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ABSTRACT

The need for research pertaining to the best use of water and recreation resources in Texas is emphasized in these four papers presented at the 1968 Experiment Station Conference, College Station, Texas. "Parameters of Water Resources in Texas" identifies and elaborates upon the important elements presently constituting the water resources research needs in Texas--water supply (quantitative and qualitative aspects), water demand, and marketing water. "A General View of Institutional Constraints as Factors in the Development of Recreation Resources in Texas" considers government control, resource ownership, economics, organizations, financial institutions, education, and religion. "Institutional Constraints: A Factor in the Development of Recreation Resources in Texas" is an indepth study of the second paper, using a specific example, Livingston Reservoir, to illustrate the influential role of history, provincialism, isolationism, rural dominance, and misconceptions as to the meaning and significance of recreation in the formation of policy and its implementation. New institutional directives in the form of enabling legislation and constitutional revision are deemed necessary. "Estimating Recreation Demand - A Reality?" investigates two opposing forces--expansion of outdoor recreation facilities in line with population growth and urban concentration vs. the spread of private land ownership and its restricted use. (BL)

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RESEARCH ON TEXAS WATER AND RECREATION RESOURCES

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PREFACE

Research pertaining to the efficient use of the water and recreation resources of Texas constitutes a major line of inquiry in the Agricultural Experiment Station at Texas A&M University. Providing guidelines for the best management of these resources is important because of the implications to the welfare of Texas farmers and ranchers; it is also a major responsibility of the University in serving the interests of urban dwellers.

At the 1968 Experiment Station Conference, attention was focused on the need for research pertaining to the best use of water and recreation resources in Texas. The four papers contained in this report deal with various aspects of the research requirement in this area. They do not constitute an exhaustive treatment of needs of the future, but they do provide a point of departure for considering the full range of upcoming research requirements.

The intent of the papers is to stimulate thinking on the dimensions and nature of the future research requirement pertaining to the water and recreation segments of the rural resource base of Texas. The hope is to foster a more effective program of research in the years ahead for these areas of Texas Agricultural Experiment Station responsibility.

Marshall R. Godwin
Professor of Agricultural Economics

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PARAMETERS OF WATER RESOURCES

RESEARCH IN TEXAS

by

Herbert Grubb, Warren Trock and James Wehrly*

In recent years we have come to realize that water is an economic resource; i.e., it has been recognized that water is scarce and that there are alternatives with regard to allocation of water resources among competing users. Because of this realization there has been an expansion of water resources research per se from a relatively minor to a major endeavor. As might have been forecast, the rapid growth in funds available for water resources research and related education and planning activities has resulted in advancement in several directions simultaneously with some apparent absence of coordination and control. Under the circumstances this has been both good and bad. Obviously, a major undesirable feature has been the failure to most efficiently allocate the scarce funds to the most pressing problems. On the positive side, however, one could argue that a great deal of preliminary work was necessary before the most pressing research needs could be identified in a meaningful, researchable way. It is to this end that the research of the past few years has made the most significant contributions. For example, since having undertaken major water resources

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research programs, we have better ideas about the nature of the real water problems of Texas and the many and varied water problem subareas as opposed to our previous premonitions about the apparent water problems.

The specific aims of this paper are directed toward a discussion of the "parameters" of water resources research, or in slightly different terms, the objectives are to identify and elaborate upon the important elements presently constituting the water resources research needs within Texas.

The Problem

In essence, research is conducted for the purpose of illuminating the decision-making process, especially with respect to selection among alternative courses of action to solve specific problems. This is the case both in regard to major policy issues and routine operational problems. In order to understand the nature of present water resources research needs within Texas, it is necessary to focus some attention upon a statement of some rather specific water resources problems. Although it is impossible to enumerate and list all of Texas' water resources problems here, a clear statement of general problem areas will serve as a useful guide for the discussion.

In general, Texas' water problems can be conveniently categorized into the three following major problem areas. Although these major problem areas are not necessarily mutually exclusive or independent of each other, they may be listed as follows:

1. Water supply (Quantitative and Qualitative aspects)
2. Water demand
3. Marketing water

A discussion of each major problem area and the attendant research needs follows.

Water Supply

In the past, a major part of the water research program has been directed toward the technical side of the water supply problem. Specifically, the physical scientists and engineers have addressed themselves to problems of quantity and quality of available water at specific locations. Careful distinction has been made among the physical and climatic differences in the various regions of the state. Measurements of rainfall, runoff and stream flow have been made, and with the histories so acquired, efforts have been directed toward establishment of patterns or trends. Ground water supplies have been identified and measured as they have become increasingly important for productive and consumptive uses.

Distinction has also been made between quantity and quality problems within the various regions. In reality, quality of water is only an additional dimension of quantity of water. With existing technology pertinent to water quality, capital resources can be employed to change quality (presumably to improve it) and thus change quantity, within limits. For our purposes the distinction between quantity and quality should be abandoned so that the functional relationships underlying water supply can be stated more completely and in such a way that

the appropriate substitutions between water quantity and other capital resources can be ascertained.

Most of the existing water supply knowledge is expressed in terms of finite quantities and prices which apply to a specific time period, i.e., one year. This, in effect, is one point on a water supply function. Unfortunately, very little is known about the effects upon price or cost if it were to become necessary to change the quantity. The practice of construction of the project which presumably has the lowest cost, and the pricing of water at a level annual price to all users regardless of location with respect to the project (postage stamp pricing) sufficient to retire the initial investment over the appropriate time period plus annual operations and maintenance costs is used to specify the quantity and unit costs of the water supply available to specific users. This approach can be interpreted as having as its prime objective the procurement of a specified quantity of water at lowest unit cost. This single point on the supply function can be expanded into a much more useful relationship between quantity and cost by increasing the range of quantities to include additional water producing projects such as reservoirs and well fields and return flows of sewage effluents.

Economic-Engineering techniques can be utilized to generate the expected water supply function per unit time for relevant and meaningful subareas of Texas. The methods of Economic-Engineering are well understood and can be applied quite readily. In order to do so, however, it will be necessary to increase the quantity and quality of streamflow

and hydrologic data; i.e., physical science research must be expanded.

The pay-off in improved knowledge about water supply curves will be in terms of improved allocation of non-water resources. For example, productive business enterprise could improve its location and resource allocation among the various regions if supply curves of basic resources, such as water, for the various regions were known.

Demand for Water

The demand for water is composed of two distinctly different elements, (1) a demand for water as a final consumption item, and (2) the demand for water as an input in the production process. The former is comparatively small in relation to the latter and probably is highly price enelastic. The latter is a derived demand for which there are, in many cases, good substitutes. For example, many industries use water as a cooling agent, but air cooling devices can often be employed as substitutes for water coolers. Another example, considerable fresh water is used in irrigation. In many cases fresh water could be used by industry first and then later applied to crops without impairing the quality of irrigation. Thus an effluent (treated or untreated) would substitute for fresh water.

Demand for water as a production input is derived from the demands for outputs resulting from production and involves fundamental questions concerning the nature of production functions, factor shares of output, and the demands for final goods. The present approach to demand for water as a production input seldom goes beyond the simplest of budgeting

techniques which utilize simplifying assumptions involving constant output prices over wide ranges of output per unit time and imputes the residual value product to water after other production factors have presumably been allocated opportunity costs. This quasi marginal approach leaves a great deal to be desired when it comes to making substitutions among the input factors. The imputed residual earning is only applicable to the fixed or most limiting resource. In many cases water is not the most limiting resource, thus the imputed returns approach may not be the correct way to derive estimates of the demand for water as a productive input and may lead to erroneous estimates of the value of the resource to the user.

The resource allocation process could be significantly improved if the mathematical form of the various production functions were known. Insofar as agriculture is concerned, it will be necessary to carefully conduct crop production experiments using wide ranges of the various inputs including land quality, fertilizer, irrigation water, labor, and capital inputs which reflect the use of herbicides, insecticides, tillage power, etc. Once the correct form of the production function is known, the correct combinations and levels of inputs can be prescribed for the various crops and the various regions of the state, given product prices. In terms of public policies affecting the development of irrigation projects, it is not clear whether projects should be staged to deliver six inches or six feet of water per acre. Accurate production functions would guide this decision. In fact, accurate production functions are

prerequisite to the derivation of demand for each resource. The individual resource demand-supply relationships are fundamental to resource pricing and valuation policies. The necessary data, of course, are the marginal product curves obtained from production functions.

In addition to production function data, resource demand depends upon the market demand for the products produced. A continual need is present for the estimation of market demands for both agricultural and nonagricultural products. One of the most important research needs today, from the policy standpoint of public investment in alternative water resources projects, is the availability of reliable demand functions for alternative products for which water can be used in the production process. This is particularly important, since, under present practice, water rights from public projects are usually assigned to individuals at the time of project implementation, and reallocation is difficult to effectuate. If water demand functions for various industries and the various regions of the state were available to planners, it would be possible to take into account the competitive strengths of the various water using industries for purposes of project planning. Project planning has regional implications for economic growth and development to the extent that the strongest competitors for water are oriented toward or otherwise associated with regions. Regional demands would be composed of the aggregated individual user demands of a region. Planners would be guided to select the regions

having the highest demands as places in which to add new water supply projects. Thus it can be seen that accurate water demand information would be useful both to the private and public sectors of the economy. To the private sector, water demand functions would aid in the individual firm's decisions about what to produce, how much to produce and what techniques to use. To the public sector, or for that matter, private water supply industries, if such exist, water demand functions would be useful in guiding the location and sizing of new water supply projects.

Marketing Water

With correctly formulated production functions and accurate water demand information, it should be possible to achieve an allocation of water supplies so as to maximize consumer satisfaction from its use. But in the case of water, as a consumer good or a productive input, there are obstacles to marketing that effectively prevent optimum allocation. In the case of ground water, the water is closely tied to the land. This close association of land and water is traditional and stems from the notion that land without water is of little or no value as an agricultural resource. Surface water in Texas may be used only with the procurement of a permit to use water (with minor exceptions in the case of lands riparian to flowing streams). Permits or water rights are not presently transferable, nor eligible for lease or sale by individual owners. There is no water market in which prices for various quantities of water can be established. Thus a fundamental factor necessary to the

efficient economic allocation of water among competing users is not present.

The economic efficiency of water use might be improved if a freely competitive water market were established. This would require some further separation of the land and water resources in some cases. A competitive water market would permit the sale or lease of water rights and services among water users and would involve trades of this nature among agricultural users and between agricultural and industrial users without the necessity of a transfer of ownership of the associated land resource. A competitive water market in which active bidding for water resources on the basis of value to users would be a more effective guide to water valuation than present methods and would result in more efficient allocation of capital to water producing enterprises. The combined value of land and water would no longer dominate and confuse the decision-making process as it now does in many instances of multipurpose water project development.

A further consideration in water marketing is the interdependence of economic sectors within local areas, regions, and the nation. The economy is specialized to the extent that the output of the firms of one industry will be distributed as inputs to firms of other industries. The process of interindustry flow of goods and services may require several such transfers before basic resources such as water are ultimately transformed into goods and services useful to consumers. Under present procedures of allocating water rights to available water users,

some important industries may be overlooked and the costs of obtaining the required services from alternative sources may be higher than would have been the case if such industries had been appropriately included in the planning process. The present absence of water markets makes it difficult to transfer water among competing users, thus important local industries may not be able to enter at a later period if water is a major resource.

A thorough understanding of the interrelationships among the industries as to the nature of the interdependence and the quantitative extent of the interdependence would contribute to an improvement in allocative efficiency. Research that relates the agricultural and the nonagricultural sectors of the economy is needed. A better understanding, in quantitative terms, of the external effects of changes in outputs within an industry upon other industries is also necessary if more efficient water resource allocation is to be achieved.

Problems of water resource development and use which have been described above are major elements presently constituting water resources research needs within Texas. Briefly, they are (1) water supply; the nature of the functions plus empirical estimates of their shape and location, (2) water demand; the nature of the curves plus quantitative descriptions and finally (3) water markets; economic research dealing with fundamental economic relationships underlying water resource allocation within the Texas economy including water ownership, water ownership transfers and capital substitutions for the water input.

A GENERAL VIEW OF INSTITUTIONAL CONSTRAINTS
AS FACTORS IN THE DEVELOPMENT OF RECREATION RESOURCES IN TEXAS

by

Dr. Richard L. Bury*

As a recent arrival on the Texas scene, I find many of her institutions pleasantly friendly. The easy-going, relatively unhurried manner of Texans appeals to one so recently emerged from the bustling California scene. And, because I feel that I've barely a speaking acquaintance with the state and people, my view of Texan institutions is essentially that of a newcomer.

However, I'm pleased to share with you some of my impressions of Texan institutions and their apparent effects on the provision of recreation opportunities. Of course, my impressions are colored by values of the northern and western areas in which I have lived. Because of this, my comments may help you to view Texan institutions through the eyes of an outsider--and this different viewpoint is really the only basis for any contribution I may make today. My impressions are necessarily tentative, and subject to clarification as I discuss the state and her culture with those of you who have preceded me here. Therefore, I'll restrict my discussion to generalizations, and leave supporting details or exceptions for the presentation by Dr. Suggitt.

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Government

To me, the most distinctive Texan institutions are those related to governmental form and to resource ownership. The Texan seems to abhor any considerable amount of government and to treasure the private ownership of land and resources. Any attempts to control his actions through legislation, or to provide for more ownership of land by public agencies, is met with general disapproval. These traditions appear to have had several marked impacts on provision of recreation opportunities.

County parks seem few and far between; although counties have been given the power to levy taxes to support parks and recreation programs, they have seldom done so. Similarly, enabling legislation is available for compacts between counties or other governmental units, but has seldom been used for joint efforts in planning or provision of recreation areas or developments. There is a general failure to form joint planning commissions that could provide for recreation facilities. And the communication gap seems large between Texans who like things the way they are, and those few judges or commissioners who wish to initiate or radically improve programs for public recreation.

Existing public park systems are often underfinanced--although, of course, we have notable exceptions in the larger cities. In general, however, the park systems seem to reflect the Texan philosophy of maximum individual freedom and minimum government control--and thus many systems are plagued by underinvestment and by paucity of operating funds. The state park system seems to be evolving into what may become

excellence, after a period in which management positions were often filled through political favoritism.

Are Texans satisfied with their relatively small and mediocre public recreation facilities? I cannot really say, being too new here. However, I have talked with some recent migrants from San Diego who were accustomed to the excellent Mission Bay facilities of that port city. They thought our Texas Park System excellent, and have been very active in boating and water skiing since coming here.

Resource Ownership

Since relatively little recreation is supplied by public agencies in the state, private landowners have a great opportunity to develop their resources for recreation. In most cases, however, outdoor recreation enterprises are hardput to make profits. Communication with potential customers is poor, and so most recreation businesses just limp along--or lose money. This problem is even more acute where low-cost or free public facilities are nearby.

Of course, some operators are able to operate big--with resultant favorable opportunities for profits. By catering to the hunting desires of the wealthy, for example, the YO Ranch has been able to establish and maintain a good business. Similarly, the owners of favorably-located areas have been able to subdivide to capture the profit potential of the second-home or vacation-home market.

Location near a rapidly-expanding city like Houston--or near one of the large new reservoirs--is ideal for capitalizing urbanites' desire for

outdoor living and rural life. Thus we see mergers of King Ranch and Humble Oil interests for land acquisition and subdivision development-- as well as subdividing of commercial timberlands adjacent to the new reservoirs in East Texas. Through such actions, private interests are providing opportunities for easier access to outdoor recreation--although one might wish for better land-use controls on many of the new subdivisions.

The traditionally free use of private lands for hunting and fishing has presented conflicts. With the paucity of public land, one can hardly blame the urbanite for hunting or fishing wherever he can. And local residents have regarded this access to private lands as a right for years. As you know, some owners have begun to resist this so-called "right" through posting and patrol, realizing that they now have properties valuable for subdivision or that the hunting or fishing rights are salable to hunting or fishing clubs from the city.

In terms of the Texas tradition of private landownership, should we continue to expect hunters and fishermen to be at the mercy of the private landowner? Or should the public treasury attempt to provide leased areas for these sports--possibly funding such leases from license fees paid by the hunters and fishermen?

Quasi-public agencies--especially the river authorities--are creating much recreation opportunity through reservoir construction. In doing so, however, they are really trading off one form of recreation for another. Some of the best deer habitat in the state, I am told, occurs on the scrub-oak bottomlands that are first to be flooded by impoundments. So, in a

very real sense, the authorities are asking sportsmen to become less interested in deer and more interested in bass.

Economics

Pricing of private recreation facilities is now difficult because public facilities, although relatively scarce, are always offered for no fee or are priced below production cost. Therefore, operators of similar or substitutable recreation enterprises seldom can compete at profit-making prices. This situation is hardly likely to encourage private recreation enterprises to satisfy the growing demand for recreation opportunities.

The present awkward condition could be alleviated if public agencies were to begin charging fees at least covering the cost of providing recreation opportunities. This solution may be unlikely in view of traditionally free use of tax-supported facilities. However, fees for use of public recreation areas are becoming more common--and there is nothing patently wrong with asking users to pay, especially if park budgets can be tied primarily to fee receipts rather than to general tax funds.

Another possibility might be the voluntary restriction of government recreation facilities to a particular range of recreation opportunities. The private entrepreneur could then attempt to capture profits through providing other types of recreation opportunities. Substitutability among recreation activities is the largest potential difficulty here, since many potential visitors to recreation businesses might go instead to free public areas.

Two other alternatives remain, neither of which seems likely. First, government could reduce its recreation programs--but we all know how tenacious public programs are! And secondly, government could greatly increase recreation programs so that private businesses were not needed to satisfy recreation demand. However, Texans would not take kindly to such expansion of the public sector at the expense of the private!

Organizations

The neighborhood associations found in Houston are Texan institutions I have not seen elsewhere. And, in view of the Texan's abhorrence of control--and therefore of zoning for land uses--the neighborhood association is all the more striking. Deed restrictions on land uses appear to be perpetuated through the associations, and thus we have de-facto zoning--although, regrettably, it has been underlain with no planning analysis. The neighborhood organizations also stimulate the recreation programs in publicly-built neighborhood centers, thus performing leadership and programming functions normally carried by municipal park-and-recreation agencies in other states. In the absence of strong support for municipal recreation programs, the neighborhood associations are particularly a bright light on the scene.

Financial Institutions

In most places, bankers regard recreation businesses as marginal risks. Texas seems to follow this general rule. Such hesitancy can often be traced to bankers' lack of experience with recreation enterprises.

Such lack of information could always be remedied through case studies of successful recreation businesses. Or potential borrowers could be directed to existing programs for government-guaranteed loans that provide risk insurance suitable to bankers and other institutional lenders.

However, bankers would probably still prefer the higher interest returns available from short-run consumer loans than the lower--but steady--income from long-term loans to recreation businesses. Lacking this capital source, many owners wishing to start a business may be frustrated--and thus as a whole Texans will have fewer recreation opportunities available than otherwise.

Education and Religion

In our schools and churches, are Texans still teaching the virtues of work but remaining silent on the equally important virtues of developing full lives through leisure pursuits? School curricula may provide a clue through emphasis given to physical education or to the various creative arts. And religious teachings could be revealed through sermons and the lesson materials used.

Education and religion are very favorably situated to aid the development of recreation and of fruitful leisure activities. The increasing emphasis on leisure--and use of available leisure time--indicates that school and church would do well to strengthen their emphases in this direction.

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The above comments though very general in nature, have illustrated the possible impact of some Texan institutions on the recreation picture. Now let us become more specific. In the next paper, Dr. Frank Suggitt will narrow and deepen our view through examining some specific effects of Texas institutions on development of recreation facilities and allied matters.

INSTITUTIONAL CONSTRAINTS: A FACTOR IN THE DEVELOPMENT OF
RECREATIONAL RESOURCES IN TEXAS

by

Frank W. Suggitt *

The Livingston Reservoir of the Trinity River Authority will be used as a case upon which to focus the topic of institutional constraint in the development of recreational resources in Texas. This is an illustration of the influential role of history, provincialism, isolationism, rural dominance, and misconceptions as to the meaning and significance of recreation in the formation of policy and its implementation. The Lake Livingston Case emphasizes constitutional inadequacies of civil government at the state and local levels, with special concern for the function of special purpose districts and authorities. It is hoped that the presentation, and the study that preceded it, will contribute to an appreciation for the need to create new institutional directives in the form of enabling legislation and constitutional revision, along with elevation of the role of special and general interest groups and of recreation.

This is not to suggest that institutional constraints to recreational resources development are unique to Texas. The intent is merely a routine summary of the forces that must be understood if more complete and satisfactory utilization of the natural and cultural resources of the state

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are to be achieved.

Ubiquity of recreation, and myriad individual and group connotations of the meaning of recreation, give rise to built-in semantic constraints, at the outset. To some of the people, organizations and agencies concerned with Lake Livingston, recreation means merely the creation of a limited few public access sites and facilities on the general order of Texas-type state parks with which they are familiar. To others recreation means an opportunity to create second home subdivisions to take advantage of the public investment that made the reservoir possible.

Recreation is the use of leisure for pleasure. It covers a complete spectrum, ranging from:

Passive to active: from rocking chair riding and daydreaming, to rock and rolling and skydiving.

Sedentary to mobile: from TV fixation in the living room, to jetting to Europe to ski or she.

Simple to elaborate: from whittling, to the assembly of equipment necessary for a family camping or hunting-fishing trip.

Individual to group: from a solitary fisherman, to the teeming masses in a theme park.

Private to public: from the patio or seasonal home, to the public beach or park auditorium.

Recreation is different things to different people at different times, and it is different things to the same people at different times. It covers a broad variety of interests, motivations, activities, and satisfactions that are influenced by: age, sex, color, education, occupation, income, mobility, housing, geographic location, tradition,

custom, trends, fads, awareness of needs and values derived from recreation, the availability of opportunities for the leisure pursuit of pleasure, and the dynamics migration--geographically, occupationally, educationally, income and residential migration (like from city to suburb to country, or from single-family-detached to high-rise-multiple dwelling).

Uniqueness of recreation is one of its most challenging characteristics inasmuch as it is based upon surplus or otherwise unused time and money of individuals, families, groups, and of society in general. It is the unique product of the highly mechanized, industrialized, urbanized affluent, and mobile Western World, and especially of the United States and Canada. Since recreation is a surplus product, perhaps we can afford to further indulge ourselves by capitalizing upon this unique feature to use it as a leverage pivot with which to correct blunders we have made in land use, housing, and the like.

Recreation facilities and activities can be designed and scheduled to complement other types of activities, facilities and uses of land. School sites and structures are being increasingly used during non-school hours for adult and juvenile indoor and outdoor recreation. Reservoirs, originally justified for the production of power, water supply, flood control, or low flow augmentation have been found to be among the most popular of recreation areas. Farm and forest lands are the sites for hunting, fishing, picnicking, camping, hiking, nature study, boating and canoeing, without impairing the productivity of food, feed or fiber. Residential preferences reflect recreational and aesthetic desires, best

exemplified by the trend toward large suburban homesites, the fitting of subdivisions around lakes and streams and vistas, the townhouse or high-rise residential structure looking inward to a common green for recreation and open space. About half of the new golf courses constructed in the past decade have been associated with residential developments.

Elevating the role of recreation is essential if it is to achieve its potential in shaping the use of land and the lives of people. To many people and institutions in America, recreation is indeed a frivolous, unnecessary, and wasteful use of time, funds, and land. The Protestant Ethic which has dictated much of our national consciousness continues to extoll the virtues of hard work, long hours, privation, and the sin of the affluent, the indolent, and of leisure. Having been raised within the shadow of that ethic, I cannot shake it; nor can most of you.

Thus, when a city council or a national congress dedicates a tract of land for recreation, there are those who loudly (and frequently validly) cry that the site would better be placed in a "productive" use for economic gain. Many subdivision developers assume a magnificent benevolence in pointing to the amount of recreational and open space land within the plat which they have voluntarily dedicated (generally on sites not possibly capable of supporting homes and thus would never be used for the dedicated purpose). Recreational uses and values are at the bottom of the list of benefits in the hierarchy of justifications for U.S. Army Corps of Engineers civil works projects. In many communities, the sale or gift of publicly owned recreational sites for shopping centers, industrial or

housing sites, and highway rights-of-way merely triggered the more rapid atrophy of the central business district or created incompatible uses.

Whatever the motivation, and however we may personally feel about it, recreation has taken a larger position in the scheme of priorities of many agencies and units of government, as well as in the allocation of time and money by individuals and groups. The compounding influences of population growth, increased nonwork time, more discretionary income for each individual and family unit, improved mobility, earlier and more secure retirement, and the mounting awareness of the aesthetic and cultural importance of open space and natural settings. These all combine, geometrically, to elevate the role of recreation in the scheme of things.

Lake Livingston, the second largest reservoir wholly within the state of Texas, is being created by the construction of a dam in the lower quarter of the Trinity River, the dam site being in Polk and San Jacinto counties in the vicinity of Livingston and Coldspring, the respective county seats of those counties. Closure of the dam is anticipated in the autumn of 1968, and filling of the reservoir will inundate approximately 82,250 acres in the aforementioned counties and in the counties of Trinity and Walker.

Although the area being inundated by the reservoir is but 4.0 percent of the total land area of the four counties, the 460 miles of new shoreline being created in this lakeless East Texas region already shows evidence of being the most dynamic developmental stimulant in the

history of the area. For example, there are already more than 50 new second-home, recreational subdivisions recorded. With an average of about 100 lots each and assuming second home construction with an average occupancy of four persons per dwelling on each lot, it is conceivable that there will be as many as 20,000 new people residing in these plats on a seasonal or permanent basis, and the water is not yet in the lake! Not all of the platted lots will be built upon, but many additional subdivisions are in the offing. The 50 new subdivisions would thus account for 40 percent of the 1967 estimated population of the four counties, almost double the population of Huntsville, the largest city in the region.

In acquiring land for the Livingston Reservoir, the Trinity River Authority, an agency of Texas state government, had to acquire fee simple title to the property of scores of local residents, commercial forest owners, and various classes of absentee owners. It required the relocation of five major utility facilities, including 17 miles of 26-inch crude oil pipeline, 196 graves from two cemeteries, and private, county, and farm-to-market roads and state highways. Acquisition of the land by an agency of the state government removed nearly 83,000 acres of land from the tax rolls, as well as removing land from the production of agricultural, forestry, and wildlife products. Such actions result in institutional changes of dramatic proportions to the local people and communities.

As part of its statutory responsibility, the Trinity River Authority, a special purpose agency created by the legislature, has been authorized

to acquire 19 public recreational areas containing about 3,060 acres. To date approximately 800 acres have been purchased, and plans are being drawn for the development of public recreational facilities on three sites. The Four County Development Association, a local non-profit association, was instrumental in obtaining this concession from the city of Houston. for the only source of revenue for TRA to acquire and develop recreational sites and facilities is in connection with the sale of water to Houston.

The TRA has had no previous experience in the park and recreation field, for this is tertiary to the principle function of the authority. An excellent preliminary plan for the recreational sites has been prepared by competent consultants. The one state governmental agency with experience and responsibility in public recreation is the Texas Department of Parks and Wildlife, yet there is no evidence that steps are being taken to establish a state park on this outstanding reservoir, thus easing the burden of the TRA, the counties, and of the city of Houston.

The burden of providing public recreation is growing extremely heavy, with recent court rulings that fixed the taking price of a parcel of park land by TRA at a level ten times higher than the offering price. This appears to be unwarranted exploitation of a public investment for water supply purposes, and although the case is being appealed to the state Supreme Court, the public will undoubtedly be forced to pay far more for recreational land than it did for the flood land. It does not seem reasonable that a public agency should be forced to compete with

speculative interests in order to provide for public recreation in cases where it was public investment which caused the land value appreciation in the first place. Had there been a properly prepared, heard, and adopted comprehensive plan for the entire reservoir region, with an "official map" designating the approximate locations of all planned public lands and rights-of-way, there would be no need for litigation and exorbitant payments for public use lands.

The cost of correcting land use and related public service deficiencies will ultimately be borne by the public, not by the speculators and developers. Houses will have to be removed to make way for arterial streets and for other public uses. Inadequate septic tanks and inefficient water and sewer systems will have to be abandoned and replaced by more efficient public systems. A considerable proportion of the purchasers of the new subdivision lots will become permanent residents, thus creating a need for schools and more intensive urban-type public services. All these needs must be paid by the property owners and taxpayers.

Institutional constraints limit the opportunity to develop and utilize recreational resources at anything approaching maximum levels of productivity. The creation of the Livingston Reservoir on the Trinity river is a case in point. For nearly half a century a series of institutional forces have led to the authorization and construction of the reservoir as a link in the channelization of the Trinity River. Another series of institutional constraints is making optimum utilization of the lake's recreational attributes impossible.

Problems resulting from the creation of Lake Livingston led the Four County Development Association to request guidance from the Recreation and Parks Department of Texas A&M University, with funds provided by the governments of the four counties affected. The more apparent problems are here enumerated to indicate the institutional limitations.

1. No enunciation of ideals, goals, or policies for the total utilization of the newly-made lake, except for the sale of industrial water to the city of Houston, and as a part of the Trinity River industrial waterway.

2. No provision for planning, regulation, and control of water-margin and ancillary development stimulated by the creation of the reservoir.

3. No evaluation of impact of water-margin developmental costs, services, and tax and economic growth benefits (the only cost-benefit analyses relate to the provision of water to Houston).

4. No criteria, standards, specifications, controls, enforcement, or penalties for subdivision development around the lake.

5. No provision for minimum building line setbacks or for future arterial street and highway rights-of-way.

6. No specified criteria for the disposal of sanitary or storm water discharge.

7. No provision for additional urban-type services for law enforcement, fire protection, public health, roads and streets, parks and

recreation areas, or for the reconciliation of nuisances. Belief that 19 designated public park sites would be adequate.

8. No established precedent or capacity of local government to administer to the foregoing.

9. No apparent state responsibility for such problems, in the constitution, in statutes, or in the primary purposes whereby the Trinity River Authority and Lake Livingston were created.

10. No scientific research or public informational programs to help local people, local and state government, and non-governmental organizations to cope with the problems created by legislative decree and by obvious need.

Each of the foregoing problems represents one or more types of institutional constraints upon maximization of the utility and productivity of the newly created reservoir.

Consequences of these problems are apparent on older reservoirs and on natural lakes and streams where there has been little or no land use and development control. Incompatible land uses lower the value and satisfactions of ownership. Development of sites having physical impairments is either costly or unsatisfactory. Inadequate subdivision design creates a host of problems and dissatisfactions, including incomplete use of the potential carrying capacity of the land and waterfront resource. Poor road and street design and construction specifications require subsequent public expenditure and perhaps relocation. Failure to adequately provide for the collection and treatment of sanitary wastes can be

a health hazard and can add to the cost of water treatment by the ultimate user of the lake water.

In each of the foregoing instances, the property owners and taxpayers suffer the consequences of improper community development, and are forced to tax themselves to correct the mistakes of the developer. Blighted conditions around older recreational lakes are frequently as severe as in some of the most deteriorated areas of the inner cities. Blight seems to attract more blight, and it certainly drives away new investment and development, thus reducing the economic development potential for an entire area or region.

This is especially true where the direct public investment in parks, boat launching sites, and highways is jeopardized by adjacent parasitic and shoddy commercial development.

The original developer of lakeside subdivisions is frequently not a local resident and has no permanent attachment or sense of responsibility to the community. These are the "cut up and get out" developers who leave the solution of the consequences of substandard development in the hands of ill-equipped lot owners associations and equally poorly qualified local governmental units. Thus the problem is not confined merely to the residents of the subdivision, but extends to the local civil governmental unit, the school district, and really to all the people of the state and nation.

Enabling legislation empowering counties and groups of counties to create planning commissions and to adopt comprehensive plans is not

available in Texas. Similarly, there is no enabling legislation permitting the extension of the police power of the state in the zoning of unincorporated land uses. There is no enabling legislation for counties and no state supervision of land subdivision and plat regulations. Texas is one of the few major states without a large and professionally staffed state planning commission, although a great deal of progress has been made recently through the creation of the coordinative Planning Agency Council of Texas. River authorities of the state have varying statutory responsibilities and power with regard to the provision of park and recreational land. Other state agencies have limited power and capability to adequately provide for parks, parkways, recreation areas, or for inspection and supervision of sewer and water utilities. The Governor of Texas likewise has extreme limitations upon his power and cannot truly function as a chief executive of the state.

Because of the limited powers of the counties, the state administrative agencies, the Governor, and of the legislature itself, there has been a proliferation of special legislation to create special purpose districts of various kinds and to grant additional powers to specific metropolitan counties or municipalities on the basis of population brackets. It has been said that Texas has more legislation, a longer constitution, and more constitutional amendments than any other state, yet it does not have the necessary legislation to enable state or local governmental entities to plan for and control recreational and other development.

The absence of such constitutional and statutory guidance is thus an institutional constraint upon optimum development of the recreational resources of the state. The voids are most apparent when dealing with a newly created resource such as Lake Livingston, and an understanding of the institutional framework of the state is an important step toward correction of the deficiency. The following points are cited as institutional influences which have led to the current situation:

1. Historic influence of the recent frontier, the struggle for independence, the post-Civil War carpetbagger and reconstruction era led to the present state constitution, adopted in 1876, with nearly 200 subsequent amendments. The spirit of the organic law of the state was to weaken all levels and branches of government in an earnest attempt to minimize the possibility for corruption and usurption of power.

2. Rural influence is reflected in the delegates to the 1875 Constitutional Convention, in the constitution itself, and in the fact that all rural counties ratified it while all the larger cities of the time opposed it. Rural control over the legislature has continued throughout the period, up to the recent efforts at more equitable apportionment of members of the legislature. In the pre-industrial and pre-automobile era, county government was simple and close to home, and the constitutional limitations upon counties were less of a hardship. Such is no longer the case, especially where urban influences and urban-like development patterns are occurring even in remote rural counties like those surrounding Lake Livingston.

3. Provincialism and isolationism also have historic roots, coupled with the vast expanse of the state and the logistical problems. Texans are proud of their heritage and they do not wish to be accused of adopting programs of more liberal or more progressive states elsewhere, for to do so would be an admission that Texas is not progressive. There has been considerable influx of residents from other states since World War II, but prior to that Texas was a population export state with a perpetuation of inbred points of view. Within the huge state there is a sectional clannishness that has divisive effects upon uniform, state-wide legislation and attitudes.

4. Independent conservatism has been the product of the foregoing institutional influences, with objectivity and realism being considerably warped by the legendary romantic past and the provincialistic pride. This has tended to enshrine many myths such as; "The best government is the least government"; "The closer government is to the people the better"; "Big government is inherently corrupt"; "We don't need or want state or federal financial or technical aid because those bureaucrats from Austin and Washington just want to grab control, and we can take care of our own problems locally."

5. Property rights have been bitterly fought for by earlier generations of Texans, and there is perhaps a stronger pride in property possession and control here than in other states. There is a deeply rooted feeling, not just in Texas, that a man can do whatever he wants with his land, regardless of the possible ill-effects upon neighbors or the community in general. Yet there is no provision for protection

against depreciation resulting from a neighbor's decision to build a junk yard or a junky bar or subdivision.

6. Long lineages of family ownership and control of land, timber and oil resources, frequently reaching back three and four generations, reinforce these feelings toward property and the freedom to do as one wants to do with one's own property. Yet these same long-term, large-block owners are the best assurance that there will be a rationing of land released to the second-home subdivision market, and that it will not all be instantly blighted.

Therefore, a major challenge confronting those concerned with optimizing resource use and with minimizing maladjustments is to better comprehend these institutional limitations, turn them to advantages where possible, and to help create new institutional devices where needed.

ESTIMATING RECREATION DEMAND

--A REALITY?

by

Robert E. Branson and Ivan Schmedemann*

I. Why Forecast Recreation Demand?

Texas possesses an exceptionally wide array of both natural and latent outdoor recreation resources. These range from an extensive 400 mile Gulf of Mexico coastline, to a total of approximately 75 major man-made lakes, to natural forest and mountain areas, and to canyons and high plateaus. This span of scenic resources provides an excellent setting for camping, boating, hunting, fishing, and other outdoor recreation activities. Why, therefore, should there be concern over Texas' outdoor recreation facilities?

Texas, like other states, is faced with the phenomenon of two opposing and rapidly converging forces operating on a rapid collision course. One such force is the evergrowing demand for outdoor recreation facilities, which expands at some conceivable ratio with the state's population and the degree of urban concentration of its citizenry. The second force is the further spread of private land ownership and its restricted use, together with spiraling land values. Prime space available for recreation activities decreases as these two demand variables grow, and the economic and social cost of regaining that space multiplies with any time-delay in the procurement. Under

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these circumstances, the rational course of action is to, first, endeavor to forecast outdoor recreation demand and second, to obtain the necessary space and facilities, with the procurement to occur at as early a date as is economically and politically feasible. Thus there is an urgent need for demand forecasting.

No productive planning, however,--either from the social or economic view--can evolve without an adequate knowledge of the recreation habits, preferences, and propensities of the citizens to be served. Cognizance of this has spawned a considerable number of recreation demand research studies in recent years--nationally, in other states, and to some extent also in Texas. The objective of them all is to seek the requisite information to permit optimum productivity of the resources expended. Sizeable funds have become available as the U.S. Congress and various state legislatures, impressed with the present and impending needs, have risen to provide the monetary base for providing outdoor recreation facilities.

II. Limitations of Previous Recreation Demand Research.

But the task of determining present, much less future demand, is fraught with formidable difficulties. This becomes clearly evident as one reviews the design and accomplishments of previous recreation demand research efforts. That research, for the most part, may be basically classified into two categories,--one, that concerned with measuring demand at existing facilities and two, that devoted to obtaining state recreation participation levels, or for regional or national geographic bases, with the hope that these participation rates will be indications of effective demand.

Those studies concerned with on-site surveys of outdoor recreation are very important and most useful, insofar as they may be applied. Yet the range of application has a serious horizon limitation--one that stems from a variety of sources. Measured is only the degree of present use--not potential use if more adequate or additional facilities were provided. This is a serious limitation, for it has been observed that, in the field of outdoor recreation and not unlike many others, creation of a further supply of facilities also almost, if not, simultaneously creates or stimulates a pre-existent latent demand. Such a phenomenon was certainly observable several years back as the Tennessee Valley Authority chain of lakes began to emerge. Boating, fishing, waterskiing, and related activities followed lake development in rather short order, and of course these continue today.

From a forecasting standpoint, this supply-demand interrelationship is not one the demand analyst finds easy to harness into a predictable pattern. On-site researchers have now repositioned their stance in an earnest effort to cope with the crucial problem. Rather than study a single facility, the approach has been modified to studying, more or less simultaneously, sets or complexes of facilities in various geographic locations. Over time, through such an approach, one may deduce some of the significant attributes of the functional interrelationship between facility supply, on one hand, and demand and associated facility usage rates, on the other. The latter phrase is, of course, the kernel of the problem--usage rates are not equative with demand. But beyond this limitation lies another set.

The further set of complications that permeate the use of on-site studies from the demand forecasting view may be generally characterized as within the realm of sampling. And sampling has three important dimensions with respect to outdoor recreation demand research. The three are: (1) sampling over a universe of people, (2) over a universe of geographic space, and (3) over a universe of time. Each of these merits further consideration in order to grasp the inherent nature of the sampling problem.

First, let us consider the people sampling aspect. To properly measure total demand it logically must be done over the total demand surface--and, insofar as people are the demand source, this means that coverage of the total population is required--not just current users of a specific location. This, in itself, has further facets which require attention. Recent preliminary semi-depth household personal interviews in Houston, for example, revealed such problems to be present.

There is latent demand for outdoor recreation in Houston, for example, that is not implemented because of the lack of available facilities of the type and quality desired. That is one sub-facet. Another is the diversion of potential lake water activities to river areas, again because of the lack of presently adequate lake and facilities.

These are not new problems in demand research. Yet, contrarily, they are not faced in the conventional type of demand analyses to which economists are accustomed and generally apply themselves. In my limited range of personal exposure to marketing problems as a business consultant

there is a problem with a somewhat similar parallel. Cross-fertilization benefits from other types of research is a definite benefit. The somewhat parallel demand analysis concerns shopping center market analyses. Whenever a new shopping center is developed, similar interplays among dynamic demand forces occur as are found in outdoor recreation. Establishment of a new department store, for example, does not simply divide the preexisting department store business volume. Rather, a three dimensional demand surface evolves, aside from the usual price-quality parameters. These are considered in turn.

First, a degree of dilution occurs of the effective demand experienced previously by the other department stores--a division of the pre existing sales pot so to speak. This parallels the division of lake, or park, use as new ones are created.

Secondly, there is a transfer of business to the new department store from preexisting substitute suppliers of the same lines of merchandise--local area apparel stores, variety stores, shoe stores, and so on. The comparable action in recreation demand is the shift from river boating to lake boating, or vacant neighborhood lot ball games to those on park playgrounds.

The third facet of demand is the creation of new demand through the stimulation which the department store presents in attracting further housing development within its trade area. Likewise, a new lake spawns new boaters, as well as more fish and fishermen.

The dynamics of such a demand, therefore, presents new dimensions for an economist whose training and concern has been solely with conventional demand analyses of aggregate national type which operates under the constraint of a limited aggregate demand parameter--for example, the individual's willingness and capacity to consume food.

From the foregoing, it is rather obvious why shopping center and retail store location studies are rather typically made from the aggregate population-demand-analysis approach and not from an "on-site" inference type of evaluation. This is not to say that "on-site" experience is not useful, rather, to say it is by no means sufficient.

One can equally maintain and justify the logic that the performance of a particular facility depends in part on its demonstrated appeal to various demand segments of the total market. Such is the "on-site" study's usefulness. Thus the argument here is not that either the on-site or the aggregate demand research is wholly self-sufficient, but rather that the two approaches working together are more suited to the achievement of maximum demand prediction ability.

Sampling over a geographic universe of space becomes an extremely severe requirement when applied to outdoor recreation. Imagine, if you will, the enormity of endeavoring to sample the length of major Texas rivers and all the area of private as well as public land on which recreation may occur, such as hunting and camping. Conceptually, such a sample can readily be designed. It is, however, in the expense and inefficiency of its execution that the problem arises. Placing survey

enumerators at a multiplicity of such locations over an extended time period is almost beyond question.

The final difficulty of on-site studies is the problem of sampling through time. To truly study the usage rates of a state park would require sampling through, or over, time for an entire year. Hourly, daily, weekly, and monthly variation exists in types of recreation activities and the number who participate in them. Yet, to sample through time at one location can be extremely expensive as well as otherwise inefficient.

The merit of on-site studies lies largely in their ability to deal with a considerable minutia of data pertaining to "on-the-spot" activities. This characteristic merits its continued use for those facets of information for which it is so well suited.

The second major class of recreation studies reported in the literature thus far may be designated as general population participation rate studies. These are designed to obtain, as a minimum, the aggregate participation measurements of outdoor recreation by the population of a geographic area. The percentage of households engaging in a specific activity is recorded, as well as the number of days devoted to that recreational pursuit. Permitted thereby is a comparison of recreation "demand," by type, versus the available capacity of existing recreation facilities. By using the participation coefficients, so developed, future needs may be estimated in relation to the total projected population growth, and changes in the various socio-economic segments within it.

Aggregative participation studies of the aforesaid type have been widely used by states developing overall outdoor recreation facility plans. These have been required to meet Bureau of Outdoor Recreation contingency requirements for seeking or obtaining federal fund aid. These participation studies, however, also have their limitations.

A reading of previous consumer, or household, survey recreation participation studies reveals that there has been a tendency to do the minimum in research design and to employ as little depth of information as possible. Such a strategy obviously avoids the extra expense that a more detailed study would involve. At the same time, it severely limits our comprehension and measurement of recreation demand.

Among the key problems of the household survey approach is that of memory bias in activity reporting, particularly with respect to some of the minutia of information details which we would like to have at our disposal for analysis purposes. A key need, at this time, is several definitive research analyses of memory biases with respect to (a) the type of information desired and (b) the passage of time since the event for which information is needed. Meanwhile, researchers can only resort to the use of guidelines of other research regarding memory bias as a basis of formulating methodology design for current studies.

Another problem inherent in household participation surveys concerns the building of data dynamics into the research. Like the on-site study, only recent or current, and not future activity, is recorded--that is, unless special designs are introduced, and these generally have been lacking.

Forward projections, as a result, have been based essentially upon the utilization of income and age-level cohort groups moved forward in time to match demographic changes in population.

Household surveys, as a further problem, also can encounter some delays in reaching the proper person for interview purposes, since only the husband may have some of the essential information; this is a sampling matter, however, that design can largely overcome.

Perhaps the principal limitation of most household-survey aggregate demand studies thus far has been the failure to provide information which is applicable to realistic planning areas. Most studies have pertained to state wide or larger areas. Although indications of gross present needs are indicated, the suitability or desirability of their location at specific sites within the territory remains unresolved. It becomes necessary, therefore, to implement the research with on-site studies within the individual subareas as a means of obtaining a semblance of geographic data.

It should be obvious from the foregoing that the adequate design of research in the field of outdoor recreation is far from a simple undertaking. Yet the challenge must be met.

III. Formulating Research Objectives and Models for Comprehensive Demand Forecasting Needs.

The Texas Parks and Wildlife Department, cognizant of the immediate need for additional recreational facilities, is presently involved in developing a state wide development plan for outdoor recreation facilities.

Cognizant of the research problems aforementioned, the assistance of a task force at Texas A&M University was sought. From a series of ensuing conferences, a plan was developed for a state wide outdoor recreation survey which would serve as the basis of demand forecasting for at least a 20-year span. It is considered likely that the research will need to be updated at five year intervals.

In view of the problems already summarized concerning the limitations of previous on-site and general household research models, the necessity of formulating a research model for a Texas study presented a real challenge. On balance, there was little choice but to select the general household survey as the basic research approach. It in turn would be supplemented, as needed, by on-site studies. The Texas Parks and Wildlife Department also is concurrently making a complete inventory of the recreation facilities within the states.

Selection of the household survey approach for the demand study turned primarily on the vital point of sampling requirements which the research objectives presented. The virtual impossibility of establishing an economically feasible sampling plan to cover all camping, boating, fishing, and hunting areas, for example, caused the on-site approach to fall of its own dinosaurian weight. Left was the necessity of improving the household survey approach. The research, following extensive planning, is now in the field, and the first phase of interviewing is essentially completed at this time.

The basic components of the research design and model are as follows.

The objective requested of generating data for planning in nine sub-areas of the state led to the final recommendation of a total sample of 15,000 interviews. These, in turn, are divided into two separate interview phases, each representing a state wide sample of approximately 7,500 households. Provision of the detailed sampling plans for such an extensive survey comprised of 164 metropolitan areas, cities, towns, or counties obviously was a rather monumental task.

Basically the sample is designed to provide demand estimates for three regions in the state. Each such region has three subareas for which data will be directly developed from the survey, or imputed from the regional data with correction for subarea differences in socio-economic profiles of the population.

Use of the two-phase sample permits the employment of only a 6-month recall requirement on the respondent regarding non-vacation outdoor-recreation activity. Such is a compromise position, lacking any definitive data on the recall fatigue that may be involved for such information as is being requested. Current literature will be continually reviewed for all possible clues in recall fatigue measurement. How a question is asked can be as important as the recall period involved. Consequently, there is no direct available answer in comparing some of the past studies.

Information sought by the research pertain to the following general categories of data or opinions.

1. Vacation time usage.
2. Weekend out-of-town trips for outdoor recreation.

3. One day outings.
4. In-town activities.
5. Changes over time in outdoor recreation pursuits--using 5 years ago versus now.
6. Propensities to change outdoor recreation activities if more time and income are available.
7. Concepts of a so-called "dream" vacation.
8. Location of present outdoor vacation activities to measure distance profiles traversed.
9. Ratings of key types of facilities in a recreation development, as a guide to planning.
10. Present ownership of outdoor recreation equipment.

The study is far too involved to be discussed here in further detail. The research design has been published for administrative use and will be available as a Texas Agricultural Experiment Station publication very shortly.

One further design comment is warranted. An effort will be made, as a part of the present design, to invert the model. Gained thereby is the opportunity of looking from facilities back, or outward, to the population served instead of only from the population downward. Thus, usage ratios for particular facilities, or types, can be formulated by asking the computer to key analyses on these as control variables.

The study will comprise a time span of about two years. It is believed that it will, among other things, demonstrate the viability of

team research in which the expertise of various researchers, such as general economists, econometricians, statisticians, consumer economists and psychologists can operate in a manner to produce more advanced and useful research models than would otherwise be possible. If our research planning proves to be effective in implementation, it may form the basis for research models to be applied in other states. Should this eventuality occur, we will begin to have comparable data among states so that interstate outdoor recreation activities can receive further analyses. If this does not evolve, on-site studies can serve as a partial measuring rod for out-of-state tourists usage rates of our recreation resources. Other bases can also be employed, such as research at entry routes into the state.

One problem which has plagued economists is that of accepting demand analytically as a given static except as it is influenced by population, income and related socioeconomic factors. Some consideration is necessary in the near future to the effect of demand stimulation activities. Texas has outdoor recreation potential unused. The active marketing of these resources will shift demand parameters of a degree we must know. This also suggests that the mix between private and public recreation is a prime point that needs our consideration, especially if the private sector has greater flexibility in supplementing, complementing, and the outright marketing of outdoor recreation. Obviously, those engaged in outdoor recreation research have interesting challenges ahead. The Texas Agricultural Experiment Station has an important role to play.