Visions of the Future

PROCEEDINGS
OF THE
THIRD NATIONAL
IRRIGATION SYMPOSIUM

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The Irrigation Association

American Society of
Agricultural Engineers

VISIONS OF THE FUTURE

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Preface

The 3rd National Irrigation Symposium is convened with the goals of summarizing current irrigation practice and focusing attention on the future of both irrigation research and technology for the next ten years as we prepare for the 21st century. This is the first National Irrigation Symposium to be held in conjunction with the Irrigation Association's Annual International Exposition.

Both the 1st and 2nd National Irrigation Symposiums were held in Lincoln, Nebraska with fewer papers presented (43 in 1970 and 26 in 1980) and included in the Symposium Proceedings. In 1980, the Symposium Proceedings were augmented by the concurrent publication of the ASAE monograph "Design and Operation of Farm Irrigation Systems." During, or shortly after, the 1990 Symposium, ASAE will publish a sequel to the previous monograph entitled "Management of Farm Irrigation Systems."

The 3rd National Irrigation Symposium is being held in the irrigated west, where much of the industry and the irrigated area of our country is concentrated. Phoenix, Arizona provides excellent convention facilities which can accommodate both the technical sessions and the International Irrigation Exposition.

The scope of the 1990 Symposium has been expanded to include concurrent sessions and one-on-one (poster) presentations. A call for papers attracted many authors interested in presenting papers at, and participating in, the Symposium. The inclusion of one-on-one presentations in the Exposition exhibit area is also a first for the Irrigation Association.

The joint sponsorship by ASAE and IA fosters greater interaction between the irrigation industry and the irrigation researchers and educators. We believe this forum will enhance the stature and impact of both groups, and encourage greater cooperation in solving the problems of the 21st century.

Dale F. Heermann and Kenneth H. Solomon Co-Chairs
1990 International Irrigation Exposition and
3rd National Irrigation Symposium

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Musings on a rapidly changing scene

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Member ASAE

Water, both literally and poetically, is the life blood of civilization (Schwenk and Schwenk 1989). From its beginning, the fate of civilizations has been tied to water and its management. As Helen Ingram points out, regional development, shifts in population, the growth of trade, and the ebb and flow of cultural influence have all depended in important ways on water transportation routes, sophisticated irrigation works, and uncontaminated supplies for consumption (Ingram et al 1986).

This dependence is well known; as an example, recall Mesopotomia, the land between the Tigris and Euphrates. At the height of the Sumerian Empire, about 4000 years ago, the region depended on a highly developed irrigation system. Erosion and sedimentation, as well as salination, went hand-in-hand with the collapse of the empire. As an early indication of the interaction between environment and water management, it seems that Bilharziasis, spread by fresh-water snails, created a serious public health problem (Ency. Brit.)

Closer to home, we may recall the Hohokam civilization in the Southwest.

Water, of course, is essential for much more than irrigation, but irrigation is indeed the largest user and, worldwide, irrigation plays a major part in food production. In the United States, about 25% of the value of agricultural production is grown on some 10% of the land by irrigation.

It is interesting also to trace the development of the United States in relation to water. Drainage work started in the latter half of the 18th century, especially in the Southeast. The beginning of subsurface on-farm drainage in this country is generally dated at 1835. Beginning in the mid-19th century, one sees a drive to "conquer the swamps", as settlers moved West from the Eastern seaboard (van Schilfgaarde 1987).

Drainage, or water management, was an integral part of the Nation's "developmental ethos". Development of the land was seldom easy or cost-free, but yet there was a consensus that it was right.

In the West, a parallel yet different scenario unfolded. The Reclamation Act of 1902, which established the Bureau of Reclamation, was intended to help develop the West by fostering irrigated family farms. In recognition of the fact that private enterprise was hard-pressed to develop the water resources over large distances, Federal financing was called for. Thus here the rugged individualism and strong entrepreneurship we associate with development was tempered (or contaminated?) by Federal involvement. Just as in North Carolina, Indiana and Iowa swamps were converted into productive farmland, so in the West the desert was transformed.

In many ways, the Reclamation Act was a great success. Today, some 20% of the area irrigated in the West receives Reclamation water, or 4 million

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hectares. Its influence in developing the West no doubt has been substantially greater than that figure indicates. Yet, as one reads about the history of water development, one realizes that neither the motives, nor the outcome, were as pure--or as clear-cut--as is often thought (Worster, 1985). The lofty objective ("go West, young man") of providing opportunities for development and establishing family farms was mixed with the desire to get rid of the riffraff in Eastern cities, or to develop markets for eastern railroads, or simply to diffuse socio-economic problems in the East. It also failed to recognize the intricate infrastructure required to successfully manage a large irrigation enterprise; thus the tendency towards a concentration of power and of wealth into a few hands. Consequently, the infamous "160-acre limitation" was routinely circumvented and, rather than an equitable distribution of benefits through the establishment of family farms, there often resulted a severely unbalanced distribution of beneficiaries. Goodall and Sullivan (1985) discovered, in comparing two of the largest Bureau of Reclamation projects with nearby non-Federal irrigation development, that income distribution was severely skewed: in the area with Federal water, the level of unemployment was high, as were numbers of poor families; total wealth was substantial but concentrated in a few landowners. In non-Federal areas, the range of family income was narrow, poverty was limited to a few families and social infrastructure--churches, clubs, etc--healthy and thriving.

Warts and all, the "developmental ethos" succeeded in fostering a very substantial expansion of the irrigated area in the West and, concomitant therewith, widespread economic development. However, new forces have come into play that I shall label the "environmental ethic".

A substantial number of people have looked at what has happened to their surroundings and have become concerned. Not only is Rachel Carson's message being heard after many years; not only have the rural citizens of Iowa decided that they don't like nitrates in their drinking water; also, farmers and non-farmers alike are concerned that California has lost 90-plus % of its wetlands to development, causing severe distress to migratory birds; Coloradoans are averse to damming yet another stream to provide unlimited water to profligate unmetered households in Denver; and recreationists are upset that one can no longer find any wild rivers.

Many see irrigation as the culprit, supposedly usurping or misusing the precious water that they would rather put to a different use. Of course, besides true environmental concerns, there is plain, unvarnished competition. Demand often exceeds supply, at least at the price one can afford to pay.

The question no longer concerns just water quantity, but explicitly and decisively, also water quality. Let us illustrate the issue by sketching briefly an example from California.

It has long been known that irrigation in arid climates cannot be long maintained without drainage, be it natural or man-induced. As early as 1886, E. W. Hilgard asserted that even California was not in a position to wave the laws of physics and would have to provide drainage if salination of the Central Valley was to be avoided (Hilgard, 1886). Providing adequate drainage (leaching, if you prefer) to assure that the salt concentration in the soil solution does not exceed the level that can be tolerated by crop roots, is a requirement for continued productivity. This in turn requires, generally, export of salts and thus calls for a disposal mechanism. Until relatively recently, the emphasis (in research and practice) was on removal--or in-situ soil maintenance--with relatively less emphasis on the method of disposal. As illustrated by the Colorado