This paper was presented by Senator Clinton P. Anderson at the Centennial Dinner in connection with the 100th anniversary of United States Agriculture and Land Grant Colleges on Friday, October 26, 1962, just four days prior to the Seventh Annual New Mexico Water Conference. Since the paper included so much in connection with water, it was felt that it should appropriately be included along with the report of the Water Conference so that it might be available to many of those who attended the Centennial Dinner and the Water Conference.

THE TECHNOLOGICAL REVOLUTION IN AGRICULTURE IN THE UNITED STATES BROUGHT ABOUT LARGELY BY LAND GRANT COLLEGES

Clinton P. Anderson[1/]

It is a source of pleasure to be invited to participate in the observance of the centennial of the land grant college system and the 75th anniversary of the Hatch Act which established our agricultural experiment stations.

These institutions have a large measure of responsibility for the revolution that engulfs the world today--the revolution against want, against the malnutrition, unnecessary disease and suffering which accompany such want. The technological revolution in agriculture in the United States, which the land grant colleges have largely brought about, has demonstrated to the people of the world that want can be banished and they are determined that it shall be. The same colleges may very well hold the key to the outcome of the collateral struggle which accompanies the revoluation against want--the cold war between communism and the free world.

President Abraham Lincoln signed into law three acts of great historic importance. Infrequently associated with his administration because he was a war president.

One was the act creating the Department of Agriculture. The second was the Homestead Act. The third was the Morrill Act offering federal land grants to each state for the establishment and maintenance of institutions of higher education.

In the early histories of Lincoln's administration, these three Acts have been all but overlooked by the

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historians. In another century, the Morrill Act of 1862 may prove no less important than the document for which he is most famed--the Emancipation Proclamation.

The Morrill Act was a momentous step in the development of the educational policy of the United States. It represented a determination by the national government to make higher education available to all of its citizens and to disseminate as widely as possible, through such peoples' colleges, available knowledge in such practical fields as agriculture and the mechanic arts.

The subsequent Hatch Act of 1887, to provide for the establishment of agricultural experiment stations, was an equally momentous step in the development of national research policy--a decision to provide public endowment for research in a practical field on a geographically widespread basis, expanding the exploration for new knowledge beyond the struggling research laboratories of a relatively few private colleges and universities, business institutions and individuals.

There were some very fundamental policies involved in the research policy decisions embodied in the Hatch Act, including the determination that, even in this then new nation's private enterprise economy, the federal government could properly augment research in fields where the public interest is great and the general welfare is heavily involved.

Interestingly, the Act was sponsored by two gentlemen who had previously participated in a rebellion against federal authority: Congressman William H. Hatch of Missouri and Senator James George of Mississippi, both former Confederate Army officers.

Two of the principal opponents of the Act were Senators Joseph R. Hawley of Connecticut and John J. Ingalls of Kansas, both former Union Army officers.

The measure can be described as a bi-parties product, for it was approved by a predominantly Republican Senate as well as a Democratic House of Representatives. It was signed by President Grover Cleveland, a Democrat.

There was a third important step in the development of our national education and research policies--the establishment of a system for communicating new knowledge widely, an extension education system to take out from the colleges and universities to all citizens who would take advantage of it, the expanding body of practical knowledge available through the land grant institutions.

Democracy is more than a system of social communication to those of us who were born and reared and have spent our full lives in a democratic country. It means equality of opportunity and the right to participate in the development of policies all the way from local government to the national level.

The democratic educational system and our mechanisms for social communication, exemplified by our land grant institutions, are the logical outgrowth of the basic democratic concept of the equality of man and the right of every citizen to share in opportunities--including knowledge. They make possible the achievement of such widespread application of scientific techniques that we have demonstrated that all mankind can have abundance and freedom from ignorance, want, fear, and oppression. Thus, the Morrill Act which Abraham Lincoln signed, may ultimately be credited with creating more of freedom for mankind than did the presently far more renowned proclamation abolishing slavery.

The land grant college system is entitled to all of the acclaim it is receiving in this centennial year for its key role in developing and demonstrating, particularly in the field of agriculture, the effectiveness of these democratic research and educational policies. The constantly increasing productivity of our farms has <u>not</u> resulted just in the production of an abundance of food for all our citizens, plus a so-called surplus. It has freed a large part of our population to provide abundant industrial production. It has provided a good deal of research and many new processes and techniques beyond the field of agriculture. It has made possible the conservation and maintenance of our land resource, lack of which has caused the downfall of nations in the past. It has made not only possible but desirable the utilization of land for nonagricultural uses. We can afford to take enough land out of agricultural production for highways and airports and for millions of our citizens to live in individual homes with a little breathing space about them, and to provide recreational facilities--even wilderness--without endangering food and fiber supplies.

The record of this first century of the land grant college system is one of which to be very proud. It has had a far greater effect on the course of world history than most citizens, involved in day-to-day activities and decisions, have stopped to realize.

It is because I appraise so highly the key role of the educational institutions brought into being by the Morrill Act, both in their past performance and future potentialities, that I am happy to have a part in an occasion like this.

One century is only a beginning--the moment of birth--in historic perspective.

The state university and land grant college system is certainly only in the infancy of its potential service to the nation, and to all mankind.

There is agreement on both sides of the Cold War that a great scientific revolution is under way. There is a demonstrated world-wide belief that the side which moves ahead the most swiftly in scientific fields will win the ideological struggle between free and dictatorial forms of government.

The free portion of the world clearly has the lead in the area in which the land grant colleges and univiersities have specialized: the technology of agricultural production.

But far more remains to be done if free institutions are to win the race for world-wide adherents.

The Agricultural Committee of the National Planning Association recently proposed that you be given an international dimension in the agricultural field, with a responsibility not only for supplying and training agricultural technicians for other free world countries, but also for assisting them in establishing their own institutions for research and instruction in the field.

This should be done.

The Planning Association Committee was quite severe in its comments on past performance in the international agricultural development field as being the result of "drift rather than design." The national government must take a very large part of the responsibility. Year-to-year authorizations and appropriations for foreign aid programs have not been conducive to the development of well designed, long-term proposals.

Regardless of where fault lies for "drift rather than design," I believe that if the land grant institutions will develop and propose a program for international assistance of the sort proposed by the National Planning Association. Congress will authorize it. When need is as clearly recognized as it is in this instance, Congress ultimately does what should be done.

The report of the National Planning Association's Agricultural Committee itself has a serious shortcoming, reflecting an all too common impression that the Morrill Act institutions are single purpose, <u>agricultural</u> education and research centers.

The charter of the land grant institutions is a broad charter.

The original Morrill Act of 1862, and subsequent revisions of that Act, all provide that the land grant funds provided shall be devoted "...to the endowment, support, and maintenance of at least one college (within each State) where the leading object shall be, without excluding other scientific and classical sudies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislature of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

This is not restrictive language. The author took precautions not to exluce "other scientific and classical studies" from the field of these colleges. He gave as much emphasis to the mechanic arts as to agricultural, and he referred to "the several pursuits and professions," not to a single one.

There is abundant room for the land grant college system to expand, and there are many areas, including the international field already discussed, where your services and the genius you have demonstrated in the agricultural field are urgently needed.

There are two areas in which I would like to see the colleges heavily involved. They relate to agriculture but are not exclusively agricultural problems and they should not be dealt with as such--the fields of recreation and water resources.

The Outdoor Recreation Resources Review Commission made a very extensive study of the recreational desires, or demands, of American citizens. A scientifically selected cross section of 19,000 Americans was questioned in detail about their present recreational activities, and what they would like to do if they had a little more time and a little more income.

We found that the bulk of recreational demand is not for elaborate, far-off recreational opportunities, but for simple, relatively nearby activities: a short drive for relaxation, a walk in the woods or beside a stream or lake, a short picnic or fishing trip, a place to play outdoor games, to swim, or to ride a bicycle. Even annual vacation trips, in more than half of all instances, are within a 500-mile distance.

There was a time, a couple of generations ago when "grandpa's farm" was a great recreational center. Sons and daughters who had moved into the towns and cities returned to their birthplace to enjoy the out-of-doors, a big country dinner of chicken and dumplings--and to let their children become acquainted with farm animals and roam and romp in the meadows and the woods. Sometimes the family enjoyed a week or two on the farm. But our population has been so swiftly urbanized that only a fraction of us anymore have grandparents on the farm from whom we can sponge recreational opportunities.

There is unquestionably a chance in every area of the nation for some farm operators to add to their incomes, or even convert entirely to the recreation business. But whether or not this potential new farm "crop" is first overdeveloped, to the economic injury of those who fail at it, or comes along on a sound basis can depend to a large extent on guidance provided through land grant institutions.

But there is no restriction on the colleges and universities which limits them in the recreation field to farm-related aspects of the problem. The provision of urban as well as rural recreation is a pursuit and a profession well within the mandate of the Morrill Act where trained personnel and a great deal of research is and will be urgently needed for as far ahead as we can foresee.

The Outdoor Recreation Resources Review Commission estimated that recreation "activity occasions" will increase from the 4.4 billion level of 1961 to 6.9 billion in 1976 and to 12.4 billion in the year 2000. More people with more leisure, more income and greater mobility are going to maintain a pressure on recreation facilities which will require both public and private efforts to meet.

The second area to which I want to see the colleges apply their great abilities and potentialities is the field of water resources.

Two days after I introduced a bill in the Senate to provide financial assistance for the establishment of water resources research institutes at the State univiersities and colleges, the National Science Foundation approved a recommendation, yet to be generally released, that these land grant institutions be involved in research on all natural resource matters.

I am not in any disagreement with the Foundation recommendation.

Because of the urgency of water resource problems, it is my feeling that they should be given great emphasis, if not a priority, in the years just ahead.

The Senate Select Committee on Water Resources found, in its 1960 report, that four areas in the Southwest--the South Pacific, the Colorado, the Upper Rio Grande-Pecos and the Great Basin of Nevada--plus the Upper Missouri Basin in the Midwest, will have reached the limit of their water resources by 1980.

By the year 2000, the Upper Arkansas-Red, the Western Great Lakes and the Western Gulf regions will require full development of their water resources if anticipated demands are to be met.

Here in New Mexico, with the completion of the San Juan-Chama project, we will be virtually at the end of our presently usable water supply. We confront increasingly urgent problems of allocation to the most economic uses, increased efficiency in the uses made, reclamation of brackish and saline waters, and experimentation with weather modification to find a way to increase rainfall and the total of water available to us.

The new brackish water plant at Roswell represents a costly federal effort to extend water supplies, but an effort which will repay its cost many times, on a world-wide basis, if the research and experimentation proves up an economic method of purification. It is a project serving not just New Mexico, but areas around the world short of water of usable quality.

Because of our supply situation, phreatophyte control, and the reduction of evaporation and seepage in our management of the water we do have, are pressing problems for us, not only in terms of agricultural supplies, but to meet industrial, municipal and recreational requirements as well.

In reality, water problems are equally pressing in some of the humid States, where supplies are abundant but are being so seriously misused--polluted--that they are valueless to meet needs. Washington, D. C. is located on the Potomac River at tideland with a vast expanse of water on its western boundary--water so putrid that when a boat upsets the hapless occupants are rushed to the showers to prevent infections.

I am told that one of the greatest recreational opportunities in the nation is on the Delaware and Monongahela rivers in Pennsylvania. They are today so polluted with municipal and industrial wastes they contain virtually no aquatic life. Restored to reasonable purity, they could

provide swimming, camping and fishing opportunities for several million urban residents in one of the nation's most congested areas.

The Select Committee on Water Resources made five general recommendations for meeting water problems. The first was the preparation of optimum use plans for the water of every major river basin. The second was to appropriate funds to assist the States in Water Resource planning at State level.

The third recommendation was that the nation undertake a coordinated scientific research program on water.

The fourth and fifth recommendations proposed that an assessment of the water-supply demand outlook in each region and the nation be prepared biennially, and that steps be taken to encourage efficiency in water use.

The Interior and Insular Affairs Committee of the Senate, on which I serve as chairman, originated the Select Committee and its studies. It has a continuing responsibility of seeing that the recommendations of the Select Committee are acted upon.

Pursuant to that responsibility, the Committee is working on planning bills and this year undertook a study of the statue of water resources research in the federal government, and in the various water regions of the nation.

The Committee has obtained reports from federal agencies working in the water field on their research activities, and reports from more than a hundred colleges, universities, private institutions, firms and individuals--including land grant institutions in all 50 States.

These reports, shortly to be available as a printed Committee document, underscore several points of particular importance in relation to water research.

One of the major points made, in my mind, was the necessity of tying research and education together. Typical of the response in this area was the comment of Dr. Carl E. Kindsvater of the University of Georgia, who wrote:

> I would emphasize that research and education cannot be considered separately, for just as education is essential to the performance of research, so is research essential to the education process. I believe, therefore, that a considerable part of the Federal Government's investment in water-related research should be earmarked for the support and

intensification of university research and graduate study programs.

A second reason for stimulating college and university work in the water resources field is the present shortage of experts on hydrologic fields.

One agency in Washington, in the bureaucratic tussle for dominance in the developing water program, has even contended that it has all the well-qualified hydrologists in the nation on its staff. That is not so far-fetched as it may sound. There is only one school in the nation today where a scholar can take a full graduate course in hydrology--the University of Arizona--and that has been true there for only one year.

John C. Geyer, chairman of the department of sanitary engineering and water resources at Johns Hopkins University, responding to the Committee for his school, wrote:

> Scientifically trained people of exceptional ability rarely go into the water field. If an attempt were made to establish broadly based fresh water science research institutes, difficulty would be encountered in staffing them with competent people. Universities need support in developing water science training programs to provide staff for such institutes. Students should be attracted from all the sciences and professions and afforded an opportunity to pursue any of a variety of educational and research projects related to water.

A third point repeatedly emphasized in response to the Interior Committee inquiry was the necessity for involving many disciplines, or specialized fields of knowledge, in water research work.

In view of the shortage of scholars in the many related fields who have specialized in water problems, it is apparent that for a time, at least, water research projects should be located where scholars of many disciplines may be induced to work in the water resources field, to become specialists on water and to train others in the field. The colleges and universities are the one place where this may be possible.

There was one further point, or factor, which caused me to propose the establishment of water research institutes throughout the land grant system. This was their ability to work on regional problems and their experience in the field of communication; of disseminating and making useful to the agencies and the citizens throughout each State the knowledge which results from scientific research.

The reports of our Committee showed that many college and university faculty members were working and consulting with State planning boards, state water agencies, municipalities, irrigation districts, drainage districts, farmers and other individuals on water problems ranging from deep well supplies in the arid areas of the West to oyster propagation on the East coast; and from the planning of water management on small, individually owned tracts to the planning of water resources on a statewide basis.

The demand for research and scientific advice on water resource problems is broader even than the demand on the present agricultural experiment stations and the extension service. Water problems extend into the towns and cities and can be pressing problems for everyone--farmer, householder, industrialist, flood victim, sportsman, all of us. They vary from region to region, and there is need for a widespread system of laboratories which can investigate the specialized problems of their own area, as well as the broader national problems.

In the water field, as in the agricultural field, there is an extensive demand for practical results--for answers to immediately pressing concerns. Basic research--pure, scientific research aimed solely at understanding the laws of Nature, without regard for immediate practical results--is easily shunted aside, as it has been for too long in public and private profit research programs.

It will be a great mistake for the federal government, and for the colleges and universities, if, in the establishment of a coordinated water research program, we do not make a liberal allocation of funds for basic research work which will be unimpeded and unharrassed by the practical exigencies of the world at any particular moment.

So far as I can determine, federal appropriations have always gone almost exclusively to applied research. This was true in the case of atomic energy. The basic research had been done before a scientist sold Franklin D. Roosevelt on the possibility of perfecting an atomic bomb that would end World War II.

Our times call for more liberal support of basic research than it is now being given anywhere in the free world. We have a common responsibility to see that it is forthcoming.

There are people in politics who like to claim that they are New Dealers, or New Frontiersmen, or Progressives blazing new trails toward national and world abundance, security, and peace. This is the season which comes in each even numbered year, where these claims become the loudest.

In reality, those of you in the colleges and universities are the frontiersmen of our times, blazing trails into new physical and social science fields which may lead mankind around a cataclyamic war to the abundance and security upon which a lasting peace can be built.

The challenge of the second century to the land grant collges and state universities is to become leaders on these frontiers, to occupy new and critical fields of research, instruction and communication of scientific knowledge, just as rapidly as your persuasive power with public policy making and appropriating bodies will permit.

I have been tremendously gratified with the response of the land grant institutions--and other colleges and universities--to our inquiries in the water research field. A few of them are ahead of us, leading the way, as they should be. They already have established water research institutes or broader natural resource research institutes. All of the rest indicate a desire to move ahead.

The products of your research into scientific fields, and particularly into water and natural resource fields, are of far wider significance than their economic value within this nation alone.

They are items we can export--useful everywhere in the world where there are resource problems. They can tie free world countries more closely together, and perhaps even tie together political enemies like Pakistan and India, or Israel and Egypt in cooperative projects to solve mutual water and natural resource problems.

Ultimately, they might tie all mankind into a society which turns to science rather than conquest to solve its problems of security and abundance. I hope you will continue your contributions toward that end.