



RESOURCES

Some findings and conjectures from recent research
into resource development and use



Accuse not Nature! she hath done her part; Do thou but thine!—PARADISE LOST

NUMBER 10

RESOURCES FOR THE FUTURE, INC.

JUNE, 1962

EXPLORABLE WATERGAPS

WE HAVE LEARNED that the way in which we use water resources at one point can have effects for good or ill on the use and control of water at other points. Flow regulation, for example, may benefit a wide range of activities over extensive areas; surface water used for irrigation often incidentally recharges ground-water aquifers; and cool water released from the bottom strata of reservoirs may benefit game fish. On the other hand, wastes introduced into a stream at one point affect the cost, if not the feasibility, of downstream activities; artificial recharge of an aquifer raises the water table and may cause drainage problems at another point; and hot water effluent from a power plant reduces the oxygen saturation level of the water downstream and makes it a less efficient assimilator of organic wastes.

Knowledge of such causes and effects, part of today's slowly acquired learning in the field of water management, is small compared with the vast areas that are still unknown. For all our successes with irrigation and our experimentation with desalinization and cloud seeding, we are a long way from making the deserts bloom in any large-scale way. The climatic changes needed to increase evaporation—and distribute fresh water more evenly upon the earth's surface—could involve altering the reflectivity of large areas, modifying the circulation of ocean currents, and otherwise affecting the temperatures of earth or atmosphere. But we lack the knowledge to understand the total effects of such techniques.

The need for further knowledge in the hydro-science field is far more acute when we lower our sights to smaller, more familiar, problems. Gaps in our understanding of the uses of water are becoming increasingly costly in preventing efficient water use both in

areas where water is in short supply and in areas where it is plentiful and therefore exploited for many varied purposes. The examples that follow are just a few out of many.

IN ARID AREAS, co-ordinated planning for the use of surface and ground-water storage is becoming vital, largely because evaporation from reservoir surfaces is high and because deltas become infested with phreatophytes—water-loving weed trees and shrubs like the salt cedar—which, like camels, can adapt themselves to drought conditions but soak up water when it is there. Evaporation from reservoirs and transpiration by phreatophytes in the seventeen western states amount to more than twice the water withdrawn for public supplies in the entire United States, and perhaps twenty times the amount that disappears in that use. In the Colorado Basin and the Great Basin, reservoir losses alone are nearly one-third as large as all irrigated agriculture. Methods of controlling reservoir evaporation and phreatophytes are known, but their costs are high and they



often yield unsatisfactory results. We need to know much more about how to retain water through transpiration control.

It is equally important to find better means of tracing and predicting ground-water movement and quality, improve techniques for forecasting the capacity of aquifers and recharge areas, and investigate the possibilities of using treated waste water for artificial ground-water recharge.

ON THE COLORADO RIVER, salinity levels are rising as depletion of dependable flow rises. And in several of the underdeveloped countries in which the United States is sponsoring irrigation schemes, salinity has proved to be the major obstacle. Where rainfall is insufficient for leaching out accumulating water-soluble salts in the soil, crop yields are rapidly reduced. This can necessitate the use of large quantities of irrigation water for leaching salts from the soil.

We still do not know satisfactory ways of controlling salinity conditions and adapting to them—through breeding salt-tolerant crops, for example. And if we could predict the effects of irrigation on water quality, our system planning could be made vastly more efficient.



IN THE HUMID REGIONS, the major water problem centers around pollution. But our water purification methods are primitive in relation to the increasing problems of organic wastes and associated algae growth. Left unchecked, algae, thriving on plant nutrients dissolved in the effluent of even treated sewage, can decrease the oxygen content of a stream to a level at which such wastes cannot be assimilated through the stream's natural self-purification process. Appearance, taste, and odor of the water become affected, and fish cannot live. A few people have experimented with harvesting algae from ponds in which rapid growth is stimulated. But we are still a long way from developing methods that will

effectively and economically deal with organic chemicals and plant nutrients. Meantime, large-scale plans for river development involving dilution of plant nutrients must be based on arbitrary rules of thumb, since there is disagreement among scientists as to the critical factors affecting algae growth and the effect of algae on oxygen balance.

Methods of separating the wide variety of pollutants from water, it is true, would incur large operating expenditures; yet, were such methods satisfactorily developed, they still would have a comparative economic advantage over devices requiring large investments of capital (like dams) which now are designed to maintain a stream standard at extreme and rarely occurring low flows in order to cope with the pollution such flows would incur.

We need to know more about pollution abatement measures that can be flexibly applied during critical low periods. And, just as importantly, we need to develop the data that would permit a systematic inclusion of waste disposal costs in planning for integrated water resources systems.

OF SOME 500,000 organic substances known, a substantial number are found in water bodies and in treated water supplies. The vast majority of such trace pollutants occurring in public water supplies is never identified because procedures for detection are difficult and expensive—estimates run from \$50,000 to \$250,000 a compound. Meantime, we are almost completely ignorant of the chronic physiological effects caused by absorption of minute amounts of chemical substances in drinking water. Because chemical production and use are increasing much faster than population and economic activity, we should devote more of our resources to finding ways of dealing with the problem.

Few, if any, sophisticated statistical studies of the physiological aspects of water quality have ever been made. Studies to find significant differences in general health and in degenerative and other diseases between different communities and population groups could shed light on the effects of

differences in water quality and on the factors accounting for these differences. They could also point to more fundamental scientific studies deserving of emphasis in this hitherto largely ignored area of public health.

Adapted from a paper presented by Allen V. Kneese of RFF before the Seminar on Concepts in Water Resources Development, University of California at Berkeley. The paper, in turn, developed from Mr. Kneese's participation in a study of research needs in the natural resources field, organized by the National Academy of Sciences-National Research Council at the request of President Kennedy.



Life in A Deep Freeze

MAN IN THE ARCTIC is something more than a biological or military concept. Man is essentially and uniquely a political animal. It is in this sense that I wish to draw attention to him in connection with the North.

Start with the general picture of the Arctic as one of the almost vacant regions of the earth. In view of the world's ever-increasing populations we might look northward for the living space man so badly needs and will need even more acutely. But there must be a good reason for these northern regions being virtually uninhabited, and there is. It's a most uncomfortable place, much too cold for what we consider civilized living. In order to survive through most of the year man must become a primitive astronaut, somehow creating for himself a new outer body to make up for the shortcomings of the one he possesses naturally and creating indoors the elements which the natural climate does not adequately provide. In saying this I speak from personal experience, not as an explorer or scientific investigator, but as a transplanted exurbanite living in the suburbs of Fairbanks, one of the northernmost outposts of Suburbia, U.S.A.

In this Arctic environment, we act like the proverbial Englishman dressing for dinner in the depths of the jungle. We attempt to be true to all the detailed rituals of our culture while living in this gigantic deep freeze. Daily we gallantly battle the perils of ice and snow in our non-compact American automobiles with automatic transmission. Nightly we worry and fret over our headbolt heaters which are essential if our beloved monsters are to go on living and dominating our lives. We are kept in a perpetual state of genteel poverty trying to pay the heating and other utility bills for our ranch-type houses. With due apologies to Dr. Stefansson, this "friendly Arctic" business can be overdone.

Attempts to settle the Arctic and subarctic in these terms is indeed a daft notion. At most we could take up seasonal residence during the warm period, take care of our business and get out before freeze up. This has been the pattern of the past development of the North. But somehow in Alaska we have been given a public conscience which tells us that this is wrong. In Alaska political aspirations toward full statehood were based upon the idea that not only was permanent year-round settlement desirable, but even possible. It is, but at a cost. Public invest-

ment must be diverted to making it possible through costly community facilities. Private investment must pay a subsidy in the form of extra wages and fringe benefits, and the individual pays a heavy cost in inconvenience and added living expenses.

There are other social motivations causing some of us to continue on in our deep-freeze environment, of course. Whenever I begin to berate myself for continuing this struggle, it only takes a trip outside to bring me back to my senses. The frustrating struggle from congested air terminals into congested cities, the hair-raising drives at top speed along crowded freeways (an ironic label), the polluted air, the social violence and sudden death screaming from the morning paper does, indeed, make the Arctic and the subarctic seem friendly in contrast. And where else can such a relatively small collection of American citizens enjoy and realize so fully its political destiny?

From a talk by George W. Rogers, of the Arctic Institute of North America, at the Natick (Mass.) Conference on Man Living in the Arctic. His book Alaska in Transition: The Southeast Region was published in 1960 for Resources for the Future by The Johns Hopkins Press. He has now completed a study of the whole state of Alaska, also with the support of an RFF grant to The Arctic Institute.



Planning a City's Future

THE PURPOSE HERE is to focus interest on what seem to be the most pertinent questions relating to the economic aspects of human resources in the contemporary American urban setting. The conventional concept of resources relating to the production of goods and services can, by extension, be

applied to people as members of the labor force. It is less conventional, but increasingly important, to consider human resources as consuming households.

First, the location of production activities is usually placed near its markets. Thus, the study of the location of industry, and in these

terms labor resources, must take account of the facts of consumption—the nature and location of effective demand. Second, as the means of private transportation have proliferated, if not exactly improved, individual workers' decisions regarding residential location have come more and more to involve consumption questions. That is, they live where the housing, schooling, recreational, and some other household consumption factors are best suited to their needs. Just as the growth of cities once represented essentially the relocation of rural labor, so recently the mass decisions to migrate to suburbs reflect decisions taken principally as consumers.

Residential location has been viewed traditionally as a junction of proximity to job opportunities and ease of transportation. In the past this was generally true. However, the growing importance of the consumption factors in choosing one's homesite is modifying the traditional rationale of urban locations principally as production centers. Consequently, the simple association of human resources and job opportunities, although still useful for some analytical purposes, appears to be growing less so. Instead, increasing emphasis will have to be put on urban centers as places to attract consuming households both in the sense of encouraging the development of the appropriate skills needed for future industry, and in the sense that the community will be able to hold its best workers because it is a pleasant place for them to live.

THE URBAN SETTING, as we conceive it, is the site of services provided to households in order that most of them can contribute to the labor force. The quality of their services directly affects the quality of the labor outputs. There is good reason to believe that the community, rather than the single household, to an increasing extent has the determining voice in specifying the skills and attitudes which particularly affect the quality of the labor force. Education has long been largely the problem of the community. Health and recreational facilities are becoming increasingly the community's responsibility. Welfare services to the

poor, the handicapped, and to the aged are also each decade becoming more and more social rather than happenstance individual household responsibilities, not only because minimum standards, themselves, are being raised, but also because as a result of improved medical knowledge each decade sees the old becoming a larger share of the population.

Thus, three generations ago, it might have been adequate for virtually all analytical purposes to conceive of the city as a huge manufacturing environment into which were fed raw materials, machines, labor, and entrepreneurial talent. True, cities at that time did provide many services, but because so much of the labor was unskilled and because households consumed relatively so little in the way of either public goods or services, the quantity and quality of public inputs into the household could largely be ignored except by a few socially conscious reformers.



Now, I suggest the city must be conceived differently. Besides being the site of the manufacturing of goods and salable market services, it has become the conscious molder of men, not only in general terms of their social values (which social economists have long understood), but also in terms of their physical and intellectual competence to participate in traditional industrial activities. Once, rebellious or unteachable students could look forward to earning their own living as unskilled manual laborers. Now, so direct a "solution" seems increasingly less feasible. If it cannot teach them in their youth, the community bears the burden of

their dependency in the years when they should be most productive. For these reasons I urge the inclusion of household consumption factors in the discussion of human resources, even though this may be somewhat of an innovation.

MARK PERLMAN, in a paper at an exploratory meeting on the economics of human resources sponsored by RFF's Committee on Urban Economics. Mr. Perlman, associate professor of political economy at Johns Hopkins, is consultant to the Committee in the preparation of a conference later this year.

J. CASANOVA, ECONOMIST

THE WEALTH OF LYONS arises from good taste and low prices, and Fashion is the goddess to whom that city owes its prosperity . . .

The manufacturers of Lyons give high salaries to designers of talent; in that lies the secret of their success. Low prices come from Competition, a fruitful source of wealth and a daughter of Liberty. Therefore a government wishing to establish on a firm basis the prosperity of trade must give commerce full liberty, only being careful to prevent the frauds which private interests, often wrongly understood, might invent at the expense of public and general interests. In fact, the government must hold the scales and allow the citizens to load them as they please.

In Lyons I met the most famous courtesan of Venice . . .

From the Arthur Machen translation of the Memoirs of Jacques Casanova. Casanova visited Lyons in 1750.



RIVER BASINS AND THE STATES

AT THE END of World War II it did not appear that the state level of government would play a very important part in river basin development. In spite of the fact that the federal government is continuing to assume an ever-larger financial burden for river development, there has been a significant resurgence of state activity in this field. California has undertaken a large-scale development program. A number of states, such as Kansas, New York, Ohio, and others, are developing competent staffs to deal with river basin matters and to participate effectively in the planning and operation of river development programs. It is noteworthy that under the Watershed Protection and Flood Prevention Act, the Department of Agriculture functions through local governmental units established under state law and that the Administration is sponsoring legislation to grant funds to the states for strengthening state water resources planning activities.

I have long felt that one of the real handicaps confronting the states has stemmed from the underrepresentation of urban areas by state governments. Thus many people felt that the federal government reflected their views more effectively than the state governments and, therefore, were hesitant to see the states assume tasks being performed by the federal government.

One is led to wonder whether the recent court decision relative to reapportionment of state legislatures may result eventually in an even further revitalization of state governments in the water resources field.

IRVING K. FOX, of RFF, in a paper presented recently before the Ninth National Watershed Congress.

PUBLISHED THREE TIMES A YEAR.

RESOURCES FOR THE FUTURE, INC. is a nonprofit corporation established in 1952 to advance the development, conservation, and use of natural resources through research and education. Its work is financed by grants from The Ford Foundation.

DIRECTORS: Reuben G. Gustavson, *Chairman*; Horace M. Albright, Erwin D. Canham, Thomas H. Carroll, E. J. Condon, Joseph L. Fisher, Luther H. Foster, Hugh L. Keenleyside, Otto H. Liebers, Leslie A. Miller, Frank Pace, Jr., William S. Paley, Laurance S. Rockefeller, Stanley H. Ruttenberg, John W. Vanderwilt, P. F. Watzek.

OFFICERS: Joseph L. Fisher, *President*; Irving K. Fox, *Vice President*; John E. Herbert, *Secretary-Treasurer*.

RESOURCES FOR THE FUTURE, INC.
1775 Massachusetts Avenue, N.W.,
Washington 6, D. C.