

A GREAT DOMAIN BY IRRIGATION.

"IRRIGATION makes homes for millions better than the rain makes homes." The prosperity of the people living in the so-called arid regions averages better and higher than the prosperity of those living in any of the sections under the rain-belt of the United States. In irrigated countries, the condition arising from crop failures owing to too great a rain-fall on the one hand, or to drought on the other, is entirely eliminated and is not a factor in results. A man's living is sure. Nothing needs to be subtracted from the sum total of the product on account of crop failure. In the arid regions of the United States, taken as a whole, conditions prevail which are much more advantageous to the tillers of the soil—whether cultivating grain or fruit—than the conditions in those sections of the country dependent for a crop outcome on the rain-fall. These, briefly stated, are: a richer and more prolific soil, gentler climate, greater variety of products, cheaper land, larger yield per acre, less labor in making homes, less capital required to own a farm, cheaper living, the prospect of great advance in the price of land on account of settlement and improvement and because in great part the arid lands are fitted to produce crops common to both the temperate and semi-tropic zones.

The arid region of the United States, as stated by Major Powell, covers an area of 1,500 miles in its widest part, from east to west, and 1,000 miles from north to south. It embraces the area between the 100th meridian and the Coast Range, and from the British Possessions on the north to Mexico on the south. This space contains over a million of square miles—one-third of the area of the United States, excluding Alaska—equal to more than 600,000,000 acres. All of Arizona, New Mexico, Utah, Wyoming, Idaho, Colorado, and Nevada and portions of California, Oregon, Washington, Texas, Kansas, Nebraska, North and South Dakota, and Montana lie within this belt.

For data in this article I am under obligations to the writings of the late Patrick Hamilton, Esq., Major Powell's "Lands of the Arid Regions," the "Report of the Special Committee of the United States Senate on the Irrigation and Reclamation of Arid Lands," made to the Fifty-first Congress, and to "The Irrigation Age."

It is estimated in the report for the year ending June 30, 1891, of the Hon. John Noble, Secretary of the Interior, that "120,000,000 acres that are now desert may be redeemed by irrigation so as to produce the cereals, fruits, and garden products possible in the climate where the lands are located."

When it is remembered that 120,000,000 acres about equal in area the States of Pennsylvania, Ohio, Indiana, and Illinois combined, the gigantic possibilities and future of so great an extent of fertile and productive land now lying fallow, may be imagined when it is made to "laugh with a harvest." The four States above named now have a population of about 15,000,000 and could easily support thrice that number, so that estimating the cultivable area of the arid region at 120,000,000 acres, and doubtless it greatly exceeds that amount, the United States has in that desert land an empire, awaiting development, capable of supporting a population in comfort, almost equal to the now existing population of the entire Republic. Irrigation of late years is rapidly increasing in the United States. Until the annexation of the great State of Texas this method of cultivation was practically unknown to the people of the Union. While it was in vogue in a careless, slipshod way among the natives of New Mexico, Arizona, and Southern California at the time that territory was acquired by the United States, its practice had never taken root among the Americans, and it was not until the Mormons demonstrated its great efficiency in the Salt Lake Valley and other parts of Utah, that the Americans began to see its possibilities and to adapt themselves to a method of land culture hitherto foreign to the habits of their race and ancestry.

The acreage in the United States now under irrigation, though increased greatly in the last twenty years and still rapidly growing, is but an atom compared with what can be done. In an approximate way, perhaps 3,000,000 to 3,500,000 are now farmed under the canals and ditches, and the mileage of these waterways is variously figured at from ten to fifteen thousand miles. The data obtainable, owing to the newness of the country, its sparsely settled condition, and its widely scattered settlements, are necessarily only approximately and relatively reliable. But accepting the figures given above as approximately correct, an idea can be easily formed of the great importance to the United States of a system so well adapted to reclaim the so-called desert of the arid region—a desert that under the American farmer can be reclaimed from almost the "abomination of desola-

tion" and be made the happy home of an industrious people more than equalling in number the inhabitants of the United Kingdom of Great Britain and Ireland.

Abundance and cheapness of land are probably the greatest factors in the production of cheap food, and, these being admitted with their limitations, the millions of acres of fertile soil in the arid region become at once of profound importance to our people. Taken as a whole, the great States of Pennsylvania, Ohio, Indiana, and Illinois represent probably the best land in the rain-fall districts of the new world producing the necessities of life, and the land in their limits is, perhaps, as intelligently and industriously cultivated as any other of similar area in the United States.

The table below shows the average yield per acre and the average value per acre of these States for the years from 1880 to 1889, both inclusive:

	Yield.	Value.		Yield.	Value.
	Bushels.			Bushels.	
Corn.....	28.8	\$12.63	Rye.....	12.1	\$7.69
Wheat.....	12.8	11.94	Barley.....	20.5	14.39
Oats.....	29.7	9.27	Potatoes.....	70.1	34.37

The average yield per acre in the whole United States in the same years and the average value per acre for ten years were:

	Yield.	Value.		Yield.	Value.
	Bushels.			Bushels.	
Corn.....	24.1	\$9.47	Rye.....	11.9	\$8.27
Wheat.....	12.0	9.95	Barley.....	21.7	12.76
Oats.....	26.6	8.16	Potatoes.....	76.2	38.84

For the same period of time the average yield and value per acre are given for these crops in the arid regions, in a district composed of the States and Territories of Idaho, Colorado, Nevada, Arizona, Utah, and New Mexico:

	Yield.	Value.		Yield.	Value.
	Bushels.			Bushels.	
Corn.....	22.6	\$16.49	Rye.....	13.8	\$9.34
Wheat.....	13.2	14.16	Barley.....	22.1	15.89
Oats.....	27.5	14.05	Potatoes.....	87.4	56.30

Idaho, Colorado, Nevada, Arizona, Utah, and New Mexico are chosen as examples of productive power and value per acre because

they best represent the arid region by being forced to depend almost entirely upon irrigation for their water supply, and therefore stand for that system most thoroughly as compared with Pennsylvania, Ohio, Indiana, and Illinois, producing under the natural rainfall.

It will be seen that in corn only does the irrigation section fall below the average of the yield in the United States, while in wheat, oats, rye, barley, and potatoes the percentage of increase is in favor of irrigation, and in the value per acre the difference is remarkable. In the comparison with Pennsylvania, Ohio, Indiana, and Illinois, these States produce more corn and oats to the acre, but in wheat, rye, barley, and potatoes the arid belt shows more and better results, while in average value of the different crops per acre the showing is very largely in favor of the irrigation States and Territories.

It should be remembered also that the appliances, conveniences, and machinery for the most productive farming are everywhere present in the rain-fall States, and are almost universally absent in the irrigation section from which statistics are given above; that, in the one, the naturally fertile ground is given every assistance known to modern agriculture, while, on the desert, the soil and water alone bring about the fruitful result unassisted by any artificial fertilization whatever.

In the culture of fruit under irrigation the profit is much greater than that derived from the production of grain. On one fruit farm in the arid region the showing for 1890 was as follows:

	Gross Receipts per Acre.	Net Receipts per Acre.
Apricots	\$343.00	\$211.00
Nectarines	400.00	268.00
Peaches.....	500.00	350.00
Yellow egg plums....	500.00	400.00
French Prunes.....	720.00	600.00
Raisins (1889).....	305.00	240.00

Oranges, lemons, olives, figs, almonds, English walnuts, are estimated to pay, when the proper age of the tree is reached, from \$250 to \$500 per acre, although instances are well known where the profit per acre attained a much higher figure. It may be said that the present profit obtained by the grower of oranges, lemons, etc., is exceptional, and that in the future prices will fall and profits decrease in proportion as the price decreases. In answer to this it should be understood that the land, fitted to produce these fruits, is of very limited area, and that the consumption of the fruits is increasing much faster than the production. Many people, not yet old, can remember when

an orange was a treat only to be enjoyed upon rare occasions, and the price was so high that practically the fruit was out of reach of the many, while now the breakfast table without the orange, in its season, is almost the exception, and the orange is eaten almost as freely as the apple. In a general way it may be stated that the arid region, covering so great an area from north to south and from east to west, can produce almost everything that is raised in the Northern, Eastern, and Southern States of the Union, and can, in addition, in its southern portion, produce at a fair and remunerative profit all of the products of the semi-tropic zone, and that the farmer of the North, East, and South, moving to this region, can, with the same good sense and industry he applied in the older States, under the irrigation system, make a larger and certainly a surer profit.

The cost of water—*i.e.*, the money cost per acre for water furnished—varies so greatly in different localities, that it is impossible to give more than a very general idea of this important factor; but it may be said that, so far, in the history of irrigation the tendency is to a reduction in the yearly cost, and that the highest rate charged in any locality has never been a bar to the profit made by the buyer of the water. As land under any ditch system is taken up, occupied, and put under cultivation, the consumption of water increases, and the seller of water is thus enabled, owing to the larger consumption, to lower the selling price, just as the merchant who sells hundreds of thousands of dollars of merchandise per annum is able, from the very fact of his immense sales, to reduce his percentage of profits to a minimum and yet reap a large reward.

In California the law regulates the price of water on the same principle that the State controls and regulates railroad freight charges, and there is no doubt whatever that all States and Territories must and will, sooner or later, enact laws to control the price of water and thus prevent ruinous, unjust, and prohibitive charges. The sovereignty of the State extends over the water as well as over the land, and its power to regulate is unquestioned, as the land, in irrigation countries, is utterly valueless separated from the water. In a general way the cost of water per acre may be fairly stated as ranging from fifty cents to three dollars per acre each year. The lower rate prevails in the small settlements where the canal or ditch is usually owned by the users of the water and the price per acre is the yearly maintenance charge for repairs and replacements, and interest or profit on the capital invested in the ditch is not expected.

This yearly rent of water, however, is not the only cost. Where the canal is not built upon the co-operative plan—that is, where the users are not also the owners—the first cost of water per acre enters as the most important factor. The plans of this first cost are as many and as diverse as the localities in which the canals are constructed. One of the most popular plans is for the owners of the canal to issue and sell “water-rights.” A water-right is supposed to represent the quantity of water needed to irrigate a certain quantity of land—usually one hundred and sixty acres. The owner of the land buys this water-right from the canal company, and this ownership entitles him to draw from the canal sufficient water to irrigate his quarter-section—estimated usually at 80 miner’s inches—upon the payment of a certain yearly rent per acre. These water-rights are sometimes a fixture to the land, and under other systems are transferable, and can even be rented out if the owner of the right for any reason does not desire to use the quantity of water called for. It will be at once seen how very important the water-right is in estimating the cost of land. Thus, if a water-right costs eight dollars per acre, this sum added to the Government cost of the land and the expenses of proving up under the laws of the United States would make the first cost of the land about eleven dollars per acre. These water-rights, in highly improved sections, become in time immensely valuable, and their cost, in reality, governs the price of land.

To any one contemplating, for any reason, settlement in the irrigation section, it can be safely said that the question of ability to obtain water, either by rent or by purchase, need be no hindrance. The water exists; its distribution is being provided for; land under the canals and water-courses is abundant and cheap, and nowhere under the shadow cast by the Stars and Stripes can a home be had at so little first cost to the seeker of a home.

The amount of water required for a crop upon an acre of land is usually called the “duty” of water. It varies with the country, the climate, the character of the soil, and the nature of the crop to be produced. It differs greatly even in different portions of the same district. In Spain one cubic foot of water flowing per second suffices for two hundred and fifty acres; in Italy, ninety acres; in France, one hundred; in parts of Africa, three hundred; in Utah, Idaho, Colorado, Arizona, and New Mexico, from seventy-five to two hundred and fifty acres. In this country the unit of water measure is the miner’s inch, which, in practice, is really an indefinite quantity.

In Europe, Asia, and Africa the unit of measurement is the flow of a cubic foot per second, and this unit is much more fixed and certain than the miner's inch. The character of the soil also exerts a marked influence upon the duty of water, a porous and coarse earth requiring more water than a heavier soil. Evaporation and seepage are also factors to be considered.

No one can do more than generalize on this subject. There can be no fixed rule. The intelligent farmer studies the nature of the land he owns, and soon learns the amount of water needed for his various crops. Hay and grain, he finds, need much more than the orange, lemon, olive, grape, or fig. He studies the climate and makes due allowance for evaporation and seepage. He finds, that after several seasons of cultivation and irrigation, the quantity required from year to year is constantly diminishing. By careful and intelligent observation he becomes proficient in this necessary part of his business, and is as able to tell the amount of water required for any given field bearing a specified crop as he is able to state any other fixed rule of his profession.

Colorado and California have almost the only well-defined laws with regard to water. In the other States and Territories many questions are still unsettled, and the entire system upon which the various canals base their claims is vague and undetermined. These minor matters, of course, will in time be settled by the courts, just as conflicting claims in land titles in the older States have been adjudicated; but the great principles involved and the gigantic interests that will eventually be at stake demand action by Congress.

Mr. Wm. H. Hall, of California, who has given the matter great study, thus briefs the assumption of the State:

"That all existing water privileges should be defined and recorded.

"That a definite standard of measurement for water be established.

"That water-rights should be issued in proportion to the supply in each stream, and that the extent and priority of each claim should be designated.

"That provision should be made for supervising the distribution of water from the sources of supply to those holding water-rights.

"That provision should be made for the care of the beds, banks, and waters of the streams.

"That the adjustment of the conflicting interests of the irrigator and the riparian claimant should be provided for as they arise.

"That general regulations should be established from time to time, which will prevent waste and guard against water monopolies and the careless use of the fluid."

These regulations, well enforced, will doubtless settle all claims

and matters in controversy when the facts are ascertained and made of record.

But these matters, while of great importance, are secondary to the great question. Right of appropriation, priority, riparian ownership, control, carrying, and sale can and will be fairly and satisfactorily settled, under proper State laws, by the courts.

Three plans are presented for the construction of lakes for the storage of water:

First, that it be undertaken by the Government of the United States as a National work.

Second, that the State or Territory provide the reservoirs within its borders.

Third, that the work be done by private capital.

Of these the last, taking everything into consideration, is infinitely preferable.

The future prosperity of the people in the arid region, and the millions that region can easily be made to support, depends upon the solution of the problem of water storage or the reservoir system. There is no lack of water. The trouble arises from the unequal and unseasonable distribution, and the problem is to retain the water falling in the rainy seasons, and that caused by the melting of the mountain snows, in reservoirs until it is needed for the production of the crops. And this problem is merely a matter of capital first and engineering skill second. It must be noted that all the arid region consists of mountains and valleys. The mountains contain the water and the valleys the soil. Everywhere in the mountains are natural storage places for water that only need walls of sufficient dimension and strength to hold safely and surely the great mass of water. These reservoirs or artificial lakes, once securely constructed, the question of supply will be answered, and all doubt as to the great future of irrigation will be settled forever. To these great works, the attention of capital and brains is invited. The era of railroad-building in the older States has almost passed. In the arid region all the work remains to be done. In it is the great future field for genius, energy, and money. Upon its development rests the well-being of millions and the foundation of fortunes.

But before much can be done, Congress must act. Reservoir sites must be defined. The system of location must be made clear and titles must be unclouded. Many of the rivers flow through two or more States or Territories, and thus the question as between the different States must be adjudicated by Congress.

In his comprehensive report for 1891 the Hon. John W. Noble, Secretary of the Interior, says:

"It is perceived from these facts that Congress has so far acted that private corporations and associations are now substantially given the field of water supply for that domain that may be redeemed by irrigation, and that this field is being rapidly seized upon.

"The United States by existing legislation does not retain any control, but weakly and insufficiently establishes the authority of the States or Territories; the control of the water is handed over to corporations and associations.

"The States or Territories may be expected to exercise under the reservation of authority expressed in the above statute (Act of Congress of March 3, 1891) some control of these water companies and to protect their citizens from oppression, but the United States Government, from whom these vastly important and far-reaching privileges emanate, should not release altogether its hold upon the water supply and its ultimate distribution. No one can now compute the money value that will concentrate in these reservoirs and canals and ditches conveying the water to the fields of the husbandman, and upon which the people must depend for their prosperity. . . . It has been said by an eminent writer on the future of our country that the child is already born who will see 400,000,000 of inhabitants in the United States. Long before this stage of our development is reached, the question of the water supply and its distribution will be one of vital interest, and its proper solution should be given now."

The Secretary further says that the United States may not build the reservoirs or retain the desert lands for improvement; that the expense may be greater than the Government would care to assume, and that "the reservoirs, canals, and ditches may be transferred, so far as already located by the United States, to the States and Territories, and those yet to be located will be put under local legislation and control." But if this is done he deems it essential "that there should be reserved to the United States the power of forfeiture and resumption in case of great abuse or a conflict of interests between States threatening to lead to actual violence between their respective populations, or allowing the irrigation of vast districts to fall into the hands of monopolies without sufficient protection to the people," and recommends that as the subject is of such great and immediate importance comprehensive laws should be passed at once "determining the national policy upon this subject." And the President in his recent message to Congress says: "The Government should not part with its ownership of the water sources except on the condition of insuring water to settlers at reasonable rates."

But whatever may or may not be done by Congress, whether additional legislation be enacted, or the laws now in force remain un-

changed, the great field for capital and capitalists in the arid regions will exist, offering and insuring both promise and fruition.

There are many advocates of a system of storage reservoirs built and constructed by the United States. And those favoring this plan advance many strong and cogent reasons. They cannot see why the Government should build dikes along the southern Mississippi River to keep water off private lands and then refuse to build dikes in the arid region to put water on private lands. But should the Government, as it probably will, refuse to enter into the business of building reservoirs or lakes, it still has a duty to perform. This duty is to provide for complete and accurate surveys and to collect all the facts and data to induce private capital to take up the work, and this should be done by liberal and effective appropriations.

In August, 1889, a Committee of which the Hon. M. M. Estee was Chairman, made a report to a special committee of Congress presenting fully, strongly, and eloquently the views of those advocating that all preliminary work should be done by the Nation.

The report goes on to say, that if the land west of the 100th meridian was not owned by the United States and was still thinly settled or inhabited, it would be deemed the highest statesmanship to acquire it in order that our surplus population might find a field for its energies; and this being granted, the reclamation of this land stands for the equivalent of its acquisition.

That the Government must do something is patent. The density of population is approaching, in parts of the country, the conditions of Europe, and the child is now living who will perhaps see in the fertile portions of the United States a population almost equal in density to that of England or France. Our statesmen can find no greater field than this for the exercise of statesmanship. The golden opportunity is here, and it is to be hoped that there will be no lack of men to grapple with, and, happily and satisfactorily, solve the question, benefiting thereby the Nation, the State, the owner, and the user.

There are many progressive men who advocate that the States or Territories should build the storage reservoirs, each within its own borders. This sentiment is growing, and unless private capital comes forward, the different States and Territories in the arid region may conclude to enter upon this work as a matter of great public concern and necessity. The plan under which the work is to be done and paid for is: that the General Government shall grant to the respective

States and Territories all desert lands remaining unsold. With the proceeds of the sale of these lands, the necessary reservoirs and waterways can be constructed. A bill to this effect was presented in Congress in 1886, but no action upon it has yet been taken. The objections to National or State construction are, however, many and strong. Private capital will do the work with less friction and on the whole with greater advantage to the people.

To capital seeking investment in a large way, irrigation enterprises in the West offer a most solid, lucrative, and tempting field. Without water, in the arid region, land is agriculturally valueless. With water assured and applied, land suitable for average farming becomes immediately worth from thirty to one hundred dollars per acre; while in those portions where the soil is adapted to the culture of fruit and the climate is favorable, two hundred to three hundred dollars an acre is not an uncommon price. Water for irrigating purposes cannot be had by the individual farmer, and it is almost impossible, owing to the large amount of money involved, for a neighborhood to procure water upon the co-operative plan. Hence the necessity for capital, and its opportunity. The owner of the land will gladly pay a fair price for a water-right in perpetuity, because by so doing a value is at once stamped upon land otherwise worthless or at the best useless, while the amount paid for the water gives to the investor an ample return and an assured revenue, and both parties to the transaction are benefited.

To the farmer or fruit grower, agriculture under irrigation presents many advantages not enjoyed where rain is depended upon to insure a successful outcome. He is safe against too little as well as against too much water; he controls the conditions of ploughing and seeding and is absolutely sure of a permanent supply of the elements necessary for plant food; he can cultivate a greater variety of products, and the water put upon the land carries with it the silt deposit needed for fertilization of the soil; almost absolute certainty of a full crop each year is assured, and harvest time gives full immunity from loss by reason of rain. In fruit culture both growth and ripening of the fruit can, to a degree, be controlled, and the danger from frost is reduced to a minimum, because of the ability to arrest the supply of sap, thus giving time for the tree to perfect and strengthen for cold weather.

JOHN N. IRWIN.

THE GERMAN LABOR-COLONIES FOR TRAMPS.

GERMANY is the home of the system-makers. It is to Germany that the theologian, the philosopher, the physician, and the naturalist go for their systematic discipline; and now that philanthropy with us has passed beyond its age of sentimentalism and become a part of science, Germany in this department also has important lessons to teach. Each part of charity-organization in Germany shows this instinct for system, developed at times to the point when the evils of system-making begin, but certainly providing on the whole a much more thorough and sympathetic plan of municipal and state charity than anything we have yet achieved. I wish to describe the way in which Germany thus systematically deals with a single form of relief—the case of the vagrant unemployed.

The tramp-habit is a much more conspicuous evil in Germany than it is as yet with us. It is a survival of times when young apprentices made it their custom to march from town to town, learning their handicraft from the best masters and plying their trade as it might be needed. The reasons for such frequent shifting from place to place are now, of course, in large degree, gone; but the *Wanderlust* is still felt in the German blood. It has become a subject of romance and song. Prosperous and humble Germans alike know the charm of tramping through rural scenes, with plain living and a touch of adventure on the way. The war of 1870, like our war of 1861, increased the number of the habitually unsettled and vagrant class until in 1880 it was computed that not less than 200,000 men were thus living "on the tramp" from town to town, subsisting for the most part through mendicancy and demoralizing both the community and themselves by their way of life. If each of these nomads obtained help by beggary to the amount of twenty-five cents a day, it amounted to a loss to the state of something like \$15,000,000 a year—a sum which in the economic conditions then prevailing in Germany called for radical treatment. A connected series of tests was therefore by degrees devised which now systematically covers the whole ground of this