WATER - A KEY TO A QUALITY ENVIRONMENT - NEW MEXICO AND THE SOUTHWEST

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Water is truly the key to a quality environment in New Mexico and the Southwest. Furthermore, it is probably the most important - and most limiting factor - in growth and development of the area.

The demand for water is increasing at an alarming rate. We need water, not only to supply a growing population base, but to take care of increased pressures associated with affluence and technological development. The U. S. Water Resources Council estimated that, before the year 2020, industrial, municipal, domestic and power requirements for fresh water in this Country are expected to reach 1000 billion gallons per day (1). This is about three times the total withdrawn for all purposes today. Such a demand would leave no water for agriculture, which presently accounts for 41 percent of the present total withdrawals.

These kinds of projected needs not only alarm the average U. S. citizen, but they really shock those of us already faced with water shortages in the arid southwest. It is time that we ask ourselves some very serious questions about this most valuable resource -- and about our future as it may be related to water use and development.

The first and most basic question is, "How much water is required per person?" This is a simple and straight-forward question, but to arrive at an answer is very, very difficult. We know that we need only about 2 quarts daily for drinking, but, even in the early 1900's, our home use of water was about 10 gallons per person per day. Now, each of us is using about 180 gallons per day for home use. In addition, we need water to produce food, to refine oil, to manufacture automobiles and to operate our growing metropolis. Our total withdrawals in the U. S. now amount to about 1270 gallons per person per day. So, we might again ask the question, "How much water is required per person -- 2 quarts? 180 gallons? or over 1200 gallons per day?"

Let's approach the question in a different way. What standard of living are we willing to accept? A recent study in California will serve to illustrate the general relationship between standard of living and water use. In 1968, residents of Beverly Hills, where per capita income was $4929, used an average of 313 gallons of water per day for home use. This compares with 89 gallons per person per day in Compton where the per capita income was only $1727 (2). Should we be satisfied with 89 or go to 313 gallons per person per day for home use, or should we get by with the 20 or 30 gallons common to most people of the world in metropolitan areas?

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It should be fairly simple to calculate the per capita water requirements for business, industry and municipalities, but what about water for food production? To grow a pound of wheat in the field will require about 1,500 pounds of water. If we follow this wheat on through the milling processes, with average losses, and to the completed bread, we find that over 2,500 pounds of water are used to produce 1 pound of bread. To produce 1 pound of rice may require as much as 2 tons of water.

As we introduce animal protein or other essentials for balanced diet, the water requirements are increased correspondingly. For example, on some brush infested semi-arid rangelands in New Mexico, from 100 to over 500 tons of water are involved in the process of producing 1 pound of beef -- measured at the supermarket level.

This does not mean that 100 tons of water are "required" to produce a pound of beef -- but it does mean that this much water is "involved in" or "associated with" the production of a pound of beef. Much of the water involved in range beef production is dissipated by undesirable weeds and brush or evaporates from the unprotected soil surface. Also, most of the water necessary to the process of photosynthesis in range plants is transpired through the plant and returned to the atmosphere.

Purely from a water efficiency standpoint, we can increase the effectiveness of water use for beef production at least 10 times by producing animal feeds on irrigated lands and confining the animals to a dry-lot during the production period. But this is only part of the story. A "quality" environment involves considerations other than efficiency or economy of water use.

I would like to go back and enlarge on a statement that I made earlier -- namely, that more units of water are required per person as our standard of living rises. Canada and the United States utilize over 1600 pounds of grain per person per year compared with 400 pounds for Iran, Morocco, Japan, UAR, Pakistan, Thailand, and India. This difference in grain use is four-fold, but if the U. S.-Canadian levels were projected across the world's population, the grain use would be nearly 8 times the present world production (3). In terms of water use, Canada and the U. S. would require 1600 tons of water per person per year to produce their grain needs, but India and Pakistan must get by with 400 tons of water per year -- assuming the same level of efficiency.

The U. S. has increased its beef consumption from 48 pounds per person per year in 1930 to over 110 pounds per person in 1970. Japan gets by on about 16 pounds. Even with good efficiency, our water requirements for beef consumption per capita would be over 1100 tons compared with 160 tons per year for the average Japanese.

Research on both cropland and native range areas indicates that, as a general principle, we can increase the effective use of water in the agricultural sector by concentrating our limited water resources on a smaller area of land. On range areas this means more attention to mechanical land treatment, land shaping for modified water harvest, contour furrowing, water spreading, and micro-climate modification. On cropland this means level benching, other forms of water concentration and irrigation.

Man first started using water for irrigation in ancient times. During the Bronze Age, in the Biblical period of Abraham, complex irrigation systems were designed and used in the Mediterranean region. Irrigation has changed the geographical pattern of food production more than any other single factor. It has moved intensive agriculture into arid and semi-arid regions and has become accepted as a risk-reducing factor in humid and semi-humid areas.

Irrigation, or other methods of water control, makes possible the full use of technology in food production. It brings out the genetic potential of plants. It increases the effectiveness of fertilizers. It allows for crop rotations designed to maintain organic matter or reduce erosion. Water management increases the production of land two- to four-fold.

In the early sixties, irrigation was used on 380 million acres in the world -- about 11 percent of the total arable land. The major regions of the world had the following percentages of the total world irrigated land: Europe - 5.9, the Soviet Union - 8.3, Asia - 64.8, Africa - 3.8, Oceania - 0.6, South America - 3.2, and North America - 13.4 percent.

The United States now has approximately 42 million acres of agricultural land under irrigation. Most of this irrigation - both from surface and underground water sources - is in the semi-arid and arid west. This irrigated cropland, although only 10 percent of the total U. S. cropland, contributes nearly 20 percent of the total farm income from crops.

In addition, studies have shown that water used for irrigation may generate considerable income off the farm due to the multiplier effects on the economy and the value of water-based recreation. For example, studies in the Texas High Plains, where there are 63,500 irrigation wells and 5.5 million acres under irrigation from a depletable underground aquifer, show that irrigation generated $3.40 off the farm for every dollar at the farm level (4). A similar study in Nebraska indicated that for every one dollar net increase in crop production due to irrigation, a total of $6.68 in new business was generated throughout Nebraska.

With the growth of industry and the development of metropolitan areas, the competition for water has increased. At the present time, water for food production is in a lower priority than the use of water by metropolitan areas or many industries. Predicted water deficiencies by the year 2000 therefore may lead to a shift in some intensive farming back to the higher rainfall areas. If this change occurs in the United States, we can anticipate substantial increases in the cost of production. Reasons for this expected cost increase relate to highly variable and low fertility soil conditions, smaller operations, increased land prices, more insect and disease problems, and other factors associated with the humid zones in the Eastern United States.

We are all concerned about water pollution. This problem ranges from direct contamination by improperly treated effluent discharge from towns and cities, to the problems of chemicals and siltation from erosion. Farmers in the United States have made great strides in the conservation of soil and water since the the dust bowl period. Yet much remains to be done. Water pollution also seriously inhibits water based recreational activities. About one-fourth of all outdoor recreation is now dependent upon clean water.

The approach to water pollution control is, of necessity, quite different in the agricultural sector than for other business, industry, or for municipalities. While water is truly a renewable natural resource, it can be cleaned up, pollutants removed and recycled in the short run by municipalities and industry rather rapidly with a technological and economic input. On the other hand, water used for food and fiber production can be reused only in the long run as it moves through the complicated hydrologic cycle. The use of this water as it passes through the cycle is the basis for life itself.

This leads to another important consideration as we discuss water - the key to a quality environment. Water is most often the limiting factor in vegetation production. The key to the quality of the air that we breathe is the Co_2/o_2 balance -- although certain specific pollutants may be critical at any one time, such as sulfur dioxide, lead, etc.. The only way that we can maintain our oxygen supply is through plant growth. The process of photosynthesis is still the most important chemical reaction in the world. Through this process the plant can convert carbon dioxide back to oxygen. Thus, as a generality, we can say that all vegetation can be classified on one side of the system as an asset to the environment while all other forms of life, and technological development, tend to be detrimental. Thus a man-vegetation balance is essential -- particularly with reference to environmental quality. Some estimates indicate that the United States is now producing only about 60 percent of our total oxygen needs. Without the vast ocean areas to supply an inflow of oxygen to the great land masses, man could not be sustained at even the present population level.

From an ecological viewpoint, I believe it would be well to point out that some of our so-called "solutions" to environmental issues are not really solutions for society when we look at the impact on large eco-systems -- even though they may be satisfactory "solutions" for certain individuals or interest groups. Let me illustrate this point with an example. If the 3.6 billion people in the world had to depend upon "organic" farming and chemical-free backyard food production, our land resource requirements would triple -- our water requirements would be so great that many people would be without this essential element for life -- and our pressure on the environment and problems of pollution (of a different type) would be greater and not less.

Ecological understanding and "management" orientation are essential to our survival. Our earth in its natural state could maintain only about one human being per square mile (5). By modifying his environment, man has added millions of acres to his production potential and created desirable living situations in hazardous climates for both rural and metropolitan living. Water has played a key role in this development. Our future is still tied to this important renewable resource. This is the time to strengthen our research programs on water, to increase our efficiency of use, and to improve our understanding of the role of water in environmental improvement.

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