SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION I., ECONOMIC AND SOCIAL SCIENCE.

II.

Is an Ideal Money Attainable? CHARLES A. CONANT, Treasurer of the Morton Trust Company, New York city.

Mr. Conant discussed some of the projects for doing away with money which have been put forward from time to time by students, and rejected them upon the ground that they ignore the true function of gold as a store of value and the most exchangeable of commodities. He declared that while large transactions could be cleared against each other without the use of gold, yet in the long run gold must be employed as the final test of value, because it was the one thing desired above all other things because it could always be exchanged for other things. Other things fluctuated in value according to their degree of exchangeability. This degree of exchangeability fell greatly where there was overproduction of goods, and it would be futile and unjust to take the values of goods, even over an average of time, as a proper measure of values. Gold money was the touch-stone of the need for goods. If they rose in price in gold it was an indication of unsatisfied demand; if they fell in gold it was an indication of overpro-

duction. Hence, the exchange value of gold in relation to each other thing was the governor of production and determined the direction in which capital should be employed. It would deprive society of any accurate means of determining the proper direction of capital, and the necessity for increasing or decreasing production of given articles, if it should be attempted to replace gold by a system of averages intended to give uniformity to prices without regard to the relation of demand and supply between different classes of goods.

Cooperation, Coercion and Competition: Professor Lindley M. Keasbey, Bryn Mawr College.

Industrial organization is determined by two factors, by the character of the social surplus, and by the monopolization of the sources thereof. History shows us three characteristic systems of industrial organization—the cooperative, the coercive and the competitive—which have succeeded each other in the order named. In the natural state before the appropriation of natural resources for pastoral and agricultural purposes, the cooperative system prevailed; during the proprietary period which followed, when natural resources were appropriated, but before the institution of exchange, the cooperative system became subservient to the coercive system, while with the rise of the commercial era, resulting from the development of exchange, the coercive system was superseded for some time by the competitive system. Present tendencies appear to point to a reversal of the original order of this succession. Owing to the gradual monopolization of the sources of the industrial surplus by the great capitalists, the older competitive system is breaking down. In its place the coercive system is being reestablished. But coercion when applied stimulates cooperation. The laborers are combining to resist the coercion of organized capital. If, as seems likely, capitalists and laborers cooperate in profit-sharing undertakings, then the consumers may possibly be coerced by the producers. It will then be necessary for the consumers to cooperate. Or to put the general thought theoretically, we may expect the present monopolization of the surplus sources to be extended gradually to admit laborers as well as capitalists, and finally, perhaps, some monopolies to be still further extended so as to admit consumers as well as producers.

Economic Work of the Weather Bureau: Professor Willis L. Moore, chief of Bureau.

In connection with the economic worth of the Weather Bureau the question is often asked, 'Does it pay?' I will cite a few facts in answer to that question.

The first year of the weather service the annual appropriation was about $20,000. This year that appropriation is $1,250,000, and congress and the people are plainly well satisfied with its expenditure. Our daily survey of the atmosphere is the largest attempted by any country or organization, and our system for the dissemination of warnings of severe or injurious weather conditions, such as storms, hurricanes, cold waves, frosts, floods, heavy rains and snows, is so complete that these conditions seldom occur without the country being notified well in advance. To give you some idea of the value of the storm warning service alone, I may say that there are 6,000 sailing vessels and as many steamers engaged in the trans-Atlantic trade, which leave our ports in a given year, and 17,000 sailing vessels and 4,000 steamers which annually ply between the ports on the Atlantic coast. Marine insurance people estimate that one West Indian hurricane, if it

were to sweep up the Atlantic coast unannounced, would leave wreckage to the amount of $2,000,000, without considering the loss of life. There has not been a storm of marked violence along the coast in the past eight years warnings for which were not issued from eight to twenty-four hours in advance of its approach.

Warnings of floods in the river valleys of the United States are also of great value. In the great flood of 1897 in the lower Mississippi valley, warnings were distributed over the inundated districts four to five days in advance of the flood, with the result that almost all of the movable property was taken to higher ground and saved. It is estimated that $7,000,000 worth of property was removed from the Yazoo valley alone on this occasion.

Warnings of those sudden temperature changes known as cold waves are of great importance. In January, 1896, a cold wave of exceptional severity swept over nearly the entire country east of the Rocky Mountains. Warnings of its approach were sent to nearly every weather bureau station in that region from twelve to twenty-four hours in advance. Information gathered systematically from shippers of perishable products and other interests affected disclosed the fact that the warnings resulted in the saving of over $5,500,000 in the protection of property from injury or destruction.

The frost warnings recently issued for Florida, when the temperature in the northern part of the state fell as low as 20° to 24°, and frost formed as far south as Tampa, resulted in the probable saving of hundreds of thousands of dollars to the truck interests of that state.

These are but a few instances of property and money values saved, and they give a very incomplete idea of the full economic value of the Weather Bureau forecasts and warnings to the interests of the country. The work of the bureau in the collection and publication of data and the issue of forecasts and warnings affects the daily life of the people to a very great extent, and becomes an important factor in their various avocations and business enterprises.

Economic Work of the Bureau of Animal Industry: Dr. D. E. SALMON, chief of Bureau.

The Bureau of Animal Industry is required by its organic act "to investigate and report upon the condition of the domestic animals of the United States, their protection and use, and also inquire into and report the causes of contagious, infectious and communicable diseases among them, and the means for the prevention and cure of the same, and to collect such information on the subjects as shall be valuable to the agricultural and commercial interests of the country."

Since the organization of the bureau, however, it has been given from time to time a great amount of executive work, and this now largely exceeds the investigations which constituted the original object of its establishment. Thus it is expected to control and stamp out the contagious diseases of animals which are dangerous to interstate or foreign commerce; to prevent the introduction of diseases from foreign countries by an inspection and quarantine of imported animals; to inspect and certify to the healthfulness of exported animals; to supervise and control the fittings of steamships which carry our animals to foreign countries; to inspect the meat slaughtered for interstate or foreign commerce; and to inspect and certify to the quality of dairy products that are exported.

This brief summary will give an idea of the scope of the duties of this bureau under existing laws.

The first great task was to establish what is known as the Texas-fever line, which now extends from ocean to ocean and serves to divide the section of the country in which the disease originates from that in which its ravages are usually seen. This line needs constant rigid supervision to prevent the spread of the infection. It involved last year the inspection of 1,545,000 cattle and the cleaning and disinfection of 46,736 railroad cars.

The wisdom of establishing the bureau is attested by the successful eradication of the contagious pleuro-pneumonia of cattle from this country, at a comparatively small expense; by the development of a single vaccine for blackleg, which has been used upon millions of cattle and has reduced the losses in infected herds of cattle to less than one per cent., thus saving many millions of dollars to the cattle industry; by the development of a federal meat-inspection service which last year inspected at the time of slaughter 38,829,439 carcasses, insuring healthy meat to domestic consumers and enabling the government to certify to the wholesomeness of that which is exported; by its successful control over the exportation of live animals, a trade embracing 300,000 to 400,000 cattle and 200,000 sheep a year, and which has done away with all unnecessary suffering aboard ship and reduced the losses to 0.13 per cent. with cattle and 0.89 per cent. with sheep; by the successful investigation of many diseases and the dissemination of a vast amount of information relative to the breeding and management of domesticated animals in health and disease.

These are only the principal lines of work undertaken. Every outbreak of disease which is supposed to be contagious is promptly investigated, and in case any are found dangerous to the animal industry of the country the proper measures are applied. Scientific researches are constantly conducted and are throwing new light on the nature of diseases and the means applicable for their control. The objections raised in other countries to our animals or animal products are carefully watched, and the causes removed when well founded, or explained when they are brought with a misunderstanding of the facts.

Economic Work of the Bureau of Plant Industry: Professor B. T. Galloway, chief of bureau.

The organization of the Bureau of Plant Industry was first described. It was pointed out that the general policy of the bureau is to give the broadest opportunities to its individual workers, recognizing the fact that the best results can be accomplished by giving to each individual such responsibilities as will lead to the strongest development of both the man and the work. The bureau's work is handled by problems rather than by groups of subjects. It was pointed out that while the object of the bureau's work is practical in all things, the policy is to encourage scientific research in every way, it being recognized that scientific investigation is the basis for all applied work. The work of the more important branches of the bureau were then briefly reviewed. Examples of the methods of handling plant diseases were given, showing the relation of laboratory research to the securing of practical results in the field. Various methods of handling diseases of crops were described. Treatments by direct remedial measures were discussed; treatments, or preventions, by the securing or creation of immune sorts, were described, and the other methods followed in this line of work were brought out. The work in physiology was described, especial attention being given to the results obtained in the laboratory investigations on nitrifying organisms. The

economic bearing of the plant-breeding investigation was shown. The efforts being made to increase the protein content of corn, and the creation of new varieties of corn for special purposes, were described in detail. Some of the new creations in the matter of fruits were also discussed. The work of the bureau in the matter of foreign explorations for the purpose of securing new plants for use in this country was described. Finally there was given an outline of some of the important work of the botanists in the matter of investigating poisonous plants, and the results accomplished in finding antidotes where the injuries to stock, through the eating of such plants, had proved serious.

Economic Work of the Bureau of Chemistry: Dr. H. W. WILEY, chief of bureau.

The science of chemistry is the first mentioned in the organic act creating the Department of Agriculture. Chemistry, botany and entomology were the three fundamental scientific divisions recognized in the establishment of the department. And the chemist was the first man appointed to investigate the economic problems relative to agriculture in which chemistry is concerned. I will try to give you some idea of the extent and character of this work. In 1886 as vice-president of Section C at Buffalo I gave an address on 'The Economic Aspects of Agricultural Chemistry.' So you have on the records of this association what I have to say on the subject. There has been little change, and I can only offer illustrations and use data not then available. In the first place, chemistry has established the principles of scientific crop feeding. The business of fertilizing in this country has grown enormously. Until twenty-five years ago fertilizing was altogether empirical. When a farmer had any fertilizer to use he spread it all over his fields and used the same kind for all parts of his farm. The patches which yielded the poorest were of course most treated. He had no idea of what was needed or how it should be used. When commercial fertilizers came into vogue many were of poor character and some farmers were rather badly cheated. However, the general effect was good and lands in almost every state in the union have increased in value in consequence of the adoption of the principles laid down by agricultural chemistry. Much better results may yet be obtained when the needs of the soil and plant life are given more attention by the farmer. The researches of agriculture in plant life show often that only certain elements essential to plant growth are lacking in a particular soil, and that others, not always present elsewhere, can be found here in abundance, so that some constituents of the ordinary fertilizer may be left out and others should be present in even greater quantities. It is not necessary to supply a complete fertilizer for each field. The needs of the field should be determined beforehand, and this the agricultural chemist is doing. The great problem is not only how to conserve fertility, but how to increase it when it has been diminished. There is no reason to believe that there will be any reduction in the ratio of the food supply to the population. The former will increase as rapidly as the latter. I might refer to the address of Sir William Crookes a few years ago before the British Association for the Advancement of Science, in which he looked forward to a period about thirty years hence, when humanity would begin to suffer very seriously from a lack of land of the proper productive capacity to feed all of us, until finally there would not be enough food to go around. There is no

longer ground for such fears. The productiveness of the soil will keep pace with the increase of population. When it is necessary to produce 1,000,000,000 bushels of wheat annually in this country it will be forthcoming. The part of the doctrines of Malthus which holds that the food supply can not be made sufficient to maintain the increasing population as the years go by, in my opinion, is absolutely groundless. The food supply will always be sufficient, but that supply must depend largely upon the researches of agricultural chemistry. The farmer to-day can prepare steers for the market at one third less cost than he could twenty-five years ago, because he knows how to balance the rations in the right proportions. He also knows how to bring his stock into the market at an earlier period and thus effect another great saving. The cost of feeding farm animals to-day is only about two thirds what it would be had not the principles of science been applied to raising stock on the farm. After a while perhaps we will be able to study the scientific feeding of man. He is an animal too, you know. If we want a man to be an athlete we feed him in a certain way, and so the time is not far distant when we must learn to feed all kinds of men for the markets just as we do the other animals. And so economy will come in the feeding of men as well as in the feeding of what we are pleased to call the lower animals. We shall save at least one third and shall still have as much as is good for us.

Here is another way in which the principles of agricultural chemistry will prove of economical value. I refer to the idea of securing elements necessary for the growth of the plant from the nitrogen in the air. It has been suggested that the nitrogenous material now in the soil is insufficient for a very great period. But it may be augmented yearly by the floods of which Professor Moore has spoken, by damming rivers, etc., and the use of water power thus secured for converting the nitrogen of the air into forms available for plant nutrition, by electrical means. This, with the nitrogen already available, is more than enough for present and future needs. With a sufficient food supply for the present we can look with complacency upon our rapidly increasing population, and rely on agricultural chemistry for all additional food needed.

Economic Work of the Bureau of Soils: Professor Milton Whitney, chief of bureau.

The Bureau of Soils of the United States Department of Agriculture was organized as a part of the Weather Bureau about eight years ago. Since its organization it has been separated from the Weather Bureau and reorganized into an independent division, and later into a bureau, its rapid growth in size, scope and efficiency having been remarkable. One of its most important lines of work is the soil survey which, while not in itself immediately productive, really constitutes a more intelligent basis for the development of other economic work in agriculture than has hitherto been available. In the strenuous competition for agricultural supremacy existing between different countries, states and individuals, a thorough knowledge of all factors bearing on agriculture is essential. The soil is one of these factors, just as climate, insects and plant diseases are others.

As an illustration of the economic value of the soil survey work may be mentioned the introduction of Sumatra tobacco in the Connecticut valley. A soil survey made in that valley in 1899, showing the distribution of the different soils, disclosed a soil producing a leaf which was the closest approach to the Sumatra wrapper. While

the Connecticut tobacco then brought an average of twenty cents per pound, the imported leaf commanded from $2.50 to $5 per pound. By growing Sumatra seed under cheesecloth tents, erected at a height of nine feet over the entire field, this covering modifying the climatic conditions, and with radical changes in the methods of cultivation and fermentation, a wrapper leaf has been produced equal at least in all respects to the imported article. This past season 700 acres have been grown, the product of which is valued at $1,000,000, bringing on an average from $1.50 to $3 per pound, compared with twenty cents per pound for the ordinary Connecticut wrapper; and an industry has been established which will pay 100 per cent. and over on the investment. Capital is attracted by reason of the fact that a large expenditure can be made on a small area with large returns, or on a larger area with proportionally large profits. An expenditure of $650 per acre yields a return of 100 per cent. or more over and above all expenses. This is a productive industry that has been developed by the bureau, and which is attracting the investment of enormous sums of money.

Another illustration is in the discovery of a soil in Texas which will produce a leaf possessing all the desirable qualities and aroma of the Cuban product. These lands are entirely undeveloped, principally uncleared and practically valueless for other crops, yet tests of the leaf produced, made by experts, show it to be far superior to any of our domestic filler tobacco.

A soil survey made in the Yazoo delta, Mississippi, has brought attention to a soil which, covering enormous areas, has heretofore been regarded as absolutely worthless, but which with a slight expenditure for protection from overflow would produce from $200 to $1,000 per acre, being particularly adapted, by reason of fertility and climatic and market facilities, to trucking.

Another line that has been productive of useful results has been the study of alkali soils of the west. It has been thoroughly demonstrated by practical experiments of the bureau that excessive alkali may be removed by drainage, and thousands of acres of land now worthless may be reclaimed and made productive. A careful study and practical experiments are now in progress, and already the success achieved has thoroughly demonstrated the success of these operations.

Economic Work of the Office of Experiment Stations: Dr. A. C. TRUE, director, Office of Experiment Stations.

This office is so related to the agricultural colleges and experiment stations as to constitute a general agency for the promotion of agricultural education and research. On the economic side, the agricultural colleges, chiefly through their research departments called experiment stations, are doing a large and successful work directly for the improvement of agriculture, by increasing the amount of production and at the same time raising its quality through the application of science to agriculture. But it is on its social or educational side that the experiment station movement is destined to exert its most profound and permanent influence. For the scientific researches of the stations and their application to agricultural practice not only provide much material for effective courses of instruction in the theory and art of agriculture, but they also furnish to the farmer the hitherto lacking motive for definite technical education along the lines of his art. This is changing the intellectual attitude of the farmer from conservatism to progressiveness. If, as now seems likely, the stations and the Department of Agriculture shall erelong succeed in arousing the mass of

farmers to a progressive attitude of mind, and put the center of interest of the vast and fundamental industry, agriculture, in the future, they will accomplish a work of incalculable importance—a social revolution the like of which has never before been seen. This subject is well worth the earnest consideration of students of economic and social science. The important thing to note here is that it is the present policy of the Department of Agriculture to aid broadly in the education of the farmer along the lines of agricultural science, in the belief that the broadening and deepening of the intellectual life of our rural population are as important, to say the least, as the improvement of their material conditions.

The Office of Experiment Stations promotes the general interests of the American system of agricultural education and research in several ways: (1) It collects and diffuses information regarding the progress of agricultural science the world over through a monthly journal called the *Experiment Station Record* and through numerous technical and popular bulletins; (2) it seeks to formulate the principles on which institutions for agricultural research should be organized and managed, and exerts its influence to secure the practical application of those principles in the management of the state experiment stations; (3) it aids the movement for the technical education of the farmer by encouraging the formulation of a distinct science of agriculture and its reduction to 'pedagogic form'—to meet the requirements of different classes of students. It is now especially promoting the establishment of secondary courses in agriculture and the extension of farmers' institutes.

Besides its general functions, the office has at present certain special duties. It has organized and directly manages agricultural experiment stations in Alaska, Hawaii and Porto Rico, and in cooperation with agricultural colleges, experiment stations, state officials and private organizations in different parts of the country, it is conducting investigations on the food and nutrition of man and on irrigation.

Its nutrition investigations have a broad economic bearing as affecting the food habits of our people and as contributing to the scientific basis of the teaching of home economics in our schools and colleges.

Its irrigation investigations deal with the laws and institutions of communities whose agriculture is wholly or in part dependent on irrigation, and treat of social and economic problems of fundamental importance to such communities.

The office is also beginning studies regarding the use of various kinds of power in agriculture and other subjects in the domain of agricultural engineering, hoping to lay the foundation for a broad treatment of this hitherto neglected branch of agricultural science by the department.

Economic Work of the Division of Entomology: Dr. L. O. Howard, chief of Division.

The work of the Division of Entomology is to investigate insects directly or indirectly injurious to man, and to endeavor to lessen the damage which they bring about. It also includes an investigation of beneficial insects. It has been estimated that insects injure the agriculture of the United States to an extent of more than three hundred millions of dollars annually, and it is further estimated that were it not for the continued investigations and suggestions of economic entomologists, this money loss might any year reach the sum of four hundred and fifty millions to five hundred millions of dollars. The sum expended by the government for investigations of this character, whether under the

state agricultural experiment stations or under the Department of Agriculture, amounts to less than two hundred thousand dollars annually. Public interest in this work and confidence in the recommendations of entomologists is growing. This means that the service is being encouraged by larger appropriations. When the speaker came to Washington twenty-five years ago four thousand dollars was appropriated for this work, which was carried on by two men; now nearly one hundred thousand dollars is appropriated and about twenty-five scientific experts are employed. The work is well systematized and is being carried on under the following heads:

1. Field crop insect investigations, including a southern section which comprises the insects injurious to cotton, tobacco and sugar cane, and a northern section which investigates the species damaging cereals and forage plants.

2. Fruit insect investigations, with a northern section devoted to the deciduous orchard fruits, and a southern section which cares for citrous and other tropical fruits.

3. Small fruit and truck crop insect investigations.

4. Forest and forest-product insect investigations.

5. Insecticide and insecticide machinery investigations, which include a section of field operations and experiments and a section of chemical analyses and tests.

6. Investigations of insects affecting stored products, such as cereal, animal and other food substances, materials and fabrics of all sorts.

7. Investigations of insects in relation to diseases of man and other animals, and as animal parasites. The enormous importance of mosquitoes in relation to malaria and yellow fever, and of flies to typhoid, has drawn very general popular attention toward this phase of the work.

8. Special insect investigations, which include a section for the investigation and introduction of beneficial insects, a section for the study of fungous and other diseases of insects, and a section for emergency and unclassified work.

9. The conduct of an insect laboratory and the care of collections, as well as the care of an experimental garden.

10. Investigations in bee culture.

11. Investigations in silk culture.

The speaker, with some little detail, described some of the operations carried on under these respective heads, and dwelt especially upon the work now being prosecuted in Texas against the Mexican cotton boll weevil, an insect which has caused a money loss to Texas cotton planters, during the past three years, of approximately seventy-five millions of dollars. He showed that this insect may be practically handled by simple variations in the cropping methods in use in the state of Texas, and described certain large-scale demonstrations which have been carried on during the past year upon farms of 150 and 200 acres, respectively.

He also spoke especially of the introduction of a fig-fertilizing insect from Algeria which has rendered possible the cultivation of the Smyrna fig in the United States, and also of the recent introduction of a lady-bird beetle from China which feeds upon the San José scale.

Economic Work of the Biological Survey: Dr. C. HART MERRIAM, chief of Division.

The Biological Survey comprises three independent sections: The Biological Survey proper, which studies the geographic distribution of animals and plants and determines the boundaries of the life zones and crop zones; the section of economic ornithology, which studies the food and

food habits of birds with respect to agriculture and horticulture; and the section of game preservation and introduction, which has jurisdiction over matters covered by the provisions of the Lacey Act, and also of the game laws for Alaska.

The Biological Survey proper carries on field explorations in all parts of the country, but does most of its detailed work in the west. It collects data and prepares maps showing the actual distribution of various species of mammals, birds, reptiles, trees and shrubs, and determines the boundaries between the several life zones and areas. By a study of the associations of species distinctive of the several zones in connection with the crops found to thrive best in parts of these zones, it prepares lists of the particular varieties of fruits and other agricultural products adapted to each belt.

The section of economic relations, by studying the food habits of birds in the field, and the stomach contents of birds in the laboratory, determines the economic status of various species of importance from the standpoint of practical agriculture. Birds are studied by species and groups, and an effort is made to ascertain the food of each species during each month in the year and from different parts of the birds' range throughout the United States, so that the results arrived at may be authoritative and final. Among the groups thus far treated are the hawks and owls, crows, blackbirds, orioles, cuckoos, shrikes and sparrows.

The section of game protection and preservation inspects importations of live birds and mammals from foreign countries in order to prevent the introduction of noxious species, such as the mongoose, the large fruit-eating bats, the starling, kohlmeise, and others, and gives permits for the introduction of non-harmful species. It has charge, also, of matters of federal game protection and the interstate commerce in game shipped in violation of state laws. It publishes digests of the state game laws and laws for the protection of birds other than game birds, and other literature bearing on the general subject of game protection.

The Economic Value of the Remaining Public Land: J. D. Whelpley, Washington, D. C.

The land office of the United States has had under its control for disposal under such laws as have prevailed from time to time an area probably amounting to about one billion five hundred million acres of land. About one billion acres of this land have passed from government to private ownership. About five hundred million acres remain subject to the law of congress.

The economic value of the one billion acres which have already been disposed of has been fully demonstrated. The world power of the United States as a nation has become great in direct ratio to the development of the natural resources of the public lands. The tremendous increase in wealth resulting from the rapid settlement of the one billion acres of public land has blinded the people of this country to the serious defects which have existed in the laws governing the disposal of the same.

Not one hundred million acres of the five hundred million remaining are suitable to profitable and comfortable occupation by American citizens under existing economic, physical and social conditions. It is now generally recognized that it is of supreme importance that the government should intelligently conserve the possible economic values of that area of the United States which is still included within the limits of the public domain. Room is needed for more population, more raw material is necessary to maintain our manufacturing industries, and one homesteader

and his family settled happily upon 160 acres of carefully tilled land is worth more to the industrial, commercial, transportation and social interests of the country than the non-resident ownership of a range industry covering many thousand acres.

Every Secretary of the Interior for twenty-five years past has recommended a curtailment of the land privilege. Congress has responded in some degree to this demand, but there is immediate need of radical changes in the laws now upon the statute books. Not another acre of the public lands should be sold for cash or its equivalent. Residence and cultivation should be required before title could be obtained, and this residence and cultivation should be at least five years, so as to insure a permanent and not speculative interest in the holding. The desert-land law and the commutation clause of the homestead act should be repealed, for while there may be isolated cases produced in evidence of the alleged beneficial character of these laws, a vast majority of the land acquired under these filings is for other than the legitimate purpose of settlement, occupation and general development of the country.

In 1902 about twenty million acres were taken from the public domain under the various laws now on the statute books. It is estimated that there will be nearly twenty-five million acres appropriated in 1903. In 1901 there were but sixteen million, and yet at that time that figure was considered enormous and alarming. Those who are building up large land holdings in the west realize that public sentiment is aroused, and they are crowding in every direction to secure title to as much land as possible before congress takes this matter in hand.

It has been argued against the repeal of these laws that the fund created by the national irrigation law from the sale of public lands would be destroyed. In the first place, if these laws were repealed today and existing rights allowed to be perfected there would probably be about twenty million dollars in the reclamation fund. The government would reap an enormous profit on the investment, even if it were necessary to appropriate one hundred million dollars to maintain the fund for reclaiming the arable public lands of the west rather than to allow a continuation of the present system.

The cream of the people's land is being skimmed each year; and with less than a hundred million acres which may be considered as reasonably possible of settlement, it can be but a very short time, at the present rate of segregation, before this has disappeared and the area which congress proposed to improve for the home-builders will have been included within the boundaries of great pastures producing not a thousandth part of their possible annual contributions to the wealth and prosperity of the country.

Outlook of the Timber Supply of the United States: Professor B. E. FERNOW, director, State College of Forestry, Cornell University.

This paper reviewed, upon the basis of the last census and of other statistics, the consumption of wood products in the United States, and the probabilities of meeting the same from the virgin supplies still on hand.

Contrary to expectations, the wood consumption of the leading industrial nations has, in spite of substitutions, constantly increased during the last forty years, and that greatly in excess of the increase in population, as a result of greater industrial activity and higher civilization; the increase in per capita consumption in Great

Britain being by five per cent. annually in the average; for Germany and France, ten per cent., and for the United States the apparent increase indicated by census statistics is above this last figure.

The total wood consumption for the United States is placed at round twenty-five billion cubic feet, of which over seven billion is log-size material, the important part needed for the industries.

After analyzing the relative value and importance of the different parts of this consumption, in which the conifers are shown to furnish three fourths of the log-size material, the question of supply is discussed.

It is shown that Canada, the only country from which such supplies can be imported, can not be relied upon for any length of time.

A probability calculation of the present stand of virgin timber in the United States, ready to supply the demand for lumber, although admittedly on a slender basis, brings out the improbability, if not impossibility, of meeting the increasing demand for another thirty years, under present methods of utilization. Even if the entire forest area of 500 million acres were supposed still fully stocked with the average stand per acre, as reported by the census in the holdings of lumbermen—an absurd proposition—the stock on hand would be exhausted within that period.

The possibilities of securing the requirements from the reproduction in the natural forest are discussed on the basis of European experiences, and with proper reference to the damaging forest fires. It is shown that even under good forestry practice, the present increasing demand could from the present area be supplied only for a limited time. Hence the efforts to secure such forest management and greater economy in the use of timber are not too early, but rather too late, and the dallying with the problem by the legislatures fatal.

Sociological Aspects of the Irrigation Problem: Guy E. Mitchell, editor, *The National Home-Maker.*

The reclamation of arid America through government construction of irrigation works will furnish for years to come an effective outlet for the industrious surplus of our great cities. The irrigation sections of the west present almost ideal rural conditions. The tendency is, where water is used for farming, to subdivide land into small individual holdings, which gives to a community a prosperity and stability not found in larger farming districts, nor in cities. This is not a new idea. But while this is being done, the people of the entire United States will become so educated on irrigation matters and irrigation methods that there will be a gradual spreading eastward of the irrigation idea, which will eventually result in the subdivision of great numbers of large eastern and southern farms and plantations which are now farmed without thought of artificial water supply, into smaller irrigated farms. Never a season goes by even in the best watered districts of the rain belt that there is not some period of plant growth where the judicious application of water would very greatly increase the yield, and in some years double and treble it. It takes only a year of excessive drought among eastern farmers to get them talking about irrigation, but little comes of it, for the reason that they are entirely unfamiliar with irrigation methods and have no idea how to go about the practice of supplementing the natural water supply.

The irrigation then of the one hundred million acres of western plains and valleys, while it will create innumerable small rural homes of five, ten, twenty or thirty acres

each, will serve further to encourage subdivision of larger areas in the east and south and tend to make the small farm and home a general rule throughout the entire country.

Under wise administration, arid America has a glorious future. With her countless small farms and rural homes, communities where people live in the open air, till the soil with their hands and yet enjoy the privileges and advantages of the city, she will prove the sheet anchor of the republic in any time of national peril, while from her will radiate eastward the same idea of the division of the large into small farms and the utilization of the stream and the pond in making certain and increasing an oftentimes unreliable crop.

An Inquiry Into the Composition of Creamery Butter: Major HENRY E. ALVORD, chief of Dairy Division, Department of Agriculture.

The value of butter depends upon the fat it contains, and although there are necessarily other constituents, and they have value, they should not be in excess. This is especially true of the water content. Purchasers do not wish to buy water by the pound at butter prices. The product of creameries, or the factory system, is the leading grade of butter in the markets. Creamery butter has been alleged ordinarily to carry too much water. There has been no reliable basis for such assertions, and it has seemed desirable to ascertain the facts.

During the year 1902, the U. S. Department of Agriculture (Dairy Division) has had opportunity for examining 730 different packages of butter, representing the product of 400 different creameries, located in eighteen states. The butter was made in May, June, August and September. Moisture determinations were made on 802 samples. The range of water content was found to be from 7.20 per cent. to 17.62 per cent., and the general average was 11.78 per cent. There were but three results below 8 per cent. and only eight above 16 per cent. Seven eighths of the 802 samples were between 10 and 14 per cent., and more than half between 11 and 13 per cent.

Making all reasonable allowance for error, it seems safe to state that American creamery butter, during the months named, has an average water content not exceeding twelve (12) per cent.

Education for Farmers: Professor WILLET M. HAYS, Minnesota Agricultural Experiment Station.

The states are gaining charge more and more of education. By unifying the primary and graded schools, the city high schools, and the universities and colleges into an articulated system, education has been greatly promoted. But the current in this system is away from the farm, and a parallel system is suggested in which the student must go against the current to leave the farm. The suggested system includes the consolidated rural school, with free transportation of pupils, serving an area three to five miles square; the agricultural high school, serving ten or more counties; and the agricultural college, serving the entire state. The consolidated rural school supplies superior primary education; could include some studies of rural industries; and a small demonstration farm and garden could be added to the equipment. By extending the course in the consolidated rural school to include the freshman and sophomore high-school studies, the pupils are longer under the parental roof; and the expense of non-resident study in the agricultural high school is reduced to the junior and senior years, which study may be made largely technical. The civic and economic,

as well as the educational, value of such a system is urged.

School Gardens: Miss Louise Klein Miller, director of the Lowthrope School of Horticulture and Landscape Gardening for Women.

Educators are becoming alive to the importance of school gardens as a potent factor in education, and the next five years will see rapid progress in this direction.

The schools of Europe are far in advance of us in this phase of education, and the agricultural and horticultural progress is largely due to the efficiency of the school gardens. In Austria-Hungary alone there are 18,000 school gardens. In France, the teachers are required by law to be able to instruct their pupils in the elements of agriculture and horticulture, and normal schools have been established for the purpose of giving teachers such training. No plans for school buildings to which the state contributes are approved unless accompanied by plans for a school garden. The study of horticulture is compulsory in Belgium. In Germany and England, school gardens are encouraged, but not regulated by law. Some excellent work has been done in this country, but in many instances the educative features have been made subservient to the raising of vegetables.

The theory and practice of gardening satisfies certain dominant interests in a child's physical, mental and moral evolution; affords an opportunity to expend normally and naturally often misdirected energy; develops an appreciation of the proper values of things; quickens a knowledge of the close interrelations in nature; gives fundamental principles of great economic significance; suggests some of the great problems in the struggle for existence; teaches the dignity of labor and personal responsibility.

The day is not far distant when a supervisor of school gardens will be as important an officer in a school system as a supervisor of music or drawing. Children are not satisfied with evasive answers. They are alert, inquisitive and intelligent, and a teacher who wishes to gain their confidence and keep their respect must be able to respond to most of the demands made upon her, and have her knowledge at her tongue's end and finger tips. This is an open field for women, and in this capacity an earnest, capable and enthusiastic teacher can render valuable service to the public good.

A difficult problem for the economist and sociologist to solve is the herding together of a large population in a crowded city. Strenuous efforts are being made to turn the tide countryward, and induce persons to seek homes where life will be freer and more wholesome. If the elements of agriculture and horticulture were taught in country, town and, so far as possible, in city schools, in an intelligent, scientific and attractive manner, life in the country would be the joy that the opportunity affords.

Frank H. Hitchcock,
Secretary.

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*THE UPPER TEMPERATURE LIMITS OF LIFE.**

The upper temperature limits of continued and active life are possible of observation most satisfactorily in the case of the organisms inhabiting hot springs. Such springs are widely distributed in both hemispheres and vary in temperature from tepid to boiling. In all these springs, except in the very hottest waters and in those in which there is something in the chemical composition which prevents, organisms have been found. Various indi-

* Abstract of an address before the California Chapter of the Sigma Xi, Berkeley, April 28, 1903.