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WATER RESOURCES:
A BASIC COMPONENT IN THIRD WORLD DEVELOPMENT

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INTRODUCTION

The human achievement which most influenced the rapid expansion of homo sapiens was the development of agriculture. A small human population could have continued to survive by hunting and gathering. However, the cultivation of plants and the domestication of animals made it possible for hundreds, and eventually thousands, to flourish in abundance where only a few had found a meager existence.

That relationship between successful agriculture and development is no less valid today than it was 10,000 years ago. Where agriculture thrives, so does civilization; where each meal is wrestled from a harsh environment, there is little time or energy for creativity.

Just as agriculture is basic and central to development, so water is essential to agriculture. As the song says -- "you can't have one without the other."

POPULATION CONCERNS

In many ever-more-densely populated developing countries food production is the number-one concern. Yet, the quality and quantity of water available for food production is often less than optimum and technologies to overcome these constraints are not available.

Two-thirds of the inhabitants of these developing countries do not even have access to safe domestic water. They move ahead slowly and stoically against tremendous odds, with only occasional gratification or security. One constant source of pride is their children. So, they have many children -- to love, to help with the hard work of moving ahead, and to care for them in their old age. The children, in turn, become adults with the same problems and aspirations. For the same reasons they, too, have large families

For centuries, population growth throughout the world was limited by high infant mortality and brief life span. But this changed with World War II. Advances in medical, nutritional and agricultural knowledge have sharply reduced mortality and morbidity. As a consequence, death rates, particularly among young children, have

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declined sharply even in the least developed countries. Concomitant declines in birthrates, however, have not taken place except in the more developed countries. In the developing world, family planning has not yet had a wide impact on birthrates.

Developing-country populations are, therefore, still increasing rapidly and will continue to increase well into the next century. Much of our planet is being adversely affected by these rapid increases in population; many of the negative results are global. But it is in water-deficient areas that the population problem is most acute. Population growth rates are highest in some of these water-short regions. The news coming daily from drought-prone areas of Africa emphasizes this fact.

CRITICAL PROBLEMS IN THE TROPICS

The major concern of these rapidly increasing populations is often how to survive in a harsh agricultural environment. Many of those in rural areas have, at best, access to a small piece of marginal land, meager, if any, inputs and primitive tools. Some have no land of their own and are forced to use or, more commonly, misuse public lands in order to survive.

All tropical regions have critical problems. In humid upland areas, the high rainfall, often combined with poor soil management, severely reduces soil productivity. This is particularly true in areas subject to slash and burn culture. In the past, long periods of fallow allowed these lands to rebuild to a more productive condition. Now, with increasing pressure on the land resource, the fallow period is shortened, resulting in soil erosion, nutrient depletion and low yields. Farmers must learn to control the movement of water in order to minimize erosion, waterlogging, salinity and leaching of soil nutrients.

But as current events indicate, arid and semi-arid tropical regions are particularly vulnerable. Traditionally, many of the people who live in such regions are nomadic, moving from place to place in an annual pattern to follow seasonal water and vegetation. Now, the increasing numbers of people and livestock put intense pressure on these scarce natural resources which are often severely reduced or adversely affected.

The nomadic culture makes it difficult for the individual to take action to conserve soil and maintain crop productivity. Focus must be on group education if this situation is to be changed. Fortunately, experience with group interaction in irrigation systems provides some guidance in addressing this problem.

In recent years, increasing population coupled with land-use intensification and drought have accentuated another problem -- that of fuelwood shortage and associated deforestation. Water deficiency, along with inadequate forest technologies have aggravated this problem.

WATER RESOURCES

This is why your focus on water resources is so relevant. Research and development efforts are essential to help reverse the negative trends I have noted. Presently, there is a worldwide depletion of usable water resources. Even in the United States, aquifers that might have sustained moderate agricultural use for centuries have already been abused beyond easy reclamation. However, we in the United States have financial and geographic alternatives which cushion the effects of water depletion.

In the low-income countries of the more fragile tropical environments the alternatives are limited. But, effective use of water resources must be made if the populations of these areas are to survive. This wise use will involve not only agriculture but health and general economic development. I will use the agricultural sector as an example of an area where improved water utilization is essential if low-income countries are to succeed in their economic development efforts.

The current devastating famines in Africa are the result not only of years of drought and population increases, but of unwise public policies affecting water and land use and of a void in improved agricultural technologies. The malnutrition and starvation we are witnessing in these countries are more extensive and severe because fragile lands have been rendered unproductive and very little technology exists to deal with marginal agriculture. We just do not know enough about how to sustain small-scale agricultural endeavors where inputs are limited by poverty, and rainfall is meager and unpredictable.

A.I.D. AND RESEARCH

The U.S. Agency for International Development (AID) recognizes that research is essential to develop new technologies and to adapt existing technologies to the needs of developing countries.

We also know that particular attention must be paid to what will work best for small-scale subsistence farmers. Our objective is to stimulate and sustain research in and with developing countries so that in time they will improve their ability to overcome their own problems. In the long term, these efforts will provide a basis for profitable systems of production, marketing and utilization.

In recent years AID has moderately increased support for research that addresses some of the most pressing Third World problems. In FY 1981 AID obligated a little over \$158 million (\$158,276,000) for research. By FY 1983 that amount was over \$227 million (\$227,268,000). Somewhat more than \$366 million (\$366,269,000) has been requested by the Agency for research activities in FY 1985* -- more than double the FY 1981 obligation.

*These PPC numbers include DA and ESF funds.

Because water is so basic to life, many of our projects deal at least peripherally with water resources. However, we do have a few projects which focus directly on water-use issues. One, our Water Management Synthesis II project, is focused on water resources institutions in developing countries to improve the efficiency of existing irrigation systems. Another, in the planning stage, is the Dryland Soil and Water Management project which deals with the evaluation and improvement of existing dryland production systems.

This small sampling helps me to make two points. First, in the developing world, poor management of a system may be a central cause of failure. And second, where possible, AID strives to improve existing systems and institutions rather than to create new ones. We recognize the resource limitations under which we operate and want to assist countries as much as possible, given those constraints. For the same reasons -- to conserve time and resources and avoid duplication of effort -- we also favor collaborative research and technology transfer.

In arranging our research collaborations, we strive to identify and involve those institutions which have the greatest comparative advantage for the proposed work. These collaborations are implemented through grants, cooperative agreements and direct contracts. Let me briefly describe some of these relationships.

U.S. Institutions of Higher Education

U.S. agricultural colleges and universities have played a vital role in our foreign assistance efforts for several decades. They have demonstrated their effectiveness in building human and institutional resources for agriculture and other sectors in less developed countries. Their participation is a valuable component of U.S. development assistance.

As we have striven to eliminate Third World problems and their causes, we have also worked to build and fortify teaching and research capability within developing countries. Many of the modern Third World universities were created through partnerships with U.S. counterparts during the 1950's and 1960's.

The agricultural universities in India are prime examples of such collaboration. They have become the backbone of India's extensive agricultural education and research system. Other examples of such institutional development are found in several Latin American countries, in Southeast Asia, and in parts of Africa.

U.S. university collaboration with AID declined during the late 1960's and early 1970's. But, about a decade ago the relationship between AID and the agricultural universities was formalized and broadened through the enactment of Title XII of the U.S. Foreign Assistance Act of 1975. Through Title XII, AID has mounted a series of efforts that stimulate and enhance U.S. university involvement in development assistance. A few of these initiatives are of particular interest here.

Memoranda of Understanding (MOU) define the technical disciplines and geographic regions in which AID will use a particular university's expertise. The MOUs also identify core groups of university staff professionals designated for long-term A.I.D. support. This allows universities to make sustainable commitments to experienced professionals who will participate in AID-funded programs.

Another initiative, the Joint Career Corps, was implemented to provide university personnel with "real-life" development assistance experience while, at the same time, furnishing AID with much-needed scientific expertise. Selected faculty members are envisioned to spend about one-third of their career with AID, usually on two-year assignments overseas. These appointments alternate with four-year assignments back on campus which may include occasional AID consultancies. As part of the Agency staff, university personnel gain new knowledge and intensive experience abroad, the benefits of which they take back to their campuses and students.

The Joint Career Corps has a mirror-image; science-oriented Agency personnel join university staffs to take part in teaching, research or service activities. These generally are one-to-two year assignments during which A.I.D. professionals share their international perspective with university faculty, staff and students while, at the same time, gaining new insights and enhancing their own technical skills.

CRSPs

Many of the Title XII universities are now involved in AID's Collaborative Research Support Programs (CRSPs). These efforts combine the research resources of U.S. institutions with those present in developing countries to establish long-term programs. The participating universities are willing to make a substantial financial commitment to these efforts. I think this reflects both the intrinsic value of participation and the significant benefit of the programs to American agriculture.

The goal of the CRSPs is to identify and develop technologies that can overcome the most damaging Third World agricultural constraints. Efforts focus on new and adapted technologies that apply to various crops, livestock and fish; nutrition; and soil management. Texas A&M is involved in at least four of these CRSPs -- those concerned with peanuts, sorghum and millet, small ruminants, and tropical soil.

THE ROLE OF THE IARCS

AID is also an active supporter of many of the International Agricultural Research Centers (IARCs). Although all of the centers have programs relating to water management and efficiency of water use, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India and the International Center for Agricultural Research in the Dry Areas (ICARDA) in Syria have major research programs concerned with water resources.

We are also working with a relatively new IARC, the International Irrigation Management Institute (IIMI), which will concentrate on improving existing irrigation systems. The irrigation sectors of most developing countries perform well below their capacity. These systems also operate below the level necessary to either satisfy growing food requirements or economically justify the increasing costs of their development and maintenance. The causes of this sub-standard productivity vary, but generally relate to poor irrigation-system performance and particularly to the need for better water management. Through networking long-term research and dissemination of research results, IIMI will work to correct such situations.

PRIVATE ENTERPRISE

As the new technologies take hold and development progresses, Third World countries become more likely to sustain a private sector.

AID works with host governments to improve country policies, particularly those that may mitigate against small-scale, rural business endeavors. Through our new Bureau for Private Enterprise, we also assist U.S. companies that wish to invest in and assist developing-country businesses.

CONTINUING RESEARCH NEEDS

The research effort to help developing countries more effectively utilize their scarce water resources has just begun. The current food crises in Africa warns us of what is ahead. Although the United States can produce more food than our own population needs, we cannot be expected to meet the food deficit of the rest of the world. Even if our production capacity would help achieve this goal, most of the food-deficit countries are poor and would be unable to buy the food we produced. Obviously, the long-term solution is for us to help these countries feed themselves or develop their capability to buy food from us.

Several high-priority research areas should receive attention if we are to help the Africans feed themselves. Research on irrigation should be one priority, particularly in Africa where the efficiency of irrigation water utilization is abysmally low. Attention must be given not only to the engineering aspects of water delivery, but to on-farm use of the water. Likewise, "bottom up" approaches which involve the ultimate users of the water, the farmers, in irrigation systems management decisions must be tried out. Similarly, high productivity systems utilizing water-efficient mechanisms such as "drip" irrigation should be fully explored. In other words, we must help the Africans more effectively use science to improve their use of irrigation waters.

Crop breeding and management research must also be used to provide African farmers with crop production tools they do not now possess. The new drought-tolerant sorghum varieties coming from CRSP collaborative efforts and from networks sponsored by ICRISAT are examples of the kinds of tools which science can produce if given a chance. Such research must be focussed on removing the environmental constraints to crop production in Africa. It will take the best efforts of African institutions, but will also require help from developed-country institutions (such as U.S. universities) and from the IARCs. Biotechnology must be used to help the Africans develop crop varieties which are tolerant of drought and of acid soils, which are resistant to diseases and insect pests, and which will perform well on African farms.

Innovative soil and crop management systems must also be developed and tested. For example, the so-called alley cropping system which provides a continuation of soil protection from erosion as well as improved crop production should be further explored. Likewise, combinations of herbicides and no-tillage culture should be evaluated. The "bedding and ridging" system of soil management which ICRISAT has found to be successful in India could well be tried on similar vertisols in Africa.

All of these efforts will require effective linkage among African institutions and between those institutions and counterparts in the more developed countries. Collaborative networks will be needed to bring about these linkages.

The efforts will also require the education and training of Africans to do the research themselves. While some of this training can and should be done in Africa, much of it can be done best at overseas universities such as Texas A&M. The efforts you are making to help institutions in this country and their counterparts overseas identify future water-resource strategies should be applauded.

CONCLUSION

Worldwide water-resource problems require intensive, long-term, large-scale remedial action. We must work collaboratively, networking our efforts to find fresh, innovative approaches to conservation of resources. We must then see that these ideas are adapted and disseminated to locations where the need for improvement is greatest. Only after substantial advances have been made are there opportunities for private sector development.

Among the subjects on which we should focus these efforts, water technology is one of the most important. To improve health and agricultural conditions, particularly in the arid and semi-arid regions, we must help people to increase and conserve the supply of usable water.

This is why the Water Policy conference you will hold in May of this year is so important. It is a very timely opportunity to explore some of the agricultural water-application methods that are appropriate in the arid and semi-arid regions that are now at risk. It is an opportunity to discuss the wider use of such methods as dryland agriculture and drip irrigation. It is an opportunity to look at water-related problems and potential solutions in the context of the developing-country user. Food production, soil condition, water-related policies, and ecological and energy issues, as well as private sector potential all impact on the survival and growth of small-scale agriculturalists in emerging countries.

Your conference will provide an excellent opportunity for policy-makers, technicians and scientists from the United States and abroad to communicate on all of these these crucial issues. Your efforts in May can and will make a difference. There is so much room for improved water use that your efforts can lead to great benefits in the most basic terms of more and better food and cleaner water.

Leonardo da Vinci said, "Water is the driver of life." Let's work to conserve what is, perhaps, our most precious natural resource.

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