

PAPER

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Irrigation

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IRRIGATION

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A common and natural error of those interested in the great work of irrigation is the belief that there is little further need of popular instruction on the subject. The practical steps have been taken. The great campaign of education which those of us who were participators remember so well, the struggle to awaken and stir to activity the national sense of need and of opportunity, has been carried to a successful close. The Irrigation Act stands upon the statute books of the nation, and not a hand would be raised to-day to strike it thence. Subject only to such amendment as may render it more effective, it outlines a national policy that is to bless and fructify through generations. The splendid fund has been accumulated and additions to it are being made automatically through the wise provisions for its replenishment. The engineer corps are in the field, surveys are being made, dams are rising, ditches are being opened and already the wilderness is becoming a storehouse of natural treasure. What need, then, that the friends of irrigation should take note of the hour, should continue their efforts, should meet, as they have done today here, to take council together as if there were still a hostile or ignorant public sentiment to conquer and a road to be hewn to the national desire?

In truth, the work of education is but begun. How slow, how necessary it is, how fatal any intermission in the stress and purpose of it, we may see by a glance to-day at another section of the country where another subject holds every mind in thrall and thrills every heart with terror. Nothing has been more conclusively established, to the satisfaction of science and by undeniable tests, than the fact that yellow fever is not a contagious disease; that it can be communicated from one person to another only by the carrier mosquito. Both the manner and the time of this demonstration were such as to strike with force the average common mind, to which the conclusions of science penetrate but slowly. The whole nation was interested in the sanitary redemption of the City of Havana, brought under our control as one of the results of a war that smites upon the imagination as can no event less dramatic or universal. The skirmishers of the medical corps wore the clothes and slept in the beds of yellow

fever victims with perfect immunity so long as they were protected by netting. Others, surrounded with every precaution, isolated from all possible contact with the disease, contracted it in most virulent form when exposed to the mosquito infection alone. The case was closed; and the sole method by which yellow fever can be carried from point to point and from individual to individual has been as conclusively pointed out as any facts of physical science. Yet at this moment ineffective quarantines are established by terror-stricken communities, villages and stations on the railroads of the South are surrounded by armed guards, and the attempt by force to pass these lines would undoubtedly be met by murder. So slowly that even the most dazzling and impressive fact makes its way and finds lodgment in the common comprehension, so as to become a principle of action. A campaign of education is never complete until its subject has taken a place in the universal apprehension with the daily phenomena of nature.

How this campaign was begun, many of us still remember, and it is right that the people should not now forget. The first work in spying out the land for irrigation, in investigating its possibilities, and above all in getting its merits before the people, was done by the railroad companies. At first three, and a little later five of the great systems of the West united and each furnished \$5,000 a year as a working fund to make the necessary inquiries and to spread the facts abroad. It was by the provision of these corporations, studying the interests and welfare of the West, searching for means to increase the tillable area, the wealth, the population and the prosperity of the country tributary to them, that irrigation first passed from the sphere of the bookmen to that of the men of affairs; that it rose from the rank of a theory and an idealist's dream to that of a national policy undertaken in pursuance of and fortified by a national law. It would be strange if they had not now the intensest interest in the working out of the magnificent scheme at whose birth they presided and whose infancy was nurtured by their care.

The work still to be done, therefore, a work that will go on and prove its necessity as well as its beneficence when all of us who are gathered here have passed beyond earth's activities, is the unintermitted presentation of the value of irrigation, of the need of it, of its still unexplored possibilities, of its relation to national growth and individual life, until this shall have been made a permanent part of the common stock of knowledge; not the possession of a band of enthusiasts or a picked body of scientists and specialists, but as generally disseminated as the familiar plowing and reaping that have been done by man since immemorial time. It is to repeat, reiterate, reinforce and beat in upon the slow yielding surface of the popular thought and imagination the value of the importance of this work that such conventions meet and by this that they retain their right to leadership. And that we may receive full value for our rediscovery of ancient truths and their application to life of today, these constantly recurring assaults upon indifference and imperfect comprehension are indispensable.

Of all the actual or suggested activities of our time, of all the wide aims that workers and lovers of their kind have in view, none will take precedence of the reclamation of those vast spaces of our country now closed to productive activity. None is better worthy of the labor and resources set at its disposal. We are already entered upon an era of the severely practical. The speculative rage has wrought a certain measure of disenchantment. Industries and ideas are being winnowed by a people growing more cautious and sceptical. Values are being established upon a rational basis for industrial propagandas and economic theories. A glowing prospectus is no longer sufficient enticement for a liberal investment nor are people mad to rush upon the sword point of poverty or disgrace for some abstract theory. It is a time of taking inventories; of the presentation and scanning of credentials. What is of avail, what effective, what rational, what consistent with the permanent facts in the life of man for the building of this nation, of this social and industrial state, in which our partnership is at the same time one of the deepest sentiments and the intensest practicality? Those large policies only will finally approve themselves and be wrought into the fabric of the nation that are based upon the homely facts, the clamorous needs of the millions for whose happiness and prosperity only any state has a right to exist. In such selection, tested by actual values and by potentialities, irrigation has almost first claim upon the common thought. For, by it the boundaries of man's heritage are to be enlarged, the volume of the food supply, man's first necessity, may be almost indefinitely expanded, the total sum of the world's available wealth and of common comfort may be expanded, and at the same time the conditions of the individual laborer, of the family, of the home, may be so bettered as to counteract those tendencies that are commonly admitted to be threatening in the development of the race and the rearing of a higher civilization. It is therefore an issue of paramount value that is to be discussed here and that will be carried from this spot and by means of these addresses and discussions to every corner of the country.

What the friends of irrigation propose is something more definite and not less impressive than that which has carried the great explorers, discoverers, adventurers of the world through innumerable perils. The discovery of America could by no means have meant so much to the world of the century of Columbus as the addition to our heritage of homes and means of maintenance for ten million people not now endowed with an acre of soil. Yet that would be but a mean and insufficient measure of what may easily be accomplished. The miracle is within reach. From the dregs and debris of a continent are to be called forth the elements of wealth and maintenance of societies. By merely taking advantage of conditions that nature freely offers, by following the old task that she has set before man from the beginning, creating nothing, but learning faithfully and humbly her secrets and following her pregnant hints, a new world may be called into being. The section and areas so long regarded as a mere

surplusage, obstacles and hindrances in the path of national development, are to become sources of wealth greater than all their mines, though they stretched huge spikes of metal over all their areas down to the center of the earth, and of instruction in the associated effort of man in the humanities, in the true appreciation of life values such, as existing conditions and communities could not supply.

The need of this new area for home building is immediate and pressing. There lies the great source of wealth which alone may and must be drawn upon without intermission for man's needs. The forest falls, the mine is depleted of its precious contents, even the seas might, if searched too severely, cease to give tribute, but the soil is the last unfailing resource. Play games as we may with picture cards adorned with other names, the man at the bottom, the man with his foot upon a plot of ground, the man who is drawing from the earth food for himself and others is the foundation of all advancement as well as of all prosperity. Make way for him; for where he is decaying the pillars of the state are weakening, and all the more impressive forms of wealth are trembling toward the dust.

The need of more land spaces for the home builders is created by the rapid settlement of the country and precipitated and aggravated by the insane policy of land laws which tend toward the exhaustion of the public domain by the land monopolist and speculator. Except in a few selected spots where the influence of the railroad companies as colonizers has been exercised to secure actual settlement on their lands, the influx of actual cultivators is so small as scarcely to be reckoned with. Those who go upon government land in our day for the purpose of making homes are a handful. In contrast with this the following table, giving the increase in area of public lands passing into private ownership each year, shows how rapidly our patrimony is passing away:

Year.	Acres.
1898	8,453,896
1899	9,182,413
1900	13,453,887
1901	15,562,796
1902	19,488,535
1903	22,650,928

Doubtless Congress will consent to amend the land laws by the repeal of those now employed solely to increase the holdings of the dishonest man and to give rise to such scandals as have lately thrown shame upon the American name; but if the future is to be judged by the past, this access of wisdom and of honesty will come only when there is no longer any land left that is desired by the lumber king or the cattle baron. It is, therefore, of the utmost moment that these lands capable of reclamation, which it was not in the past to their interest to acquire, and which are at least partially and in a lame fashion safeguarded by the law of 1902, should be prepared as a patrimony for the days when the land hunger that is as old and as indestructible as man shall find no food for its reasonable satisfaction.

There is, indeed, a magnificent area available for this purpose. One third of the entire land area of the United States outside of Alaska and our other outlying possessions is still vacant. The great bulk of this is included within the regions known as arid and semi-arid. In the sixteen divisions: thirteen states and three territories; to which the reclamation act is applicable, there are 535,486,000 acres vacant out of a total of 92,777,600 acres. What portion of this can ultimately be made fit for the habitation of man we are unable at the present moment to declare. Undoubtedly, for reasons to be stated hereafter, it will be largely in excess of current estimates. And it is confidently stated by good authorities that about 60,000,000 acres are capable of supporting a settled population on the basis of irrigating enterprises now regarded as feasible. A great portion of this area, many times as valuable for production as the same quantity of land would be upon the richest prairie or in the timbered districts, is included within the states and territories carved out of the mighty acquisition which is celebrated by the magnificent exposition here before our eyes. The cause of irrigation is, indeed, in a special sense, the cause of the country included in the Louisiana purchase, justifying after the lapse of a century the statesmanship which, far-sighted for its age, was more brilliant than those who conceived and executed it could possibly have imagined. In the state of Idaho 78.7 per cent of the area is still vacant; in Montana 70.8; in this noble state of Oregon, whose enterprise and achievement would denote a late stage of development and whose written history covers so extensive a period, the vacant area is 55.8 per cent. Of course, not all the unoccupied land in the mountain divisions of these commonwealths, not all the level alkali plain, can be redeemed from desolation. But the total available for experiment is so great, the raw material wherewith to work is so abundant, that the promise is a sure one to us and our children and our children's children.

The density of population in the whole country from the Missouri river to the Pacific is scarcely three to the square mile. In the irrigated lands of Utah there are 300 persons to the square mile supported in a comfort that leaves little to be desired. The lands of the Nile, where irrigation antedates all history, carry a population of 1,200 to the square mile. But if we leave that old world standard and disregard also the most desirable sections of California where there are as high as 500 persons to the square mile, prospering on irrigated farms, if we say 250 persons to the square mile—a density that will soon be reached in some of our Eastern states—and assume that 100,000 square miles have been made cultivable by irrigation, we have a capacity for 25,000,000 people additional; all supported by land now regarded as outcast, and all contributing by the conditions of their life as much to social advancement and industrial improvement as to the aggregate of our wealth and the volume of our trade.

Under the present irrigation law forty-three and a half million acres were withdrawn from entry under the general land laws, in

order that when irrigation works had been completed the country might not awaken to find that all the land which could be benefited had been absorbed by unworthy appropriations. The fact that the government found it necessary to take such action is in itself a sufficient indictment of those laws as they stand today. Afterward three and a half million acres were restored, as not coming within the scope of projects likely to be undertaken in the near future. The fund created from the proceeds of land sales amounts to about \$27,-000,000. And the initial projects adopted by the government as worthy of its care contemplate the spending of this vast sum according to the following scheme of allotment:

States and Ter.	Project	Acres	Estimate.
Arizona.....	Salt River	160,000	\$3,000,000
California.....	Yuma	100,000	3,000,000
Colorado.....	Uncompaghre	100,000	2,250,000
Idaho.....	Minidcka	130,000	2,600,000
Kansas.....	Pumping	2,000	49,903
Montana.....	Milk River	60,000	891,991
Nebraska.....	North Platte	100,000	1,000,000
Nevada.....	Truckee	200,000	3,000,000
New Mexico.....	Hondo	10,000	240,000
North Dakota.....	Ft. Buford and pumping.	60,000	1,737,m
Oklahoma.....	Otter Creek	40,000	1,301,590
Oregon.....	Malheur	90,000	2,000,000
South Dakota.....	Belle Fourche	60,000	2,100,000
Utah.....	Utah Lake	20,000	154,199
Washington.....	Palouse	100,000	1,395,035
Wyoming.....	Shoshone	100,000	2,250,000
Total	1,332,000	\$26,970,429

Some alterations in this ground plan have since been found necessary. It is doubtful whether the Palouse plan in Washington can be carried through. Work in North Dakota has been delayed by the slowness of the people, owing to a lack of appreciation of the great benefits order that when irrigation works had been completed the country might accuring, to co-operate. But, on the whole, the scheme had been adhered to. The work actually under construction, according to reports of a month or two ago. was as follows:

States and Ter.	Project.	Estimate.	Acres.
Arizona	Salt River	\$3,600,000	200,000
California	Yum	125,000	3,000,000
Colorado	Uncompaghre	2,500,000	125,000
Idaho	Minidoka	2,600,000	130,000
Nebr. And Wyo	North Platte	300,000	2,600,000
Nevada	Truckee-Carson	2,740,000	200,000
New Mexico	Hondo	280,000	10,000
South Dakota	Bell Fourche	2,100,000	85,000

To the work projected in Montana has been added the Huntley project, and one subdivision of the enormous works to be constructed in the Yellowstone region, which will ultimately add hundreds of thousands of acres to the public domain, and to that assigned to Idaho the Fayette-Boise project. The total reclaimed land under these projects is now estimated at 1,500,000 acres or more. And as the incomparable benefits begin to be appreciated and the fund for new activity increases but slowly, a movement has sprung up to commit the government to a more rapid prosecution of the work and supply the means by a direct appropriation from the federal treasury. The total area of irrigated land in the United States was 4,115,000 acres in 1890; by 1900 it had increased to 7,300,000 acres, and in 1902 it was 9,481,841 acres. The last twelve years have seen more land brought under the influence of an artificial water supply than the whole of the preceding century; and when once the reservoirs, canals and ditches upon which the resources of the people are now being expended begin to carry life and wealth to the barren spaces, the increase will be more rapid and more marked.

Viewed in another aspect, our national development must look to irrigation for succor from submergence. It has been seen that available land areas are constantly dwindled. Were this true of a country with a stationary population, it would still require the most careful scrutiny to discover and apply a remedy. But the population of the United States is increased swiftly. It has doubled at the rate of about once in thirty years. We are now receiving through our various ports in round numbers a million of immigrants every twelve months, and this vast army of newcomers must be added to the natural increase. The government has refused and probably always will refuse to exclude those who are physically and morally unobjectionable and who are not paupers or likely to become a public charge. It is no less imperative upon us than upon them that these people have an opportunity for labor; find a standing place in the nation and a niche in its industrial life. What is to be done with them?

Probably the least informed citizen of the United States would not suggest that these immigrants should be herded in the large cities. Too many bitter fruits have already been plucked from that tree. The soil is the place for them. They need it, and the country needs more farms, more country homes, more of the steadfastness and industry and worth that its agricultural classes furnish. Always, in peace and in war, they have been the national reliance. In the cities originate enterprises of greater magnitude and from them emerge ideas of more far-reaching effect. But the country as a whole is anchored to the farm. There is the unit of society, the family, in its closest union; there is the factory in which the national wealth is steadily being produced; there is the resource that carries us triumphantly through the crisis of conflict and that dowers us with the perpetually flowing stream of wealth in time of peace. Into our factories or upon our fields must these newcomers go; and which shall it be?

Desirable as it is that the agricultural element of our population should be reinforced, it is equally obvious to those at all familiar with the facts of our national growth and commerce that there is no other resource for the incoherent, even were he otherwise minded, than the farm. Until national policies shall have been reversed there is no opportunity for any considerable expansion of markets for our manufacturing industries. Already our workshops are occupied by those whose prevailing rate of wage will not permit their product to come in competition with the product of other nations in the markets of the world. How shall we add a million or more annually to their numbers and dispose of their product in a market where, to put it mildly, we are not at present gaining ground and where the alertness of our rivals and our own insensibility to the necessity of cultivating trade reciprocity threaten to surround us with a narrowing circle?

We have repeated to ourselves that mouth-filling phrase "a billion and a half of exports every year." until it has induced a true hypnotic spell. But what are the elements of that total which are stable? More than one-half, sixty per cent, of our total domestic exports in the fiscal year 1904 were the products of agriculture. Our exports of raw cotton alone were within \$80,000,000 of the value of our exports of manufactured articles of every sort; and our breadstuffs and provisions sent abroad were 70 per cent of it. It is the farm that is the stay and support of our foreign trade as well as of our domestic prosperity: and the more surely and more constantly we bear this in mind the safer shall we be against disaster. For the cheap labor of the rest of the world may be massed against us in all its markets to keep or win from us control; but the hunger of the empty stomach that must be filled before hand can do its work will always furnish the demand for those gifts of the soil which no other nation can produce in such abundance.

This is true even of the Oriental trade that naturally has so large a place in the minds of the people of this Coast. Of our exports to Japan during the year 1903, the only very considerable items besides our shipments of coal oil were raw cotton, flour and wheat. We sent to the island empire some electric machinery and a large value in locomotives • but our sales to her of iron and iron manufactures in all were less than one-tenth of her total imports of these commodities, less than one-fifth of what she bought from Great Britain and scarcely 40 per cent of what she took from Germany. From every land and on every sea we may read the same commercial story and find the portent of the future in the stolid indifference to the fate of our foreign trade that public men and selfish business interests exhibit. It is a clear commercial conclusion that these new hands stretched out to us by millions every year must be sent to the farm for occupation; and that to provide homes and a maintenance and a future for our increasing population we must avail ourselves of that added land area which irrigation alone can furnish.

What is the general and what the special effect of this improvement upon the settler, the commonwealth and the nation's activities and interests? It is no exaggeration, but a plain conclusion of experience that no agency at work does so much to ameliorate, to elevate, to raise the general level of comfort and intelligence and even of character as the reclamation of our desert lands. The keys to this are two-fold: first, the ease and certainty with which a family may be supported and supplied with all the comforts and more modest luxuries of life upon a holding whose cost is so small that it is within the reach of any man of energy and ambition; and, second, the spirit of associative enterprise, the necessity for co-operation, the greater social intimacy and the substitution of a thickly settled country with many moderate sized towns, where irrigation prevails, for the immense population centers, surrounded by a country sparsely settled, imperfectly cultivated and looking to the metropolis for the realization of dreams, that characterizes the elder states today. The greater value of product per acre returned to the husbandman is a factor which, in the long survey, might better be regarded than all the train of educative influences that are attached to the system of intensive farming. Bitter experience of the contrary and the most earnest pleas of specialists in agriculture have been insufficient to cause the adoption of this system elsewhere. The preciousness of irrigated soils and the very conditions under which water must be obtained and used make it self-enforcing in the regions once arid.

Where irrigation prevails, agriculture knows three admirable conditions: certainty, abundance and variety. These three distinguish the reclaimed tract as a wealth producer from that which relies for its moisture upon the accidental and capricious gift of the sky. There is certainty as to the times and seasons of seed time and harvest. Growth being as much at the command of the cultivator as any other feature of his work, he arranges it to suit his convenience and the needs of his crop. The grain, the fruits, the grass receive their main sustenance, water, at just such times and in just such quantities as will most promote growth and assure the largest return. There is no more guess work in the routine of the farm. Abundance is assured because the lands reclaimed by irrigation are invariably of a higher quality of fertility than the best elsewhere known. Rich in all the elements required by plant life, which have not been leached out by centuries of drenching but are carefully embalmed in the very surface layer, they yield their products in extraordinary wealth. Grain yields of sixty and eighty bushels to the acre are not uncommon; alfalfa produces from seven to ten tons of hay per acre; while the returns from fruit orchards, to which the larger portion of reclaimed lands has thus far been devoted, may range from \$200 per acre to five times that sum or more. Variety may be secured at will, because irrigated land is of such intrinsic quality, and it lies for the most part in climates so benignant, that all the products of temperate and sub-tropical countries may be brought forth in profusion with success. With thus much assured,

and with the accidents banished that bring misfortune to farmers elsewhere, the occupants of irrigated land has a reasonable insurance policy in that very fact against disaster.

The dictum of theory is confirmed by the records of experience. Utah is the oldest of communities in this country where irrigation has been practiced on a large scale over many years. The Mormon people from the first applied themselves to the land, and from it they have drawn the sum total of their wealth. The historian of the Mormon Church has gone exhaustively into this question and struck a balance sheet giving the amount which can be fairly credited to irrigation in Utah. It shows a credit of nearly \$550,000,000 for the brief span since these people first landed in what was then a wilderness of alkali and mountain and now holds more homes for the same area under cultivation and fewer incumbrances of debt on the people's holdings than any other portion of the country.

What irrigation has done here on so grand a scale would have been duplicated in California, has been repeated as far as conditions would permit. Only the devotion to a single form of industry, the inaccessibility of markets and the attempt to wrest from each acre at once the greatest possible cash return and live on the income thereafter has prevented the experiment from being as successful. Throughout all the states of the interior West irrigation has been put on trial. In Colorado, in Idaho, in Eastern Washington and Oregon, it is creating wealth. Thousands of settlers throng where a few years ago the sage brush reigned; land values have grown from nothing to fifty, one hundred, even a thousand to two thousand dollars per acre in exceptional cases; the wealth of the country receiving additions that can be compared only with the product of our richest mines. Towns like North Yakima show an increase of more than 100 per cent in population in a few years, and bank deposits rising from half a million to two million dollars. A single illustration will show with photographic distinctness what irrigation does for development. In 1893 an irrigation canal was constructed watering 15,000 acres in the vicinity of Kennewick, in the State of Washington. Before the canal was completed the owners got into financial difficulties and the company went into the hands of a receiver. No effort was made to operate the canal until 1901, when it was purchased by the Northern Pacific Railway Company, who reconstructed it and commenced operating it in 1903. During the season of 1904 approximately 3,000 acres were irrigated and about 4,000 acres were irrigated this year. There is substantially no business at this point except that which has grown out of the development following irrigation. All is its creature. Therefore the business done by the railway company at this point is a fair measure of what has been created, in addition to the supplying of the wants of those who now live in comfort where before was only silence and the desert. The gross earnings of the company from all forms of business at this station for the fiscal year ending June 30, 1901, before the canal was in operation, were \$4,891.30; for the

II

fiscal year ending June 30. 1905, the receipts from all business, freight, passenger and express, at this point were \$68,712.53. So much was created by irrigation on so small a scale within four years.

On the social side, a typical community on irrigated land describes itself with pride, not by measuring the size and wealth of its cities, for it has none, but by saying: "With a rural population of between 6,000 and 7,000 people, living upon 35,000 acres of irrigated lands now in cultivation, we support 15 churches and 32 schools, all modern and thoroughly up to date in their equipment. Five rural free delivery routes and two telephone systems afford means for constant intercommunication." In another section where irrigation is applied the following summary of average yields of staple crops is given, which may be taken as a fair estimate of the capabilities of land under this system: Alfalfa, nine to ten tons per acre, value from \$5 per ton up; hops, 1,700 pounds, value from 20 cents to 33 cents per pound; potatoes, 260 bushels to the acre up to 600 bushels, value from \$13 to \$25 per ton: apples, from \$350 to \$500 per acre net profit.

The following figures, from the United States census reports, are interesting both as a testimony of the great value imparted to lands by irrigation and for their bearing upon the question of the large versus the small farm:

	Acres.	Value of Products per Irrigator.	Value of Products per Acre.
Arizona	46.0	\$755	\$16.40
California	45.2	1285	28.40
Colorado	73.9	860	n. 60
Idaho	56.5	605	10.70
Montana	94.0	905	9-65
Nevada	169.5	1495	8.85
New Mexico	23.2	350	15.10
Oregon	62.5	660	10.60
Utah	30-0	420	13-00
Washington	33.6	675	20.00
Wyoming	197.9	775	7.20
United States	55.5	820	14.70

So much for the irrigated farm as a means of sustenance and a creator of wealth. The incidental advantages of increasing the proportion of population occupied under this form of agriculture are not less sensible or less marked. The fretfulness, the gloom and the periodical discouragement that accompany losses and disappointments for which the cultivator is not responsible give place to a wholesome cheerfulness and a calm outlook upon life in harmony with its environment. The isolation of the farm, the dread of all and the influence that drives the young so readily to the great city is banished. The irrigated country is one continuous village, with neighbors everywhere, and no incentive for the creation of vast centers that breed evils of their own, destructive as well as creative of a high civil-

ization. The comforts, the luxuries, limited elsewhere to the urban population, are here the common and familiar property of all. The adjustment of product to local conditions and to varying demand may be made almost perfect. For it is characteristic of irrigated land that it is suited to *every* form of plant or vegetable growth not absolutely debarred by climate. Its master may devote it to grain or hay or fruit or truck farming or any other product for which there is or appears likely to be a profitable local market, and can vary these proportions from time to time according to the ratio of his profit. He is no longer one of a blind multitude raising one or two crops and clamoring to heaven because, since all his neighbors do likewise, the margin of gain has disappeared, but becomes a keen trader whose stock in trade, his acres, may be thrown with rapidity and success from one occupation to another as the price list of the markets dictate. Agriculture is elevated from a game of blind chance to the dignity of a business occupation where intelligence and energy cannot fail of their due reward.

In this connection there is one rule which approaches the dignity of an irresistible law: a rule so little understood, so contrary to the traditions of the past and all the tendencies of the time, that it needs to be reinforced with all possible emphasis and vigor. The irrigated farm should be small; the best limit of size under ordinary conditions being forty acres, the maximum that should be allowed anywhere being eighty. The feature of the reclamation act which permits holdings of one hundred and sixty acres should be changed. It was a concession originally to the ideas that have become fixed by our public land policy in the past, where a quarter section was the unit. It was also perhaps, consciously or unconsciously, a concession to the desire to accumulate more acres than can be tilled profitably which has injured agriculture in this country immeasurably. Because of the size of farms, intensive cultivation is a thing almost unknown; and effort is shorn of half its reward because it is scattered over too wide a surface. The large tract that can be acquired under the laws is an advantage to those who contemplate the acquisition of vast holdings for speculative purposes, but not to the real farmer. To him it is a constant temptation to shiftlessness, a standard conducing to the worship of bigness merely as bigness that is one of the vices of our system. It is the testimony of experience, borne out by statistics, that the small farm is imperative in an irrigated country. A whole family has been supported in more than comfort from the products of a single acre. Farms of five acres are common, farms of forty are beyond the ability of any farmer without considerable capital and a large force of helpers to cultivate. Passing the forty acre stage we revert to the old policy of indiscriminate largess that curses both him that gives and him that takes. It is by no accident that in the table presented above, the states where irrigated farms are largest in area, Nevada and Wyoming, in each of which the average is over 100 acres per farm, show by far the smallest average of product value per acre, \$8.85 and \$7.20 respectively, the lowest in the

whole list. We may announce as the law of diminishing return in irrigation has been most carefully thought out and worked out, of the farm increases above a modest maximum. The state where irrigation has been most carefully thought out and worked out, where it has brought greatest and most diffused prosperity, where the number of unincumbered farms is largest, Utah, shows a farm unit of 30 acres. This should become a warning and a watchword to all friends of irrigation; and their efforts should be directed now to the reduction of the maximum provided in the reclamation law, whose administration can no more remain forever proof against the greed for more land, not to till but to deal in speculatively, than has the administration of that other great heritage, our public lands, now become a common scandal and disgrace.

The important works to be done, then, by irrigation advocates, seems to be these: Insist that the government go forward conservatively but steadily in the path marked out. Complaints of slow movement should not weigh against thoroughness and permanency. There is no need immediately for further financial assistance in the form of a direct loan, for from this year forward reclaimed lands will be in excess of the demand for them from settlers of the only sort that should be permitted to acquire them; those, namely, who propose to live upon the land and cultivate it permanently. To hasten unduly the reclamation of the arid area, to spend immense sums in advance of the spread of general knowledge and appreciation of irrigation and its benefits, would be only to lead the way to exhaustion of this, our last and most precious, resource, by a careless disposition of them to the first comer. Keep on demanding the repeal of the vicious and fraudulent land laws still in force, by which all our lands are being dissipated, by which the pressure of population is made more severe and by which a large quantity of lands that might be irrigated later will be found to have passed into private ownership. Inculcate everywhere the gospel of the small farm. Stop dazzling the eyes of the settler with the notion that he can make his fortune in a few years and then retire on his income by taking up a piece of irrigable land. The "get rich quick" system is just as objectionable in farming as in a real estate boom or in banking. The man who will thrive best and acquire the largest means as well as suck from each day's life the choicest blessings is the man who proposes to himself a comfortable maintenance as the reward of earnest and unremitting labor. And out of that ideal and out of it alone can grow a high type of citizenship, proof against all the dangers of a restless time, and the sure stay and certain hope of the republic.

We are as yet as unable to conceive all that irrigation is to accomplish for our people as were those of a century ago to imagine the development and application of the form of force called electricity. Let us glance at what the unaided natural resources of the territory under survey have been able to contribute to the wealth of the nation. For the year 1902, the latest for which complete statistics by

states are available, the thirteen states and three territories in which reclamation projects are already under way produced 298,657,755 bushels of wheat, or 45 per cent of the crop of the whole country, valued at \$191,140,963; 553,058,698 bushels of corn, or 22 per cent of the general yield, worth \$222,882,655; 71.-38g.4i6 bushels of barley, or 53 per cent of the whole, worth \$32,767,741; 197.092.602 bushels of oats, or 20 per cent of the whole, worth \$60,783,728; 53,232,913 bushels of potatoes, or 19 per cent of the whole, worth \$25,072,702; and 11-893,761 tons of hay, or 20 per cent of the whole, worth \$107,769,474. Yet these same states contain a land surface of 1.527.157 square miles, out of a total of 2.970.230 in the whole United States, or 51 per cent of our national area. They are inhabited, according to the census of 1900, by only 7.747,191 people, out of the 75,994.575 people of the United States proper, a beggarly 10 per cent.

Here are the promise and the potency of a future that stimulates encouragement while it defies imagination. Not all the spaces of the Rocky Mountains and the Cascade systems, not all the deserts baking in the sun, can be brought under the sway of the husbandman. But neither are the northern regions of Maine, the Appalachian range, the mountains and pine barrens of the South and other great tracts of the older communities arable land. It is not unreasonable, it is scientific moderation to say that, with the aid of irrigation, the 51 per cent of our Western area will in the future carry 51 per cent of our population instead of only 10. And to encourage, assist and aid that splendid consummation is the privilege and the worthy motive of all who are today interested in promoting practical irrigation as the greatest single factor in the present growth of commonwealths and the rise of national splendor.

As irrigation is only in its infancy among us, so are our conceptions of it weak and incomplete. Millions are being made today by the reduction of ores that would have been thrown out as worthless fifty, twenty, nay ten years ago. Some of the greatest mining properties in the country could not have been sold at any price until within a few years; not because their value was unknown, but because the cost of extracting it was prohibitive. Most progress in the creation of wealth in our time has been by improvement in processes, by economies in handling, by the utilization of low values, by the slow and patient methods that know no such word in nature's treasury as "waste." It would be to deny the unity of nature and to assert in one direction a completeness of human knowledge everywhere else denied to assume that the limits which we now set to irrigation are final. On the contrary, as the problems are more thoroughly studied, as science brings all her enginery to bear, as human needs cry out, and that surpassing satisfaction which flows from ministering to them beckons succeeding generations, it will probably be found that we underestimate as much today our irrigable area and its possibilities as the mining engineer of an earlier era undervalued the ores that he rejected as absolutely uncommercial because of the sulphur or phosphorus which they contained. Therefore, no words

can express and no figures can carry the balance sheet that the future will strike with the irrigation idea when it has redeemed its last acre and furnished its last home for the expansion of our country and the elevation of mankind.

To the transportation agencies of the whole country, and especially to those of the West, the subject is one of transcending importance. They were quick to realize this and to act upon it. The great railroad companies were pioneers in the campaign of education out of which emerged the first law to be passed by an American congress in aid of irrigation. With that fierce injustice which the demagogue and the grafter have encouraged, this was even made one of the arguments against an irrigation policy. The railroads are today more vitally interested than ever; and not one of them penetrating even the edge of an area subject to reclamation is indifferent to its meaning. The railroad of today which is managed with intelligence and efficiency sees in the promotion of settlement, in the rise of new industry, in the increase of cultivation, in every effort which adds to the sum total of human needs and the means of satisfying them, the assurance of its own prosperity. The mere moving of an already existing tonnage, complicated as that may be, is a small part of the problem. The railroad will grow as the communities along its lines and tributary to its business multiply and prosper. With every addition to them, every swelling of the volume of traffic, there appear the two factors now understood by honest men to be not enemies but business partners; namely, an increased profit for the carrier and a lowered rate for the shipper. It is not wonderful, then, it is but ordinary sagacity and intelligent self-interest that prompts the railroad to promote by every means in its power a system and a scheme that contains within it the increase of population by millions and the birth of a tonnage movement measured in billions. The railroad gives the irrigable advocate Godspeed. It has clasped hands and joined forces with him before, it wishes only a closer alliance, desiring nothing but the natural benefits to flow from a project for national unbuilding, and asking nothing in return but that fairness of judgment and that dispassionate treatment of all truly national interests which occasionally disappear under the play of minds mistaken or dishonest or both, but which can never long be rejected or denied by the American people.

The irrigating ditch is the silent partner of the iron rail. Give to each of them its fair opportunity, and no more. And when you have created homes from the sand pit and the sage brush, throw open with honest candor the door to all fair opportunity. Do away with the restrictions that fetter labor and with the favoritism that robs it. Let your carriers be free enough to continue the work of creating trade, which is as much their (unction as it is that of the reclamation service to create farms where never a furrow was drawn or a leaf showed green before. Insist upon that reasonableness which is the law of the land, but remember that your irrigating canal will run dry if you place too great burdens upon the enterprise and your

transportation service be maimed if it be dealt with unjustly. Deal fairly with the people on the soil. Cease to demand of them the tribute which is wrung from them as surely, though under other names and pretexts, as it is from the peasantry of Russia and was from the fellaheen under Egypt's kings. Give to the farmer a fair and open market, and compel him no longer to pay to the same maker for all that he needs huge sums in excess of the price established in foreign markets, in order that great fortunes may grow apace and the example of wealth unrighteously acquired may spread the spawn of graft to the farthest recesses of the republic until the people cry out in their shame and their desperate strait for the gift of an honest man.

Broad and strong and deep are the foundations that we are laying here to-day if we but cement them with sincerity and with courage. Not by the term "new empire," which we so often borrow from the vocabulary of an unworthy ideal, but as a "new republic" shall we speak of the land of homes that is prefigured wherever hammer is ringing on the masonry of dams, and flumes are racing from the mountain to the plain, and the water is glancing in the long canal as it speeds toward the handful of earth that has waited its coming for millions of years in order that the most wonderful and beautiful of all miracles, that of the growth of life, may be repeated and continue forever. It is a new world that is to be called into existence; and the most that we who stand at the very incipience of its creation can say—enough for man to say or know—is that it must be good. Commercially, mentally and morally the changes, the incitements, the endless impulses from this great change will be immeasurable: and over country will suffer a higher and greater transformation than that which came upon the nations when first the discovery of this continent dowered them not as much with the wealth that filled their baseless visions as with the new birth of imagination, of intelligence, ambition and of power that ever wait upon the unfolding of opportunity and the opening- of the closed door upon a broader outlook over human life.