Kates, R. W., 1966. "The Comprehensive Regional Resource Plan, 1974", Research and Education for Regional and Area Development, pp. 244-254.

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The Comprehensive Regional Resource Plan 1974

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PROJECTIONS are informed estimates of the future based on specific assumptions, and they are found in the core of most regional planning. In this chapter we shall examine a projection of the resource planning process itself. Let us consider what comprehensive regional resources planning might be like in 1974. In summary my projection takes the following form:

I will assume that the powerful public and private forces that encourage regional planning of all types will continue and intensify. Under this pressure, we can look forward to the further development of new electronic hardware for data collection and processing. These tools can liberate us from the tedium of much of that which occupies planners, the collection and presentation of basic data. The central question will be: How will we utilize the opportunities created when professionals can be freed of some of their more time consuming and less rewarding tasks?

I would suggest two possibilities. For the short run, I can visualize building on the already existing computerized methodology embodied in such analytic models as that of the Harvard Water Program. This model has been used to provide an optimal design for a water resource development system in the Lehigh Valley that can meet a variety of needs at a minimal cost. If several difficult problems can be solved, continuous planning models can be designed. A system is foreseen that would monitor at regular intervals new economic and physical data required for the planning process and would repetitively reanalyze these data prior to the contemplated implementation of each new step in the plan.

Paradoxically, for the longer range, I would consider abandonment of long-term planning and would adopt as my watchword "make no master plans."

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Our ability to anticipate the changes in future taste and technology are sharply limited to the short run. Instead, long-range planning consideration might be limited, in particular, to study on three critical problems: (1) the effects of uncertainty on the planning process, (2) techniques for incorporating provisions for change in technology and taste in resource planning, and (3) developing analytic schemes capable of accepting different values and value systems in decision making.

Now to the specifics of my projections, which like all projections begins with a statement of assumptions.

As a geographer whose specialization is the field of resource management, I would like to project what regional resource planning might be like in 1974. It is probably not a good projection, as its assumptions are selective and more hopeful than realistic. But it will serve to focus attention on items for research.

Like all projections, it begins with a statement of assumptions. I will omit the usual assumptions that there will be no war, no depression, and no price changes—and assumptions of a fixed rate of economic growth, a growing population, and status quo for everything else.

Instead, I take as my assumptions some societal trends already under way that in many ways represent substantial change and break with the past. I foresee, in an increasingly affluent society, relatively greater expenditures for products and services that enlighten the mind, exercise the body, or move the spirit. These will be coupled with a greater concern for those persons and areas overlooked by the satisfied society. I assume a gradual but substantial reduction in military spending with the savings shifted to other areas of the public sector. Ideas of what constitutes useful activity and what constitutes play will change. We shall continue to liberate ourselves from natural environmental influences, but paradoxically, we shall show great concern for existing influences as well as the new ones we create by our artificial environments.

These trends already seem to be translated to new demands on natural resource use and development. Our notions of what constitutes useful natural resource products and services have expanded rapidly. In 1933, the TVA was assigned three water-related functions.[1] For a recent U.S. Study Commission, 11 water-related outputs were identified and the classification "other purposes" added, presumably in case new ones were required before completion of the study. The concern for eliminating regional inequities always

[1] These were flood control, navigation and electric power, 49 Stat. 1076 (1935).

seems to result in the call for more natural resource development.[2] The redefinition of environmental influences introduces new terms and new specialized services. We speak of environmental engineering, urban geology, or recreational soil studies. In turn, the demands for natural resource development are translated into plans of various sorts, and the past ten years has seen rapid growth and change in regional resource planning.

A leading type of program is the preparation of comprehensive river basin plans by federal agencies, and there are studies which will be completed, or will at least be under way, in every major basin by 1970.[3] On a lesser scale, there have been reports by state planning agencies and private research institutes, and some benchmark basin studies by university groups.[4] In other resource fields we find no shortage of activity.[5] Statewide recreational resource programs and inventories are being initiated by the Bureau of Outdoor Recreation. Regional resource analysis plays a prominent role in the growing number of area redevelopment reports, and there is a continual flow of plans and studies from the many state agencies concerned with resources, promotion, or development.[6]

I note the proliferation of resource planning to make two points. First, while the unfavorable climate for regional resource planning that saw the demise of the National Resources Planning Board may still not have changed, we will, in the next ten years, however, see the country blanketed with regional resources plans, possibly several layers deep. Secondly, the techniques being used in this planning are not fixed, but seem to absorb new approaches developed in university and private research.

Now, to return to my projection and to suggest what a regional resource development planning function might involve in 1974. In brief, with the abundance of previous activity to improve upon, we might possess, by 1974, systems for analyzing regional natural re-

[2] 72 Stat. 1090 (1958), the law authorizing the U.S. Study Commission-Southeast River Basins.

[3] U.S. Department of Army, Office of the Chief of Engineers, "Seminar on River Basin Planning, Ft. Belvoir, Va., 27–31 May, 1963," Department of the Army, Washington, D.C., 1963, pp. 1–21.

[4] See for example the report of the Meramec Basin Research Project, Washington University, St. Louis, Mo.

[5] U.S. Bureau of Outdoor Recreation, "Bureau of Outdoor Recreation Manual, Pt. 241, Nationwide Plan," U.S. Bureau of Outdoor Recreation, Washington, D.C., 1964.

[6] The Association of American Geographers maintains an active concern with information systems of geographic interest and features of these systems may prove useful for monitoring regions for resource development. Two summaries of recent developments are the reports of the Association's Committee on the Utilization of Stored Data Systems and of the Geographic Coding Subcommittee of the Census Advisory Committee. Both reports may be found in the *Professional Geographer*, July 1964, pp. 36–43.

sources. These systems may include radical data collecting techniques harnessed to improved programs of short-run analysis and new concepts of long-range study.

BASIC DATA COLLECTION

The raw materials of regional resource development are the basic data inputs. These are the measurements and observations related to land use, stream flow, forest growth, and mineral potential plus all the usual indicators of demographic and economic change. To date, assembling and analyzing these data represent the largest single item in the time budget of resource planning. But the next ten years can bring new techniques and technologies that will liberate the resource analyst from much of the data handling chore.

New information systems for regional economies are discussed elsewhere in this volume. For resource planning, I visualize other useful systems as well. Examples are collecting land-use data by aerial photographs from satellites,[7] measuring changing consumer demand with longitudinal social survey panels,[8] and developing improved measures of stream flow from continuous monitoring of water quality.[9, 10] The land-use map of the future, if graphic display is still required, might well be an electronic board with grey tone patterns which constantly change as inputs of data representing land transactions, building permits, zoning adoptions and variances are fed into computers.[11] In short, the continuous or repeated monitoring of a region for basic data inputs is well within our grasp.

SHORT-RANGE ANALYSIS

In 1974, much of what passes today for long-range comprehensive planning will be looked at more realistically. At present, be-

[7] The applicability of satellite observational systems to geographic data needs is being studied by the Geography Branch of the Office of Naval Research. See also, J. B. Bird and A. Morrison, "Space Photography and Its Geographical Applications," *Geographical Review*, Vol. 55, 1964, pp. 463–86.

[8] A number of such panels exist, either for special study as in the Princeton Fertility Study, or repeated national sampling as carried out by the U.S. Bureau of the Census, *Current Population Survey*. The panels in the survey are rotated, however.

[9] For a description of synthetic hydrology, see A. A. Maass *et al.*, *Design of Water Resource Systems*, Harvard University Press, Cambridge, Mass., 1962, pp. 459–93.

[10] See references to automatic monitoring systems on p. 70 of A. V. Kneese, *The Economics of Regional Water Quality Management*, Johns Hopkins Press, Baltimore, Md., 1964.

[11] Report of the Panel of Consultants to the Bureau of the Budget, "Standards and Criteria for Formulating and Evaluating Federal Water Resources Development," Washington, D.C., 1961, mimeo, pp. 11–24.

cause of the need for reimbursing high capital costs through relatively low interest rates benefits and costs are projected over periods of 50 to 100 years. If higher discount rates are used .including those reflecting opportunity costs of various types (reflecting costs represented by what the capital could have earned in other employment), the effective period of pay out may be radically reduced. Moreover, we really can't look into the future for 50 to 100 years.[12] Our projections are arbitrarily extended to meet the institutional demands placed on the analyst. By 1974, more realistic discounting and greater acceptance of the analyst's modest abilities can lead to a short-run analysis using the basic approach to systems design now used in the best of long-range comprehensive planning. The focus in such a case would be on the additional unit to be added to the system.

Thus, I would like to take as my model the methodology of water resource system design developed by the Harvard Water Program. A recent project has been the development of a simulation program for the Lehigh River, a tributary of the Delaware, coded for the IBM computer at Harvard.[13]

> As arranged for simulation, the Lehigh System contains 42 major design variables. Sixteen variables deal with physical facility components—sizes of . . . reservoirs . . . power plants . . . and diversion works. . . . Twenty-four variables relate to allocation of reservoir capacity . . . (and) there are two output design variables . . . with target volumes of water and energy to be provided.
>
> The Lehigh simulation model is dynamic, if the investments in reservoirs, power plants, and recreation facilities can be scheduled over time to meet changing levels and patterns of demand for system outputs. . . .
>
> In the simulation, either the historical monthly and flood hydrology . . . or synthetic traces (generated internally as part of the program) can be used.
>
> The model contains the usual capital and OMR (operation-maintenance-replacement) cost functions for resource inputs, long-run benefit functions for target outputs, for water supply, energy and recreation, and flood damage-discharge functions. Functions which relate losses in economic value to output deficits . . . are provided for water supply, energy, and recreation. Economic payoffs . . . of net benefits for each demand period and for the entire period of economic analysis are provided for any specified discount rate. Information is provided on both the mean and standard deviation of annual benefits for water supply, energy, recreation, and annual flood losses with and without the system.

[12] M. H. Hufschmidt and M. B. Fiering, *Simulation Techniques for Design of Water Resource Systems*, Harvard University Press, Cambridge, Mass. (forthcoming).

[13] ———, "The Methodology of Water Resource System Design," in Burton and Kates, (eds.) *Readings in Resource Management and Conservation*, University of Chicago Press (forthcoming).

> Looking towards future development, Maynard Hufschmidt suggests: The full impact of new techniques of systems analysis and operations research, and dramatic changes in computer technology are only beginning to be understood by planners and designers. Thus changes may assume forms in detail somewhat different than those (described in the model) . . . , but we can be sure that major changes will be along the general lines presented here.[14]

Assuming this is the case, what might some of these 1974 changes be for an already advanced model? I think the major direction of improvements would lie in the harnessing of continuous data inputs into system design subprograms that convert these data into new costs, benefits, and loss functions, revise target outputs, and the like. With this continuous revision of the design variables, the role of the analyst will be to choose the next-added unit to satisfy the target outputs and the objective function and constraints incorporated in the design system. In effect, each unit to be added to the system would utilize a recompilation and recomputation of the most recent relevant physical, economic, and social data.[15]

To reach this idyllic state of affairs, I can foresee at least three major problems for research to solve. The first deals with computer capacity—which may exist only as a reflection of my rudimentary knowledge of "computerese." The present Harvard program involves both a drastic preliminary screening of design alternatives and simplification of design variables because of limitations of computer time and capacity. The next generation of computers, being so eagerly awaited, may help, but not solve, this problem. There may well be a version of Parkinson's law written in FORTRAN.[16]

I can best illustrate the second problem by referring to a recent attempt I made to synthesize industrial flood damage loss function.[17] It appears from this analysis that the notion of what a flood loss is rests heavily on the stance assumed by the analyst; the loss differs considerably if viewed from the point of view of the firm, the establishment, the community, the region, or the nation.

[14] *Ibid.*

[15] A first approximation to a time-dependent planning process can be found in L. D. James, *A Time-Dependent Planning Process for Combining Structural Measures, Land Use, and Flood Proofing to Minimize the Economic Cost of Floods*, Stanford University Institute in Engineering-Economic Systems Report EEP-12, 1964. In this study, James divides a 50-year period into five 10-year stages and for each stage sequentially recalculates the optimal mix of structural measures, land use, and flood proofing that minimizes the total economic cost of floods at seven levels of protection and for 42 small watersheds.

[16] FORTRAN, which stands for IBM's FORmula TRANSlating systems, is an automatic coding system that converts a simplified programming language (closely related to the ordinary language of mathematics) into machine language.

[17] R. W. Kates, *Industrial Flood Losses: Damage Estimation in the Lehigh Valley*: Department of Geography research paper No. 98, University of Chicago, 1965.

Now in some of the economic literature that I can understand, we are told that in these design models the objective functions are interchangeable, i.e., we can choose to maximize national income or regional income, move towards income redistribution, etc.[18]

From my own work I conclude that in order to change the objective function and constraints, all the input functions related to benefits and costs may have to be changed as well. Flood losses are not neutral observations, nor are other data. Thus, one requires many sets of observations, each set influenced by a desired objective function.

My third problem may be more difficult to solve as it involves basic understanding. With a firm conceptual framework for flood losses, it is possible to work out the differential components of loss by economic stance. But for other classes of benefits that are rapidly increasing in importance, the conceptual framework for assessing tangible benefits is extremely weak. There is no consensus on how to evaluate a recreation day, calculate the benefits of reduced thermal pollution, or assess the real cost of a reduction in pesticide application.

LONG-RANGE STUDY AND EXPLORATION

If we can foresee the development of new technologies of data collection and the refinement of analytic methods to choose additional units, I fear we cannot foresee the pattern of changes in taste or technology much beyond ten years. In this light, we should take a fresh look at what comprehensive planning means, and perhaps bury the "master plan."

> John Friedmann put it well: The phenomena of metropolitan civilization are too complex and too rapidly changing to be dealt with in a 'comprehensive' manner. The value assumptions of long-range planning are shaky in the extreme and largely non-measurable. Our knowledge of the consequences of alternative design proposals is grossly imperfect, and political support for long-range comprehensive planning is totally lacking.[19]

[18] This statement does not do real justice to the concern in regional economics with multiple objective functions. See C. Leven, "Establishing Goals for Regional Economic Development," *J. of the AIP,* Vol. 30, 1964, pp. 100-109. A less optimistic view, embodying fundamental criticism of any attempt to optimize in a formal sense for resource planning is found in S. V. Ciriacy-Wantrup, "Conservation and Resource Programming," *Land Economics* Vol. 37, 1961, pp. 105-11.

[19] J. Friedmann, "Metropolitan Form and Social Choice," *Bulletin of the Atomic Scientists,* May, 1964, p. 32.

But does it follow that if we join the "make no master plans" club we are writing off long-range analysis in an uncertain world? I would suggest that the usual type of long-range projection planning be replaced by a new study and exploratory function, and that long-range study models be devised to explore three critical resource planning problems.

The first deals with studying the effects of uncertainty. Altouney's recent study of nonrandom bias in small area population projection and in the estimation of engineering costs suggests useful methods of analyzing the effects of uncertainty on expected benefits and costs.[20] To date, long-range projections have usually involved no more than three alternatives—a high, low, and medium projection. For planning purposes, the medium projection is almost always chosen. Interest in the future will focus on other parameters and the model of the Harvard Water Program incorporates the standard deviation of expected benefits reflecting the variability of hydrologic events. Resources may pose special uncertainties related to extremes of nature not found in the normal planning periods of other enterprises. Gould's study of the 50-year experience of the Harvard Forest is a sobering commentary on the effect of a hurricane on an objective of sustained yield for forest products.[21] It also exemplifies the usefulness of extending long-range study of uncertainty as well. Not only do reviews of past experience yield insights of the uncertainties of resource planning but they reveal our inability to account for change in human behavior, consumer taste, or technology. An example of a recent projection might be in order.

The projections of *Resources in America's Future* by the organization, Resources for the Future, are the best compilation of resource projections made in the United States.[22] In a review with Ian Burton, we examined the assumptions made for the RFF estimated demand for water by 1980 and 2000.[23] We noted that the authors assume no major technological breakthroughs, no significant changes in public policy, the maintenance of the present level

[20] E. G. Altouney, *The Role of Uncertainties in the Economic Evaluation of Water-Resource Projects,* Stanford University Institute in Engineering-Economic Systems, Report EEP-7, 1963.

[21] E. M. Gould, Jr., "Fifty Years of Management at the Harvard Forest," Harvard Forest Bulletin No. 29, Petersham, Mass., 1960.

[22] H. H. Landsberg, L. L. Fischman, and Joseph L. Fisher, *Resources in America's Future: Patterns of Requirements and Availabilities 1960-2000,* Johns Hopkins Press, Baltimore, Md., 1963.

[23] I. Burton and R. W. Kates, "Slaying the Malthusian Dragon: A Review," *Economic Geography,* Vol. 40, 1964, pp. 82-89.

of water supply costs—and did not study possible price elasticities of demand for water supply.[24]

Our comments on these assumptions were as follows:

> One safe prediction that can surely be made is that most of these assumptions will have been proved invalid by the year 2000. Major technological developments will occur. Significant shifts in public policy will take place. Water costs for some uses will rise in real terms. There is even the chance that price structure with elasticities will be evolved. The authors are aware of all this . . . [but] really have no choice. If they rejected the status quo type of assumption they would find themselves in the shifting sands of a land with no signposts to the future. Thus, if there are ten major technological innovations on the horizon, there is no way of detecting the reality from the mirage. Nor is it possible to know which one of a dozen major governmental policies will be changed, and for what uses costs will rise and fall. To make projections for all the possible combinations of such a wide range of assumptions would not only be prohibitively expensive, it would also be an exercise in futility in which the answer comprises a list of all possible answers.[25]

However, if we replace long-term projection with study and exploration as the goal of long-range analysis, then it is within the scope of ten years of research to develop models in which the differential impact of ten technological innovations or twelve governmental policies can be explored. We can build in the behavioral insights that have been accumulating. For example, we can include logistic adoption functions of resource practices and innovations. Spatial diffusion models have already been put to work in at least one case involving groundwater use projection.[26]

For the final opportunity and, in my view, the most important one, we might have by 1974 long-range models capable of handling alternative objectives. In these models the functions and their constraints would represent value systems that are not presently interchangeable. The need for such an approach is being increasingly recognized. It arises in part from a concern for the quality of life. I might cite the resource economists who have done so much to clear the intellectual air of the imagery that has beclouded careful discussion of conservation and natural resource use. Noted for their rigorous analysis, they return nevertheless from their voyage of

[24] *Ibid.*, p. 87.

[25] *Ibid.*, p. 88.

[26] L. W. Bowden, "Simulation and Diffusion of Irrigation Wells in the Northern Colorado High Plains," Abstract of paper presented at meetings of the Associations of American Geographers, Syracuse, N.Y., 1964. *Annals of The Assoc. of Amer. Geographers*, Vol. 54, 1964, p. 414.

slaying the Malthusian dragon earnestly concerned, as were earlier conservationists, with values not easily handled in their calculus. Thus, we find Barnett and Morse addressing the final chapter of their volume *Scarcity and Growth* to "Natural Resources and the Quality of Life,"[27] or we find Ayres Brinser expressing an eloquent concern:

> It is not the quality of the resource itself that we are concerned with, but with its capacity to enhance the quality of life. This is a sticky problem and it becomes involved in many subjective evaluations, but it seems to me that we can no longer avoid the fact that the management of our natural environment should be geared toward an apparatus which will maximize the quality of life within that landscape. . . . It means devising systems of analysis in which the alternatives, in terms of the resulting quality of life, are fully conceived and presented so that society can understand what these alternatives really are.[28]

I look to the day that we might possess models that could for example, sketch for a region the consequences that follow if it did not choose to grow, or if it chose a national seashore rather than an oil refinery, or wanted to consider the regional effect of user fees on waterways.

CONCLUSION

Like all resource projections, this one has an element of self-fulfilling prophecy as well. If the kinds of regional analysis sketched herein seem partially desirable, then I suggest we place on the needed research agenda the following items:

1. The development of techniques and organizational forms (including financing) for continuous or repeated basic data monitoring.
2. The development of short-term system design models that can accept a continuous data input, handle large numbers of design variables including nonengineering behavioral or institutional alternatives, and include benefit valuation of so-called intangibles. The emphasis would be on identification of the next-best-unit to be added.

[27] H. J. Barnett and C. Morse, *Scarcity and Growth: The Economics of Natural Resource Availability*, Johns Hopkins Press, Baltimore, Md., 1963, Chap. 12, pp. 252-66.

[28] A. J. W. Scheffey, ed., "Resources, the Metropolis and the Land-Grant University," University of Massachusetts Cooperative Extension Service and the Conservation Foundation, 1963, p. 44.

3. The development of long-range models incorporating new measures of uncertainty and capable of simulating changes in technology, demand, human behavior, and alternative value systems. Here, the emphasis would be on advice and exploration rather than design.

In choosing these items and ignoring others, I express my preference for a research strategy that, while utilizing the best research techniques and technology, is prepared to trade precision and elegance of design for a crude approximation of a broader range of norms, behaviors, and value objectives.