TEXTILE FIBRES OF THE PACIFIC STATES.

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THE AREA OF TERRITORY AND POPULATION CONSIDERED.

STRETCHING along the northern Pacific coast, between the parallels of 32 and 48 degrees of latitude, lie the States of California, Oregon, and the Territory of Washington, while near as well as remotely inland, and belonging to the same general climate, with social and industrial relations co-dependent upon a mutual commerce which finds its way from abroad to the port of San Francisco, are the Territories of Idaho, Utah, Arizona, and the State of Nevada. In territorial extent this region covers nearly or quite one-fourth of the area of the United States; and holding, as it does, the western outlets of the American portion of the continent, it is destined to occupy an importance in the trade with the eastern coast of Asia and the Australian Archipelago not less interesting than that which has already grown to such colossal proportions between the communities located upon the western shore of the Atlantic.

The acquisition of most of this territory, and the establishment upon its soil of a numerous population, with many of the industries of civilized life, is comparatively the work of a few brief years, as less than two decades have passed since the United States claimed possession of only a narrow strip about the mouth of the Columbia river; and this possession at that time was held more as a dependency of the British Hudson Bay Company, then engaged in the prosecution of the fur trade with the roving bands of savages, who paid more respect to the authority of the English traders than to the few Boston men who were endeavoring to plant, amid surrounding hostilities and opposing obstacles, thrown in their way at every step by the jealous Hudson Bay monopoly, the footprints of American progress, which ever go in advance of and unaided by the federal government.

At the period of the gold discovery, about fifteen years since, this entire region contained not more than as many thousand white inhabitants, few of them having any settled purpose or permanent domicile, and most of them leading a life akin to that of the nomadic aborigines. It is true, there was a settlement of Mormons at Salt Lake, but this cannot be considered to have been anything more than a mere halting place, to rest and temporarily recruit the weary disciples of that faith while on their long pilgrimage from the navigable waters of the Missouri to the Pacific coast; and the final centralization of the "Latter-day Saints'" exodus in the great interior basin may be regarded as the result of one of those unforeseen occurrences by which the most sagacious human plans are foiled and entirely baffled by counteracting human agencies, in furtherance of the designs of the Ruler of the destinies of men.

Conclusive evidence is obtainable to show that the Mormon *hegira* set out from the Mississippi valley with the purpose of finding a lodgment on the Pacific coast in Alta California, a province then held in the feeble grasp of Mexico, and in the occupancy of a sparse and unsuspecting population, powerless to resist the invasion of the hordes of semi-religious zealots who had compacted their organization in bloody persecution, amid the smoking ruins of Nauvoo, and self-sanctified by martyrdom, were but repeating history when they found themselves so disturbed in the enjoyment of their peculiar doctrines in a hostile,

domineering community, that they were forced to turn their eyes toward the setting sun for a new Canaan.

Of all countries within their reach none promised the isolation required in so eminent a degree as California, as this portion of the globe was seldom visited by aggressive civilization. Indeed, fifteen years since California news found its way to the Atlantic coast by the "hide druggers," which doubled Cape Horn and twice crossed the equator in their tedious journey.

An advance colony of the Mormons had already penetrated the desert, and, scaling the Sierra Nevada, established themselves on the rich plains of San Bernardino, in the southern part of Alta-California; and the ship Brooklyn, following the devious route of the "hide druggers," had, about the same time, landed a numerous community of the Saints at Yerba Buena, now San Francisco. These two events occurred simultaneously with the gold discovery, the news of which, spreading abroad, set in motion toward the new Eldorado representatives of every nation and clime. Thus, while the Mormons were mainly seeking to reach the promised land by the slow, tedious overland route, swift-flying steamers ploughed the solitudes of the ocean, between Panama and San Francisco, bearing on their crowded decks multitudes of men of all trades and professions. With the landing at San Francisco of the first steamer's passengers, there landed also with them an organized American society, in full force and vigor, to work out its inflexible purpose of dominion.

The establishment of American society and customs in California was not the result of a *growth*—it was a *spontaneity*. On landing upon the shores of the newly-acquired territory, men fell into the employments which had previously become habitual, or that labor to which circumstances and their versatility gave them adaptation. Thus, agriculture, the mechanic arts, literature, politics, law, divinity—all the professions in vogue in older communities—were at once resumed.

With the gold discovery disappeared every hope the Mormons may have entertained of founding an empire on the Pacific coast, where isolation alone could shield them from responsibility to the outraged moral sentiment of modern civilization. And thus, perhaps, has been averted the spectacle of a power which, with its sanction of polygamy, sows around the domestic fireside impurity, the twin of slavery—both relics of barbarism—which, when hemmed in and forced to unwilling contact with a pure christianity, everywhere decay and die.

Although the volume of the Mormon emigration was brought to a halt at Salt Lake from causes briefly stated, their continued location at this point has hardly a less remarkable influence on the progress and development of the States and Territories west of the Rocky mountains than it would have had had it reached its point of intended destination. Being half way on the overland route, Salt Lake City, with its abundant supplies for man and beast—the product of the most extraordinary agricultural perseverance and tireless industry anywhere ever seen—offers facilities for the transmigration of large numbers of people and stock, as well as to furnish food, indispensable to those engaged in prospecting and working the mines in vast sections of the great interior basin.

Passing over the fifteen years which have elapsed since the gold discovery, when the white population in the three States and four Territories named did not exceed fifteen thousand, we may safely estimate that it has swelled at this date to near one million of souls. That so numerous a people, occupying so varied a soil and climate, covering so wide a region over which they are dispersed, remote from the commercial facilities of older communities, should find it incumbent, as their wants increase with the growth of the population, and the accumulation of wealth permits the indulgence in more luxurious habits, to examine their undeveloped resources for the means of supply, is the teaching of a correct public economy.

Hence the question of soil, adaptation of climate, and the available supplies of labor with which to grow the raw material of both the articles of first neces-

sity and of luxury, must be considered before conclusions can be drawn as to the capacity of a country to support a large and permanent population in a condition of continuous prosperity, exempt from too exacting a tribute to foreign trade.

Next in importance to the cost of its food is the annual expenditure of a people for clothing and the other various uses to which the textile fibres are put after being made into cloths for bagging, tents, ship-sails, carpets, and general household furniture, and upholstery; and were an inventory at any time to be taken of the two values, it would doubtless be shown that the sum total invested in textiles would greatly exceed the cost of the esculents. From this it may be seen how much the wealth of a nation is affected by the production within its territory of its requirements of woven fibres. A nation, however, may be only a purchaser of raw materials, and by becoming its manufacturer still derive a considerable share of prosperity from the enterprise. This is seen in the history of the cotton, silk, and woollen manufacture in Great Britain, where neither cotton nor silk is grown, and wool but in limited quantities. Were Great Britain the grower of the raw material she spins and weaves, how vastly greater would be the accumulated profits to her people. The United States are very large producers of both cotton and wool, and the writer, in the course of this article, will endeavor to show that within her limits there is a vast region which has both the atmospheric and meteorological conditions requisite to constitute her the greatest silk-producing country on the globe.

The production of textile fibres has been deemed of such vital importance to the people of California that the legislature passed an act offering very large bounties to those producing the first of a given quantity of the several textiles to be exhibited before a board of judges, of which the governor of the State is president. The sum total of bounties, offered by the legislature reaches the sum of $111,200, irrespective of the annual appropriation of $4,000 to the State Agricultural Society, besides $1,000 each to the four district societies, and $500 each to the county agricultural societies, to be expended in premiums for articles the product of the industry of the people of the State, The act of the legislature contemplated the production in the State of nearly all the great staples of every-day necessity, as well as many of the luxuries, which put every clime under tribute to furnish supplies.

The reasons why cotton culture in the Pacific States will never be a successful industry, except in a few localities in the southern part of California, will effectually explode all visions that this side of the continent will never become a formidable rival of the Gulf States as a grower of cotton textiles.

COTTON-GROWING IN THE PACIFIC STATES A FAILURE FROM METEOROLOGICAL CAUSES.

No plant in the vegetable kingdom, holding so important a relation to the necessities of mankind, requires so pampered an existence, both in the nourishment it must obtain from the soil and the required condition of the atmosphere, in order that it may reach its most perfect development and maturity, as does the cotton.

Sensitive to cold in the extreme degree, if the spring is excessively wet the young plants will have a yellow, sickly hue, and maintain a precarious tenure of life, until the summer solstice has deeply and effectually warmed the earth about its roots. The States and Territories on the Pacific slope, to which I design my observations to apply while treating of cotton culture in this paper, have the meteorological phenomenon of a wet and dry season, each occupying with rigid exactness an equal portion of the year. The wet season commences in November and terminates in May. During this period there is a low temperature of the atmosphere, so that, with the frequent and often copious showers of

rain, the earth becomes cool and stores up a supply of moisture against the impending six months of drought. This coolness of the atmosphere and soil, while favorable to the cereals and grasses, is, in the reverse ratio, detrimental to the cotton plant. Of a large number of plants growing in different portions of the State, which I have examined, not one of them had a healthy appearance until after the close of the rainy season. The close of the rainy season is succeeded by cold, dry winds which have the effect to dry the surface of the ground; this checks the growth of the surface roots and induces the sending down of a single strong tap root in all of the annuals. Plants which procure their sustenance chiefly from a tap root, spindle up with a corresponding stem, quite as devoid of vigorous side branches above the surface of the ground as they are of lateral roots below it. This is the condition in which the cotton plant is found in the beginning of the season in California. The object of the cultivator should be to induce the emission of vigorous side branches at as early a period in the season as possible, as it is on these he must expect to find the earliest maturing bolls. The emission of strong lateral branches on the cotton plant is greatly promoted by frequent warm rains during June and the early part of July, a climatic phenomenon unknown in the Pacific States. The cotton plant is mainly a surface feeder, which seeks its nutriment from the debris of decaying vegetation of the previous year, as it undergoes rapid decomposition under the heat of a tropical sun and a constant immersion of rain and dew, and in all stages of its growth makes enormous demands upon the soil and atmosphere for supplies of food.

The plant, starting on its career in California under unfavorable conditions, continues to meet, at every stage of its existence, a meteorological phenomenon no less disadvantageous. The climatic condition so inimical to the health of the plant consists in the certain recurrence of a low temperature throughout the night, succeeding the high temperature generally prevailing throughout the day. In nearly all of the interior districts, protected by ranges of hills from the cold winds and fogs of the ocean, the average temperature at noon may be set down at 80° Fahrenheit, while in the same localities at midnight it will have fallen to 60°. This extraordinary variation continues throughout the summer season, and is accompanied with dry parching winds which rapidly extract the moisture from the surface of the soil as well as from the foliage of the plants, shrivelling the leaves so that their valves become choked by minute particles of dust, thus checking respiration, or stopping it altogether. The leaf of the cotton plant is endowed with uncommon absorbent functions, and in countries where there are copious warm night dews it will thrive vigorously without rain. Dews, however, seldom fall in California after the close of the rainy season, beyond the region penetrated by the ocean fogs. From this it may be seen that the Pacific States have neither the periodical rains nor dews requisite for the nourishment of the cotton plant. It may be contended that the absence of rain may be remedied by artificial irrigation. This may be true of California, where the means of irrigation on a large scale are obtainable at moderate cost. But passing this objectionable mode of supplying a deficit in nature, there can be no artificial way devised by which to compensate for the absence of nightly dews. Even could this difficulty be obviated so as to get the plant started in a condition of promise, there is still, later in the season, an opposing meteorological condition to be met which no expediency of art can overcome or modify, so there will, at last, be an insuperable obstacle to successful cotton-growing in the Pacific States. This phenomenon consists in the arid atmosphere which prevails during the period while the bolls are expanding and bursting open.

The cotton fibre is formed by the hardening of the milky secretion hermetically sealed in the green boll, the rind of which is of a tough elastic consistency when approaching maturity, and is divided from the stem to the apex by a number of sutures, held together by a natural glue. When the fibre begins to mature the bolls change from a green to a dull grayish brown color, and it is at

this period that a favorable climatic influence is required more than at any other time of its growth. If the weather is dry, with an entire absence of nightly dews, the bolls open with difficulty, and the staple will be found harsh and uneven. A warm, moist, soft atmosphere keeps the rind of the boll pliable, so that its fullest expansion takes place, while the fibre is acquiring its finish, thereby enabling it to form regular layers, and giving it a silky consistency. Where this soft, moist condition of the atmosphere prevails, the rind of the boll will commence opening at the apex, the glue being dissolved by the night moisture, so that several divisions of the shell will roll outwardly and below the point of intersection at the base, thus leaving the cotton free to be plucked without the fingers of the picker being forced against the rind. Where the atmosphere is dry, as it is in all of the Pacific States and Territories with the exception of those portions exposed to sea fogs, the bolls of the cotton plant will be irregular in shape, and the fibre consequently uneven in texture. Nor can the bolls readily open, because the glue which holds the joints of the rind together becomes only partially dissolved; hence it may be observed, on examination, that the sharp points of the rind project amid the expanding fibre, so that it will be difficult to pick it out, because of its entanglement in the pieces of the rind, as well as from the pain inflicted upon the fingers of those engaged in gathering it.

Cotton may be grown with a fair amount of success in the southern part of California, where the climate is warmer and of a more even temperature than in the middle and northern portions; but even there it cannot be made to compete with the Atlantic and Gulf cotton-growing States, either in the quality of the staple produced, or in the price at which it may be profitably grown.

Even in the Atlantic and Gulf States there are climatic reasons why certain localities produce a better grade of cotton than others. The character of the soil on which the plants are grown has less to do with the character of the product than atmospheric influences. Take the sea island for illustration. It nowhere compares in fertility with the delta of the Mississippi. Yet the sea islands produce the most valuable cotton grown on the globe, while in the delta of the Mississippi the staple is scarcely up to a fair average of American cottons. The sea islands possess more fully every requisite of climate for the perfection of cotton-growing than any other locality in America. They have an evenness of temperature, with warmth and moisture, nowhere else found in the same degree. Efforts have been made to grow the sea island staple in various portions of the globe, without success, except it may be in a limited locality near the mouth of the Nile. Nor can this unequalled, long, silky textile be produced anywhere else than on the American sea islands, until natural laws can be changed.

As a further illustration of the atmospheric influences which affect the cotton plant, it may be remarked that the most precarious cotton region in the cotton States is that lying along the banks of the Mississippi river. The waters of this great affluent remain cold from taking their rise in snowy latitudes until they reach the Gulf of Mexico, continuing in this condition until well into summer. Hence there is a low temperature given the atmosphere near its banks during the night. This often keeps the cotton plant in a backward state in the spring, predisposing it to the attacks of the army worm and other enemies.

Regarding the present high price of cotton fibre as temporary, rather than to be permanent, the cultivation of this textile does not promise to be either extensive or remunerative in the Pacific States and Territories, and however desirable it may be to have sufficient produced in those localities for the consumption of the resident population, climatic reasons will be found an insuperable obstacle to even a partial success in this industry.

FLAX AND HEMP IN THE PACIFIC STATES.

If the meteorological condition in this region is unfavorable for the cultivation of cotton, it might be supposed that there should exist a congeniality for flax and hemp, because either of these textiles will thrive under climatic influences unfriendly to cotton. Both flax and hemp, however, demand one of the prerequisites of climate which must be had by the cotton plant—moisture. But cotton requires a high temperature with moisture, while flax and hemp succeed where the mercury falls so low that the cotton plant will have a yellow, sickly hue.

Flax in Ireland and Germany, and hemp in Kentucky, Missouri, and the empire of Russia, succeed best on moist, alluvial soils, near large bodies of water, where there is a moderately low temperature during the night. Alluvial soils and the requisite low temperature are obtainable in large districts on the Pacific coast, and both flax and hemp make a large growth of straw wherever cultivated upon them. From this it might be inferred that both of these textiles could be grown in the Pacific States to supply the local demand, and even for export.

The production of the straw of flax and hemp is only a small part of the cost of the textile, and is the least difficult labor in the whole enterprise. The most critical operation is the rotting process. This not only requires skill and judgment, but for its thorough and perfect accomplishment we must have the aid of regular copious dews, or the facilities to rot it in artificial tanks. The process of hackling so as to separate the fibre from the haulm or woody parts, though tedious, is not affected by climatic influences. In the Pacific States there are no dews of certain regularity, such as would accomplish the rotting of the woody parts of flax and hemp sufficiently to enable the separation of the fibre; nor are the facilities for water-rotting to be had except in limited supply, contiguous to the localities where the textiles would be grown. Indeed, the only favorable situations for growing the straw, having facilities for water-rotting at hand, are the table lands on the San Joaquin and Sacramento rivers; but these, owing to frequent inundations, would render the investment of capital in their cultivation precarious, until some general and costly system of reclamation shall have been adopted.

The absence of dews and the inconvenience of providing the means to water-rot the straw, are only incidental obstacles in the way of success in flax and hemp husbandry in the Pacific States. The real, insuperable difficulty in the way to success will be found in the fact that neither flax nor hemp has a textile fibre of any value when grown in the dry, brazen climate of the Pacific slope. Noticing the brittleness of some green hemp which I found growing wild along the mining canals in Eldorado county, I was led into an inquiry as to the character of the fibre on flax, hemp, and a large variety of plants indigenous to the country, whose related species have a fibrous tendency in climates where there are periodical rains, and, to my surprise, I found the same indisposition to clothe itself with a fibrous cuticle prevailing among all of the vegetable tribes.

It is remarkable how quick the annuals disappear in California after the first heavy rains in the fall. A swamp of mustard which, before the rain, will be found impassable even to the wild Spanish horses and cattle, no sooner becomes soaked by the first showers in the fall than the tree-like stems snap to the merest gust of wind, and, what was shortly before an impassable barrier to man and beast, will lie prostrate, rapidly decaying into debris to nourish the young vegetation which immediately shoots up to take its place. This is but the condition of all the annuals, and especially so with the grasses and the straw of the cereals. All vegetable substances in this climate have a proneness to become brittle towards maturity, and even the basket willow loses its pliability, and all other varieties of woods, whether indigenous or transplanted from other

climates, fail, when grown here, to have that elasticity and toughness which give value for mechanical purposes.

This lack of fibrous cuticle on the annuals and the brittleness of the stalk must be attributed to the dryness of the climate during the growing season, as but little rain falls after vegetation starts, and none while it is in process of maturing. Hence, in place of a fibrous bark, which vegetation acquires in countries exposed to periodical rains, the cuticle of the same plants in a dry climate is a glutinous substance Thus, all species of vegetation are enabled to resist the strong winds which prevail in all arid climates until this gluten is dissolved by the rains of the wet season, when, as before remarked, it rapidly decays and becomes a vegetable mould to enrich the succeeding generations of vegetable life.

The early Spanish colonists discovered among the natives of the country only a single species of vegetable fibre of which they made any use, and this was an indigenous hemp, of which they manufactured no other article than their rude fishing nets, and this, too, was grown about the Tulare lakes, probably the most humid locality in the country. If the climate had been favorable to the growing of vegetable fibres, should we not expect to find among the aborigines textile fabrics manufactured from the same into articles of utility and necessity? One of the most attractive features of semi-savage or barbarian life in Central America, or among the myriads of the Oriental tribes, is the domestic thrift occasioned by the ingenuity of the people in working vegetable textiles into clothing and all manner of useful implements. Where this is to be seen, however, there is an accompanying moist climate. To this phenomenon may we not ascribe their success in growing vegetable textiles? If we look at the character of the climate required for the most successful production of our own great textile fibre—cotton—we find it comprised within the limits of the Gulf of Mexico and Cape Hatteras, a region having a more regular and copious isotherm than any other of equal extent.

Comparing, then, the climate of the Pacific States with the climates of the countries where cotton, flax, and hemp are produced in greatest perfection and abundance, little encouragement offers for the production of these great staples of commerce in the Pacific States as a successful competition, and it is questionable whether the attempt to grow sufficient for the wants of the resident population will be a correct public economy while natural laws are so insuperable an obstacle to success.

ANIMAL TEXTILE FIBRES IN THE PACIFIC STATES AND TERRITORIES.

However much the climate of the Pacific may be lacking in the elements which conduce to the successful culture of cotton, flax, and hemp, this vast region is fortunately blessed with other resources which amply compensate the foregoing deficiencies.

Its capacity for the grazing of sheep and other fleece-producing animals can hardly be estimated. Not only is the herbage abundant, and of a quality suited to the nature and habits of sheep and goats, but the climate is so mild and equable, and the atmosphere so pure, that animals attain here their most perfect development in form and size, while they also retain a remarkable degree of health, notwithstanding, from their gregarious habits and the conformation of the country, they are often herded in vast flocks.

The perfect adaptation of the country to wool-growing was long since exemplified by the enterprise of the mission fathers, who could procure no other textile with which to clothe the hordes of rude savages which they collected at the various mission establishments. Indeed, the fact that the fathers no more cultivated cotton, flax, and hemp than had the natives of the country, is cumulative evidence that textiles of vegetable growth could not be successfully pro-

duced. Hence, with that singular intelligence which rendered every enterprise the mission fathers undertook a practical success, they at once commenced sheep husbandry on such a scale of magnitude that, in no long time, the rude inhabitants who flocked to the missions were clothed in garbs more fitting their advent among those of Christian civilization.

The extent of sheep husbandry, conducted by the Catholic priests at the missions, may be realized when it is stated that at seventeen of the establishments, located on a line near the sea-coast, and extending from San Diego to San Francisco, a distance of about five hundred miles, there were, in 1825, the period when the missions were at their greatest height of prosperity, an aggregate of one million three thousand nine hundred and seventy sheep. This does not include the flocks of sheep owned by the rancheros which were, doubtless, quite as numerous as those possessed by the church. Besides sheep, there were grazed at the missions enumerated eighty-eight thousand four hundred and eighty-four horses and mules, and one million one hundred and eighty-eight thousand three hundred and ninety-six head of cattle, while, within the same narrow strip along the coast, private rancheros herded far more numerous droves.

This wonderful exhibit of pastoral industry was all contained in a limited district of California, because at that time the great San Joaquin and Sacramento valleys, the country north of San Francisco bay and the foot-hill regions of the Sierra Nevada, were in the occupancy of the hostile tribes of savages. This thrift, too, marks the last decade of Spanish vice-regal dominion in California, and its subsequent rapid decline may be traced from the commencement of Mexican misrule, when the rich accumulations of the mission fathers fell an easy prey to irresponsible military and civil official rapacity.

When the United States took possession of the country, it was seen that a quarter of a century of Mexican misgovernment had been sufficient to accomplish the ruin of the missions, by the annihilation of nearly every vestige of the remarkable industry planned and put in successful execution by the sagacity, courage, and perseverance of the priests, and in no other feature was the destruction so total and disastrous in its consequence to the helpless Indians as was the sudden extinction of their sheep husbandry. By this, the hordes of savages who had been gathered around the missions, looking solely to the fathers for food and clothing, were deprived of their only source of supply, and having acquired scarcely any other feature of civilization than dependence and some of its worst vices, were, when thrown back to savage life, swift victims of hunger and nakedness, disappearing from view as if swept from the earth by an all-devouring pestilence.

The sudden rise and temporary prosperity of sheep husbandry under the care of the mission fathers was owing to a local exigency in which commercial considerations had no influence. The isolation of the country from the outside world was a bar to all thought of foreign traffic. The mission fathers reared their flocks of dumb brutes, scarcely more dumb than the people they were trying to christianize, solely for the purpose of obtaining a textile from which to fabricate garments for the savages, as an auxiliary means of proselyting. And it is this very isolation from the commercial world which caused so sudden a disappearance of a great agricultural industry. Brief, however, as was its existence, it rose to such a magnitude as served a great purpose. It left a history full of significance to an energetic race, following shortly afterwards and bringing in their advent commercial necessities as fixed as natural laws. This new race is re-establishing sheep husbandry in California on a basis so firm and enduring that no adventitious circumstances can accomplish its ruin.

The following extract from an article written by James E. Perkins, secretary of the California Wool-Growers' Association, will be found interesting as a comprehensive review of sheep husbandry in the State, from its settlement by Americans down to the year 1863:

"For several years after the settlement of this State the opinion prevailed, very generally, that sheep could not be raised here to any profit for their wool. It was argued that the extreme heat of the summer and the dry food on which they must subsist for a large part of the year would tend to produce a fleece so light and thin as scarcely to pay for shearing. Under this impression, those who owned or purchased sheep looked only to the market for mutton for their outlet and profit.

"Scarcely anything but the native or New Mexican sheep could be found, and these, worthless as they were, were still further debased by crossing with some Chinese rams which were imported about the year eighteen hundred and fifty-two or three. The only recommendation either of these classes of sheep possessed was their prodigious fecundity, the ewes often bearing triplets, almost invariably twins, and sometimes five and even seven lambs at a birth. In size, form, constitutional vigor, and disposition, they were the perfection of all that is undesirable, while their fleece rarely exceeded two or two and a half pounds of coarse, uneven, kempty wool, suited only to the very lowest class of fabrics, scarcely worth the cost of sacking and transporting to market. Yet it is from this basis that our stocks of the present day have mainly sprung, and we owe to it the demonstration of the suitability of our climate and grasses for the raising and keeping of the superior classes to which we are now approaching.

"During the years eighteen hundred and fifty-two, three, and four, quite a number of Missouri and a few Ohio sheep were driven across the plains, and towards the latter of those years some fine importations of Australian sheep were received, all of which found a ready sale at remunerative prices. Most sheep-raisers, who have been long in the business, can well remember when the possession of a very ordinary American ram was considered a most fortunate thing, and half-breeds (*i. e.*, crosses of American rams on Mexican ewes) were eagerly sought for.

"The immense increase of sheep raised in the State, and the continued introduction of immense droves from New Mexico, very shortly brought the stock of mutton sheep fully up to the demand from the butchers, and threatened, at no distant time, to be so largely in excess as to reduce prices far below the cost of production. As early as the year 1854 some of our most enterprising sheep-raisers anticipated this result, and believing that a climate and range on which the poorer breeds seemed to thrive so well must answer equally as well for the higher classes of sheep, and that they could be raised here for the fleece alone, set about the importation of thoroughbred merino rams of Vermont and New York. To Messrs. Curtis and McConnell, of Sacramento county, belongs the credit of the first importation of the Vermont or, generally designated, Spanish merino. Both these gentlemen are now dead, but they lived to see and reap the fruits of their foresight. Other importations of both French and Spanish merino stocks rapidly followed, as also of Cotswold, Leicester, and Southdown. Large numbers of Australian rams and ewes were brought in and all sold at extreme prices. Before the year 1860 there was scarcely a flock in the State that had not some infusion of improved blood from these importations, and the character of California wools began to exhibit a percentage of improvement scarcely less than the increase in quantity, until, at the present day, an unmixed flock of native sheep is by far more rarely met than were improved flocks in 1856.

"A glance at our estimated wool clips for the past ten years will show the rapid increase and the important position already attained, viz:

Estimated product of wool in pounds.

1854	175,000	1859	2,378,250
1855	360,000	1860	3,260,000
1856	600,000	1861	4,600,000
1857	1,100,000	1862	5,530,000
1858	1,428,350	1863	6,857,109

"In eighteen hundred and fifty the census reported our wool product at about five thousand pounds; but it was not until eighteen hundred and fifty-four that it attained sufficient magnitude to obtain notice in the list of exports. That year we shipped one thousand one hundred and twenty seven bales. The following table shows the extent, in bales, of our exports for each year since, viz.:

Export of wool in bales.

1855	2,487	1860	12,082
1856	3,924	1861	15,984
1857	6,664	1862	22,113
1858	6,496	1863	18,146
1859	10,570		

"A considerable portion of the wools shipped this year has been in pressed bales, weighing from five hundred to eight hundred pounds each, the ordinary bales heretofore averaging from two hundred and fifty to three hundred pounds each.

"Of the entire export up to the year 1856, probably nine-tenths was of the native breed, originally poor enough, and sent forward in such abominable condition as still further to depress it in the estimation of dealers and manufacturers; and prejudices were then formed against California wools from which they have not yet recovered. The rapid increase of our exports of wool is beginning to attract the notice of eastern manufacturers, and already California is looked to for a respectable portion of the yearly supply."

PRESENT CONDITION OF WOOL-GROWING.

Sheep husbandry in California, under the stimulus of a commercial demand for wool, has been attended with more than the success and failure which usually accompanies the impetus given all new enterprises by prospects of large gains, so attractive to every class of Americans. In this State, however, the business of sheep husbandry has been mainly conducted by two classes of persons—the capitalist, who invested his money in large flocks, and residing in the city or town, gave no personal care to them, but intrusted them to hired shepherds whose qualifications were not of a high order; and those who commenced with limited means and remained with their flocks, devoting all their abilities and increasing profits to the business as a specialty. Few persons engaged in cereal farming have as yet entered into sheep-rearing as a part of their operations.

Short as the time has been since sheep husbandry, under the system of improved grades of wool, was commenced, it has been quite long enough to discourage the capitalist who devoted nothing to the enterprise but his money, and it is probable that, at this time, nearly every one of these has sold off his flocks and abandoned the speculation in disgust. This, however, should not be considered an unfavorable indication with reference to the climate and pasturage of the country for wool-growing—it should be considered as in no wise discouraging. Those persons who invested capital in large flocks of sheep and intrusted their management to ignorant, uninterested employés, argued that because the mission priests conducted sheep husbandry on a large scale, with stupid Indians as shepherds, there ought to be no failure where, at a later day, a more intelligent race of people could be employed for this purpose, overlooking the fact that the mission fathers lived in the midst of their flocks, giving them their constant, watchful, intelligent oversight.

The persons who alone have met with a large degree of success in sheep husbandry in California are those commencing with a limited number of sheep, or, by uniting personal superintendence with the investment of capital, have followed the example of the padres, and remained with their flocks. The

largest proprietors of pure merinoes in the State can look back only a few brief years, when, with weary steps, they followed their dozen or two of pure-bloods from the rising to the setting sun, camping in their midst at night in the solitude of wide stretching prairie; and now they may sum up the results of their patient, persevering effort in flocks which will number tens of thousands. It is doubtful, however, if the accretion of forty or fifty thousand sheep in the hands of a single proprietor is correct public agricultural economy, or will, in its entire results, be profitable to the owner. Under favorable circumstances the year's gains may be satisfactory; but, should a season of drought, such as occurred in 1864, take place, the difficulty of subsisting so many animals in a restricted district must be attended with great losses from starvation, while even in the most favorable seasons epidemics are liable to break out in large herds, and from an inability to treat individual animals for the infection before it becomes wide-spread, the entire flock may be decimated. It would be a better policy for the farmers of the State to adopt a more diversified farming, for among a greater division of interests wool-growing could be made exceedingly profitable.

ALL FARMERS SHOULD BE SHEEP-GROWERS.

There are many reasons why every farmer would find it profitable to keep a small flock of fine-wool sheep on a farm where grain is the principal crop. By raising his own mutton a large saving is made in the butcher's bill; the sale of the wool will bring ready money just before harvest, when it is most needed to conduct the farming operations with celerity and economy. Nor are these the greatest benefits to accrue from a system of mixed farming in which sheep-raising has its appropriate share. Sheep are the best scavengers which can be put on a field after the grain is cut, to clear the land of weeds, while their droppings are a far better fertilizer than the debris of stubble and litter they consume, which otherwise would have to be ploughed under to decompose. In a country like California, where the noxious herbage tends to a rapid usurpation of the soil, the services of sheep are invaluable to keep the land from being overrun by poisonous weeds.

When sheep-husbandry shall become, in the Pacific States, a part of every farmer's operations, we may look for a much higher standard in the grade of wools there produced, as it will be in the power of the small herdsman to cull out the worthless or inferior animals, and to retain, for breeding purposes and the fleece, only such as are of superior quality. It must not be inferred, however, that the large herdsmen are indifferent in the matter of breeding; they are constantly improving their flocks. In no wool-growing country is there, probably, more expense and painstaking incurred in the attempt to obtain animals of the best points for breeders, both male and female, than in California; but this must necessarily be limited to such animals as are kept for special breeding, as, where flocks number tens of thousands, the matter of pairing the male and female so as to secure an improved offspring is, in a great measure, impossible.

SHEEP STARVATION IN THE PACIFIC STATES.

With a cool, healthful climate throughout the districts lying between the Sacramento and San Joaquin valleys and the shore of the Pacific ocean, there is no season of the year throughout this vast sheep-walk when animals are liable to receive injury either from an excess of heat or cold; nor are winter rains so severe as to cause the death of the most delicate where ample supplies of forage are stored so as to give a small feed of hay during the short season between the destruction of the old grass by the rains, and the appearance of the new. Favorable as this appears to be for the prosecution of sheep husbandry, yet the losses throughout this region during the year 1864 were, in the aggregate, one-

third of all the sheep within the district, and caused solely by starvation. It should be remembered, however, as a mitigating circumstance, that this year was one of extraordinary drought, and it brought to light, in a very forcible manner, the improvidence of the stock-growers of the Pacific States, as nearly every one was caught without a pound of hay stored up against such a contingency. Even in years of plenty the losses by death and shrinkage, from a short supply and the bad quality of the food which sheep are able to pick up out on the range during the inclement season between old and new grass, are always very large. This could be avoided by a little attention to the cutting and stacking of hay in the spring, when the grass is abundant. This most inclement season of all the year is the period when the female is in gestation, and if subjected to a low and scant diet, will be in bad condition for parturition, and afterwards to suckle her young.

The annual shearing takes place in the spring, at a time when the animal is in good condition, with an abundance of food to keep it so for some months afterwards; hence the fibre of the new-growing fleece comes out of the cuticle strong and of even texture. But if starvation overtakes the hapless animal, the skin shrivels as the sheep declines in flesh, and this materially affects that part of the staple then pushing through the cuticle, rendering it weak and uneven. Subsequently, as the animal again has access to an abundance of nourishing food, and recovers in flesh, the fibre resumes its first strong, even condition, but there will be a weak spot in the middle, caused by the famishment of the sheep. Such wools are greatly deteriorated in value on account of the weak spot in the fibre; because, however fine the staple, if it is not even it is unfit to be spun and worked into the finest cloths.

ANNUAL MIGRATION OF SHEEP BENEFICIAL.

Among the lessons taught the wool-growers of California by the excessive drought of 1864 was that of the benefit of migration. The absolute impossibility of keeping alive their vast herds in the valleys and coast districts, led many sheep-owners to adopt a plan similar in some respects to the Spanish custom called the *mesta*. The great merino flocks of Spain are wintered on the plains of Estramadura and the lowland provinces, where the climate is so mild that the grazing is good through that season, but on the approach of hot weather, about the first of May, they are made to take up their annual line of march for the elevated mountain ranges. The journeys are made in vast flocks, comprising often fifty thousand in a *mesta*, subdivided into divisions of ten thousand each, and the space travelled over frequently reaches a distance of three or four hundred miles. By this means the sheep are always retained in a temperate climate, avoiding the extremes of the summer heat on the lowlands and the severity of the winter on the mountains.

The value of the Sierra Nevada range has been little understood by stock-growers until the past season of drought in the valleys and coast districts. Many stock-growers fled from the famine on the plains to the mountains with their flocks and herds as from a pestilence, and this migration which began in necessity was so advantageous in its results that it is likely to become an annual custom. The cattle and sheep driven to the elevated pastures on the Sierra not only found an abundance of nutritious grasses, but the fine climate was so favorable to animal life that they were returned to the valleys when the snow compelled their removal in the best of condition.

A particular flock of merinoes, numbering five thousand, which were being tended on a share of the increase by two intelligent young men, were driven from the coast range to the Sierra Nevada and pastured through the summer, and again taken to the coast at the approach of winter. This lot of sheep were culls out of a flock of forty thousand, and not a good average lot, many of

them being sickly. Going away inferior, they came back superior to any five thousand which could be selected from those which had been summered in the valley. Their improvement over the flock remaining through the summer on the plains was doubtless owing more to a change of diet than climate, as none can be more equable and favorable to the health of sheep than the coast districts.

Added to the nutritious grasses was the great variety of the coniferous tribes, with their resinous properties, to which the sheep had, at all times, unrestrained access, the medicinal benefits of which were abundantly apparent.

There are vast ranges in the Coast mountains, on both sides of the Sierra, where herds have not yet been grazed, to which stock-growers would do well to drive their herds in the summer, and thus enable them to save the forage of the valley for winter use, adopting thus, to some extent, the custom so long in vogue in Spain, which alone enables her sheep-growers to profitably conduct this great branch of agricultural industry.

THE GREAT CENTRAL BASIN FOR SHEEP-GRAZING.

Eastward of the Sierra Nevada, and extending twelve hundred miles to the Rocky mountains, are wide stretching deserts, narrow, fertile, circuitous valleys, enclosed by hills and mountains, covered with rich grasses and other herbage, dividing the whole Territory into a multitude of natural divisions. With an average breadth of more than a thousand miles, this great sheep-walk extends from our southern border on Mexico to British Columbia on the north. A great deal of the soil consists of alkaline flats and desolate sand-drifts covered with sage brush, but there are, bordering on these, natural meadows of coarse, wholesome grasses, while the hills and mountains, ever present to the view, are covered nearly to their rocky summits with the finest pasturage. In the future this will be especially designated as the great pastoral region of the American nation, not because there may be a demand in distant markets for the wools which it may produce, but for the reason that the mines of the precious metals sown thickly in every hill and mountain will attract to this part of the continent a dense population for their development, which must find its chief supplies of food and clothing from the produce of the herds grazed in their midst. Thus, in a great measure, will be settled the difficult problem of transportation for these nearly inaccessible regions. The result of the industry of the population in the great interior basin, being reduced to bullion, will place the manual labor employed in all co-operative branches on an equable basis; hence, as the transportation to the commercial centres of the bullion, by ordinary modes of conveyance, will not be onerous, people who make the production of the precious metals the basis of their collective industry will be more favorably situated than those engaged in that species of agriculture which must seek a distant market over a costly transportation. The production of wool, and its manufacture into articles suited to the wants of a frontier population, is rapidly assuming importance among the industrial employments in the Pacific States, and the time is not far distant when the export of woollen fabrics will be a large item in their favor.

SILK CULTURE IN THE PACIFIC STATES.

Before the writer commenced the preparation of this paper he obtained a promise for the history of his experiments from a gentleman, a native of France, who had been engaged in silk culture in that country, and has, during the past five years, devoted a large share of his attention to the same occupation in California. Indeed, he wrote, in reply to my request for full particulars of his operations in silk culture during these five years of his experiment, that he had prepared a long letter upon the subject for my use, which embodied a

brief but full history of his experience with silk culture in this State, but upon reflection he had concluded not to publish anything on the subject for at least five years—not, as he stated, because he was dubious on the subject, or had thus far met with such doubtful success as to discourage, in the least, its further prosecution; on the contrary, his most sanguine expectations had been more than realized. I quote a sentence from this letter, in which he says: "I have made the culture of silk in California a grand success, but, except yourself and a few others, nobody believes it. I shall now, for a few years, keep my information to myself and get the benefit, and prove, at last, that as we have cotton-growing States, we also shall have silk-growing States."

It may be well to state that this gentleman is as yet the only silk-grower in California, and as he is receiving orders from France for all the eggs of the moths he can raise, his threatened silence upon the subject for the next five years is probably accounted for. It was my expectation that his promised article would have comprised all I intended to publish in this paper. His reticence, however, necessarily compels me to the alternative of passing in silence one of the most interesting of the textile fibres, or of trusting to memory for whatever facts connected with silk culture which came under my observation when, at various times, I have been, through the courtesy of this gentleman, permitted to inspect his cocoonery, and heard from his lips many particulars concerning his management of the silk-worm. Regretting that the valuable information in his power to contribute to the public good concerning one of the great industries should be withheld from publication, the writer trusts that when this impatient son of Gaul shall have become mollified by a more credulous public, and many shall become as enthusiastic on the subject of silk culture as he is, it may be his pleasure to communicate to the Department of Agriculture the desired information. The writer trusts that, however great his poverty in personal experience as a silk-grower, he may be able to state some facts in regard to the adaptation of this industry to the Pacific coast which may serve to direct attention to this subject.

INTRODUCTION OF THE SILK-WORM OF RECENT DATE IN CALIFORNIA.

In searching the old mission orchards we nowhere find the mulberry tree among the rich collection of the fruit-bearing species. This absence may be taken as conclusive evidence that silk culture formed no part of the varied industry introduced and conducted by the padres. I have already shown that they produced the textile fibre of wool in such abundant supply as to enable them to clothe the hordes of naked savages who were gathered about the mission establishments. Thus it would seem that articles of utility rather than of luxury received encouragement at their hands. Nor can there be found in the written history of the missions anything showing that the priests were any more aware of the unequalled adaptation of the country, by reason of climate, to produce silk, than there is to found a surmise that they knew of the wonderful deposit of the precious metals in the soil on which they stood, which, like silk culture, awaited disclosure and development by another race. Silk culture, however, has not as yet arrested the searching, restless eye of American enterprise; and after fifteen years of occupation, when nearly every source of wealth has been explored in the rush for gain, there appears only one solitary individual in the State engaged in silk culture, and this one endeavoring to "hide his light under a bushel."

If we look at the progress of silk culture in other countries, it ceases to be a matter of surprise that so little attention has been given the subject in a young community, isolated from manufacturing centres. The production of silk in such quantities as to place it within the reach of every member of the community was not accomplished until the introduction of labor-saving machinery had so

far relieved manual labor of the drudgery incident to ill-paid toil that the emancipated laborer not only craved the indulgence of his more refined and elevated tastes, but found himself in a condition to obtain possession of luxuries before within the reach of the wealthy only.

The silk-worm—*Bombyx mŏri*—was introduced into Europe from China in the year 160 A. D., and it was not until after the lapse of fourteen centuries that its cultivation became firmly established as one of the great industries of the nations bordering on the Mediterranean sea. In 1825 an attempt, commensurate with the usual large expenditure attending English enterprises, was made to introduce silk-growing into Great Britain. A company, called the "British Irish and Colonial Silk Company," was formed, with many leading statesmen among its members. This company established extensive plantations of mulberry trees in England and Ireland, but, after thirteen years of costly trial, dissolved their association and abandoned the enterprise as a failure.

During the latter period of the existence of the English company the *Morus multicaulis* excitement seized upon large numbers of persons in the United States, involving great outlays of money in the propagation of the trees to feed the silk-worm, but speedily ending in a failure which involved thousands of persons in hopeless bankruptcy. With these two stupendous failures in silk culture, occurring simultaneously in Great Britain and the United States, it should not be expected that the immediate descendants of a generation so disgusted with an industry which promised largely in theory, but was so barren in practical results, could easily be led into an enterprise about which the agricultural literature of both countries spoke disparagingly, and while there was still living a cloud of witnesses to cast upon it opprobrium.

SUCCESS IN SILK CULTURE A QUESTION OF CLIMATE.

If a proposition were made for the formation of a company to grow the sugar-cane *(officinarum)* in England or the northern United States, the dullest person applied to, before taking stock, would be apt to inquire if the climates proposed were suitable for success, which at once involves meteorological considerations.

Had this English company instituted thorough investigations into the habits and requirements of the silk-worm before making their large outlays of capital, they doubtless would have discovered that a climate subject to excessive moisture from fogs, frequent showers, and often long protracted storms, had natural obstacles to silk culture which could be overcome by no appliance of art. Add to this discouraging feature an accompanying phenomenon of nature, the presence of explosive electricity, and the question of the successful culture of the silk-worm in Great Britain or the Atlantic States would be settled in the negative.

All herbaceous food, when saturated with an excess of moisture, secreted while in a growing condition, becomes injurious to animal and insect life. This is especially and peculiarly the case with the silk-worm. Copious rains, with a continuance for days and weeks of a cloudy atmosphere, have the effect to surcharge the leaf of the mulberry with a watery, viscid, poisonous consistency, which, if fed to the worms, affects them with a kind of cholera, from which nearly the entire stock of worms thus fed will sometimes die within a few hours. It takes about six weeks for the silk-worm to pass through its four periods of moulting after hatching to be in readiness to spin its cocoons, and in order that the leaves shall be in a proper condition there should be no rain for one or two weeks prior to the time of hatching. Thus there are required seven or eight weeks of rainless skies in order that the silk-worm may enjoy its brief existence in perfect health.

Explosive electricity, incidental to rainy climates, coming suddenly and at uncertain periods, is, perhaps, more fatal in its effects upon the silk-worm than any malady caused by bad food. The shock of a single stroke of thunder

often destroys vast numbers of worms in a few moments, affecting them with a kind of apoplexy. The phenomena of rain and explosive electricity, prevailing with greater or less severity in the climate of Europe and the Atlantic States, is, I apprehend, one of the chief obstacles to complete success in silk culture in those countries, as it is palpably evident that in those seasons most exempt from rain and thunder, during the season of feeding the worms, the best results are obtained.

THE CLIMATE OF CALIFORNIA PECULIARLY FAVORABLE TO SILK CULTURE.

My friend, the Frenchman, has said: "We shall have silk-growing States." If an isothermal locality, entirely destitute of rains from May to November, with a meteorological condition in which there is no explosive electricity, should seem to be favorable, then the prediction that we shall have silk-growing will some time be verified. Enough is already known to warrant large outlays of capital in the Pacific States in the establishment of this lucrative and fascinating industry. During five years of experiment with the silk-worm in California, the party engaged in it states that he has never discovered a diseased worm except from accidental wounds or being bitten by ants, neither of which dangers are serious when proper caution is exercised in placing the legs of the tables on which the worms are fed in vessels containing water, thereby preventing the ant from gaining access to them.

The leaf of the mulberry being sufficiently matured by the 1st of May to feed the worm when first hatched, and continuing succulent until November, there are six months in which the business of raising the worms may be conducted; and allowing six weeks for each set of worms to mature, there can be raised four perfect crops in a season.

The worms, in the cocoonery spoken of, are fed by cutting the small branches of the mulberry trees from one to two feet in length and laying them on the tables in the form of a triangle, this being done twice each day, the successive layers forming quite a pyramid before the worm has accomplished its moultings and is ready to spin the cocoon, which it is permitted to do among the pile of dried sticks from which it has stripped the foliage, or it is given a cluster of sticks or a bundle of dry mustard stalks for that purpose.

Cocoons raised in California and sent to France for examination have been pronounced of superior excellence, and on measurement were found to give an average of four hundred yards of silk to the cocoon, exceeding European cocoons by from fifty to one hundred yards. It was argued from this fact that the worms must have enjoyed robust health; hence the eggs produced by the moths would be of superior excellence for breeding purposes in the silk-raising districts of Europe, where the worms, owing to various maladies, had become deteriorated. Large orders for silk-worm eggs have been received in California from the silk-growing establishments in France, and a limited quantity, sent as far as possible by an overland route, reached their destination in good condition, and the expectation that they would produce worms superior in health to the diseased progeny raised from the feeble stock of the cocooneries of Europe has been realized.

Throughout large districts of the State there are moist lands, some in course of reclamation for agricultural purposes, where the mulberry would flourish equally as well as the willow as a hedge for fencing. On such lands the mulberry could be planted as a stool, from two to three feet apart each way, and cut down as wanted for the worms, as is the practice in Hindostan. From two to three crops could be taken annually. In some of the vine-growing districts the vineyards are surrounded with live willow fences. If the *vigneron* would substitute the mulberry he would get rid of a vermin-breeding nuisance, and by allowing an occasional tree in the hedge to grow up, so as to fruit, he would

have something for the birds to feed on after they have exhausted the supply of insects, thereby saving his grapes, besides the means of raising so large a quantity of silk that it would challenge the returns from the vine in the season's results.

That the pabulum elaborated in the stomach of the silk-worm, from which it spins its fibrous enclosure, is of a superior character in the dry climate of California, is unquestionably due to the perfect maturity of the mulberry leaf on which it feeds; hence it may be expected that the silk will be of an even and strong texture, and of unequalled lustre. Much time, however, must necessarily elapse before silk culture will attain importance in the Pacific States, as the mulberry trees are not yet planted by which any considerable number of worms can be fed, nor are they likely to be propagated until old, deeply-seated prejudices against silk culture shall be uprooted by discussion, practical demonstration, and unwearied effort on the part of those who, by making the subject a specialty, at last find the usual reward of the pioneer in all public benefactions—thankless, unrequited service.