwriters to examine into the merits of Mr. Bartlett's plan reported that in their judgment the plan was feasible, and, if adopted, would be of great benefit to the city, and was entitled to the support and indorsement of the underwriters, and to the favorable consideration of the city government. Upon receipt of the report, the board passed a resolution authorizing the committee "to recommend Mr. Bartlett's proposition to the favorable consideration of the commissioners of the sinking-fund, and urge upon them the adoption by the city of the proposition in accordance with the plans submitted, in order to secure to the city an adequate supply of water for all purposes, and to meet its present needs, and that the same be done as promptly as possible."

A board of engineers, composed of Clemens Herschel, A. Fteley, and Capt. T. W. Symons, U.S.A., carefully examined the plans of Mr. Bartlett, and made a report as follows: "We do recommend as an entirely practicable and valuable project the general plan which has been submitted by you for supplying a portion of New York City from the drainage area of that part of the Passaic watershed that lies in the State of New York, and in the manner herein described, including the use of a tunnel under the Hudson River for carrying the necessary water-conduits across the river in a safe, durable, and trustworthy manner. We summarize its principal advantages as follows: 1. It will furnish to the city of New York an independent supply of water from a new and independent source and by a new and independent route; 2. This supply will be delivered directly into those portions of the city most remote from the present source, and where the pressure is most inadequate; 3. It can be delivered under any pressure desired, up to three hundred and fifty feet of head, and supply all high buildings and districts without pumping, thus resulting in a great saving to individuals; 4. It will furnish most perfect fire protection, and consequently greatly reduce the cost of insurance."

A memorial of fire-underwriters to the commissioners of the sinking-fund of New York, upon this subject, signed by the officers of all the fire-insurance companies in the city, concludes as follows: —

"The proposed method of projecting water upon fires would greatly reduce the cost of that service as administered at present, and at the same time vastly add to the efficiency of the means of extinguishing by the application of water. First, it would enable a few men with a light hose-carriage to reach the point of fire much quicker than the present heavy engines to-day; and at the breaking-out of a fire a minute is sometimes worth a million dollars, and frequently a hundred thousand. Second, it would enable the firemen, by the use of permanent stand-pipes, to connect short lengths of hose, and apply the water in large streams and solid masses; whereas at present, even when two or three engines are forcing water through a single pipe, or tower, the stream is largely converted into spray before it reaches the fire, and is then converted into steam, and even into a gas that aids combustion rather than stops it."

The medical authorities and health-officers of this city have given this plan much careful consideration, and their conclusions are favorable to the project. Mr. James C. Bayles, president of the Board of Health, in a communication to Mr. Bartlett, gives his views as follows: —

"It is undoubtedly true that at the present time large portions of New York are very inadequately supplied with water. This department has constant and serious trouble in that branch of its work which deals with the plans of tenement-houses and other dwellings, owing to the fact that the available supply of water is in many cases so small as to forbid a proper cleansing of plumbing fixtures, if these are provided. There are large districts of the city where the pressure rarely carries the water above the first story; and in the case of tenement-houses, divided into many apartments, each apartment must be provided with one or more pumps, which, finding their supply from the three-fourths-inch tap at the street-main, are not always able to lift the water required for domestic use. A good water-supply, abundant in quantity and excellent in quality, is a condition precedent to the healthfulness of a community. This is especially true of a crowded community like New York. I am of the opinion that no one thing would do so much to facilitate and make effectual the work of this department as a great and immediate increase in the water-supply, under pressure sufficient to reach the upper stories.

"I am unable to favor, from a sanitary point of view, the measures which have been suggested, looking to a restriction of consumption in order to prevent the present admitted large waste. A liberal use of water accomplishes what can be attained in no other way, — the cleansing of pipes and sewers; and people who have access to all the water they desire and can use, are likely to be cleaner in their homes and persons than those who suffer restrictions in this most important item of daily consumption. I do not think the sanitary aspects of the question with which we are now confronted, growing out of an admitted scarcity of water in New York, can be exaggerated.

"An increased supply and better distribution of water in New York would undoubtedly tend to diminish the number of contagious and infectious diseases with which we now have to deal, and would produce a marked improvement in the public health. If it were not for its peculiar position as the gateway of this continent, to which more than eighty per cent of the inflowing travel and immigration tends, our death-rate would not be so large as it is. For example: if the deaths among immigrants who have never become a part of our population could be eliminated from our totals, we should last year have reduced the death-rate per thousand from twenty-four or twenty-five to twenty-two. If, further, we could avoid the overcrowding of Italian and other impoverished immigrants in our tenement-house districts, our death-rate would compare favorably with that of the most healthful city of the world.

"It will not do, however, to attach too much importance to these hopeful figures. They are liable at any time to be changed, and nothing will tend so quickly and effectually to change them as a failure in the water-supply of the city. Of the dangers to which this is subjected, I do not need to tell you.

"Answering your question with reference to the effect which an increased water-supply would have in diminishing the number of malignant diseases of a contagious or infectious type, I regret that I am unable to be specific. This, of course, is largely a matter of opinion, but it is an interesting fact that a very large proportion of the cases of contagious and infectious disease which come under the care of the Board of Health are taken from the upper floors of tenement-houses. Whether this is due to lack of water, which is greatest on the upper floors, or to impurities in the water which rise to about that level, I am unable to say. I believe, however, that a material increase of the city's water-supply would promptly and permanently reduce the public burdens entailed in the care of the city's sick.

"The cordial sympathy and co-operation of this department would be extended to any practicable scheme looking to a supply of water for New York from other sources than the Croton watershed. Our city is growing with great rapidity, especially in the 23d and 24th wards, north of the Harlem River. It is probable that the needs of this district will not be more than met by the increased supply to be obtained through the new aqueduct, when all the engineering work looking to the impounding of additional water is completed."

If more need be said upon the subject from a sanitary standpoint, it is furnished by the following preambles and resolutions adopted by the Medical Society of the State of New York at a meeting held Sept. 24, 1888: —

"*Whereas* the present scarcity of water in this city is causing great inconvenience as well as serious apprehension for sanitary and other reasons; and

"*Whereas* the new aqueduct will not materially increase the present supply from the Croton watershed until after the storage-reservoirs are completed, six or more years from now; and

"*Whereas* the upper portion of the city, with its rapidly growing population, will soon require all the water that can be procured from that source; and

"*Whereas* the present insufficient supply of water is a constant menace to the health and safety of the city, inviting scarlet-fever, diphtheria, cholera, and other malignant diseases, as well as disastrous conflagrations: therefore be it

"*Resolved* that this society has listened to the explanation of the plans proposed by John R. Bartlett, Esq., for furnishing the city of New York with an additional supply of pure water, from a source independent of the Croton watershed, and that it approves the same, and urgently recommends it to the attention of the city authorities having such matters in charge."

## PRUNES IN FRANCE.

THE introduction of prunes into France is attributed to the Crusaders, says our consul at Bordeaux; and, if tradition is exact, this valuable fruit was first cultivated in the south-west of France by the inmates of a convent near Clairac. In travelling from Avignon to Fumel, through the valley of the Lot, fertile plains are seen covered with plum-trees, which furnish the famous *prunes d'Ente* and *Robe-Sergent*, these being exported to the remotest corner of the commercial world. The plum-tree does not confine itself to this particular district of France, but it is profitably cultivated in the valley of the Loire, the departments of the Garonne, Dordogne, Tarn, and Aveyron. The well-known brand called Tours' prunes comes from the orchards of the Loire. Lorraine produces a variety called Quetsche, one of the best for ordinary preserves.

The prune-tree thrives best in clayey, calcareous soil, and does not exact for its roots a loam of profound depth. Land adapted to the culture of the vine is also partial to this tree. In many localities these two valuable products are cultivated together, as the broad leaf of the vine is especially useful in protecting the roots of the tree from the intense heat of summer. When the prune is ripe, it is covered with a sort of glaucous powder called "flower," which greatly adds to its value as a table-fruit. The fruit is usually gathered after the heat of the day has dissipated the humidity of the night, and, when possible, straw is spread beneath the trees to prevent the fruit coming in contact with the earth. Only such fruit as readily falls when the tree is slightly shaken is gathered. As soon as harvested, the fruit is taken to a building, where it remains for a few days to complete maturity.

Prunes are subjected to not less than three, and frequently to four, distinct cookings before being pronounced ready for market.