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Coping With Uncertainty: Social Scientists, Engineers, and Federal Water Resources Planning

ABSTRACT

The growing popularity of multipurpose water management—encouraged by a great many engineers—in the early 20th century led to the call for severely rationalist studies of regional social and physical characteristics. To analyze what, where, and when multipurpose projects were needed, the federal government hired economists, geographers, and political scientists. “Planning” became the watchword, and by 1965 that activity occupied a sizable number of social and physical scientists in the federal government. Since passage of the National Environmental Policy Act in 1969, with its requirement for environmental impact statements, natural scientists also have become an important part of water resources planning, for they must determine both immediate and long-term environmental impacts. The net result of these changes is that the role of the engineer has changed in the planning process. This, in turn, has contributed to changes in organizational culture and focus. This article examines and evaluates the evolving water resources planning process and shows how that process has affected professional and organizational relationships, the design of water projects, and the theory of water management.

Throughout the twentieth century, and especially since the Great Depression, social scientists have influenced federal water resources planning in the United States. Primarily, political scientists, geographers, and economists have focused on the optimal administrative machinery and planning region; comprehensive short- and long-term planning objec-

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tives; and methods of evaluating potential projects.¹

Success has been most evident in this last area, for benefit-cost analysis, long a mainstay of water resources planning, depends on the gathering and interpretation of socioeconomic data. Nevertheless, social scientists generally have failed to convince engineers that social systems must be studied as carefully as natural systems prior to constructing a water project. Moreover, changing values and orientation among both engineers and social scientists have increased tensions between the two groups despite federal laws and regulations that basically mandate cooperative efforts.

At the beginning of the century, social scientists and engineers were closer in spirit. Both groups sought systematic principles to guide them to better planning and to improve society.² Both believed that those blessed with experience, training, and moral virtue should administer. Once problems were resolved, once "laws" were discovered, there would be no need for new answers. In succeeding decades, and particularly after World War II, engineers became more modest about their ability to discover such laws, but they retained their faith in an ordered universe, albeit far more complex than once envisioned. In contrast, many social scientists abandoned the search for any objective laws because it meant excluding concern with values. They turned their attention to examining the connections between individual and group behavior and between the environment and human activity.³ Rejecting the Spencerian determinism that dominated their profession's early years, they attempted to identify the conditions under which choices are made and objectives determined. There was also in this reorientation an implicit concession—one that many physical scientists also now grant⁴—that the world is chaotic and often unpredictable. This approach may be more practical and intellectually rigorous, but among water planners it has strained relations between product-oriented engineers and social scientists, whose seemingly insatiable appetite for data often impressed engineers as unreasonable, if not outrightly obstructive.

The social science focus on values and choice impaired relations with engineers in another way. Civil engineers proudly observed their completed projects and took satisfaction in human manipulation of na-

1. No consensus evidently exists on what fields are to be considered social sciences. In addition to those already mentioned, anthropology, psychology, and sociology are usually included. History, in particular, exists on the fringes of social science but is not necessarily part of it.

2. W. Nelson, *The Roots of American Bureaucracy, 1830-1890* at 86 (1982); E. Layton, Jr., *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession* 66 (1971).

3. R. Hinkle, Jr. & G. Hinkle, *The Development of Modern Sociology* 47-69 (1954). See Ross, *The Development of the Social Sciences*, in *The Organization of Knowledge in Modern America, 1860-1920* at 107-38 (A. Oleson & J. Voss eds. 1979).

4. See J. Gleick, *Chaos: Making A New Science* (1987).

ture. They boasted of the direct flood control, irrigation, navigation and hydropower benefits that their works produced, but, until the last twenty or thirty years, rarely reflected on what alternatives their projects denied. Unlike engineers, social scientists saw no *intrinsic* value to any project. The value lay in the alternative use of resources. They regarded engineering as only one of several tools to be used in regional development and left open the possibility that the best option may be no development at all.

We cannot be certain that the use of social science has produced better water projects. We assume it has, but without systematic evaluations of the consequences of water resources projects, "post-audits", we simply do not know how well we plan.⁵ Unfortunately, very few evaluations have been done. Nevertheless, it remains important to understand both the capabilities and limitations of the planning process. Countless monographs testify to the influence of politics and public values in this process, but the process also responds to changes in professional expertise.

Social scientists themselves occasionally have assessed their discipline's contributions to our understanding of water resources development.⁶ However, their analyses often blur the distinction between monographs about water resources and those that actually apply social science knowledge to specific policy issues. Somewhat surprisingly too, social scientists have not carefully considered the effect of their methodologies on the professional culture of engineers who actually design water projects. Finally, few social science assessments show sensitivity to the historical dimension; the period discussed is generally limited to the author's own career. By focusing on the impact of social science on twentieth century federal—especially Army Corps of Engineers—water resources planning and policies, this article illuminates an inadequately appreciated part of the natural resources history of the United States. Significant historical work on this topic remains to be done.

THE BEGINNING: ECONOMICS WITHOUT ECONOMISTS

The American dream of egalitarian economic expansion came to an end at the beginning of this century. Drastically reduced public lands

5. Gilbert White has been the foremost proponent of post-audit evaluations, although the idea can be traced back to mid-century. White, *When May a Post-Audit Teach Lessons?*, in *The Flood Control Challenge: Past, Present, and Future: Proceedings of a National Symposium*, New Orleans, Louisiana, September 26, 1986 at 53–63 (H. Rosen & M. Reuss eds. 1988). See R. Haveman, *The Economic Performance of Public Investments: An Ex Post Evaluation of Water Resources Investments* (1972).

6. *Man & Water: The Social Sciences in Management of Water Resources* (L. James ed. 1974). In successive chapters, John W. Bennett, Stephen C. Smith, Gilbert F. White, Henry C. Hart, and Sue Johnson examine the impact of anthropology, economics, geography, political science, and sociology, respectively. *Id.* James himself is an engineer. See also L. James & J. Rogers, *Economics and Water Resources Planning in America*, in 105 *Proc. Am. Soc. Civil Engineers, Water Res. Planning & Mgmt. Div.* 47–64 (1979) (for a succinct overview of the subject).

and sharply rising population evoked a distressing vision of a population outrunning food production. Lumbermen and miners voiced concerns about diminishing timber supplies and dramatic increases in iron and petroleum use. Neglected waterways, demands for hydropower throughout the country, and calls for irrigation projects in the West drew particular attention to the nation's water resources. Enthusiastically supported by President Theodore Roosevelt, multipurpose partisans advocated the application of scientific management to insure efficient water use. This meant a program of basin-wide development that would address all potential applications of the resource.⁷ Of the social sciences, economics appeared to offer the most to multipurpose development. At the May, 1908, White House Conference of Governors, convened to discuss conservation planning, Dr. Edmund J. James, president of the University of Illinois and a charter member of the American Economic Association, said, "The questions before this Conference are primarily in our opinion, economic questions . . . questions of so organizing and utilizing our national resources as to produce in the large and long run the greatest return in the form of material wealth to the Nation."⁸ Given the growing recognition that America's natural wealth must be husbanded, and the increasing popularity of a "systems approach" to management in the country,⁹ economists could optimistically envision increased demands for their service. Scientific management would guide the future development of the nation's natural wealth, including water resources, and economists would operate the twin keys to success: scientific efficiency and administrative cooperation.

However, the practice of involving social scientists in public administration, first attempted in Wisconsin just after 1900, was not easily transferred to Washington. Theodore Roosevelt prized character over in-

7. N. Wengert, *The Administration of Natural Resources: The American Experience* 28-33 (1961); S. Olson, *The Depletion Myth: A History of Railroad Use of Timber* (1971); M. Williams, *Americans and Their Forests: A Historical Geography* 331-52 (1989); S. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920* at 5, 27-48 (1959). Inland Waterways Commission, *Preliminary Report*, S. Doc. No. 325, 60th Cong., 1st Sess. 15 (1908) (includes a statement by Theodore Roosevelt to the Inland Waterways Commission on Mar. 14, 1907, which illustrates his support of multipurpose development).

8. *Proceedings of a Conference of Governors in the White House, Washington, D. C., May 13-15, 1908* at 174 (W.J. McGee ed. 1909). See these proceedings for the origins of this extraordinary conference, which included political leaders, academicians, representatives of professional societies, and bureaucrats. *Id.* at v-xii. See also C. Van Hise, *The Conservation of Natural Resources in the United States* 5-7 (1910); *Our Natural Resources and Their Conservation* 6-7 (A. Parkins & J. Whitaker eds. 1939); H. Huth, *Nature and the American: Three Centuries of Changing Attitudes* 185-88 (1972).

9. T. Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm, 1870-1970* at 184-248 (1989). Hufschmidt, *Systems Analysis*, in 16 *Water Res. In & Econ. Dev. In the South, Agric. Pol'y Inst. Series* 81-90 (1965) (on the early application of systems analysis to water resources planning).

tellect and remained suspicious of intellectuals despite his interest in efficient government. Woodrow Wilson, who came from an academic background, nevertheless did not think "experts" made particularly good administrators. Opposition also came from suspicious congressmen, who habitually scuttled any proposals to transfer legislative prerogatives to professional administrators.¹⁰ Moreover, despite experiments with national planning and multidisciplinary analysis during World War I, in somnolent postwar Washington, economists and other social scientists turned their attention to changing the process rather than basic institutional structures.¹¹ Their interest in natural resources issues waned,¹² and this created a paradox in water resources planning. On one hand, conflicting water needs drew public attention to related economic and social questions. On the other, the economists left the field largely to the engineers, who willingly expanded their professional responsibilities, especially if it meant enhancing their positions as managers.¹³ Engineers continued to dominate, not only the design and construction, but the planning of water developments.

Social questions touched all federal water agencies during the 1920s. Dating back to the Gallatin report of 1808, Congress generally had supported public works whose benefits were "annual additional income to the nation".¹⁴ However, as more and more projects were approved following the Civil War, it became evident that many projects were of questionable *national* benefit. In 1920, Congress instructed the Corps of Engineers to report on the local and general benefits of proposed projects and to recommend whether local cooperation should be required. While the Corps' subsequent analyses generally satisfied Congress, it was not

10. N. Henry, *The Emergence of Public Administration as a Field of Study*, in *A Centennial History of the American Administrative State* 40–50 (R. Chandler ed. 1987); D. Waldo, *Politics and Administration: On Thinking about a Complex Relationship*, in *A Centennial History of the American Administrative State* 91–96 (R. Chandler ed. 1987); Hays, *supra* note 7, at 4, 109–14 (*et passim*); R. Hofstadter, *Anti-intellectualism in American Life* 199–213 (1963); Wengert, *supra* note 7, at 37.

11. O. Graham, Jr., *Toward a Planned Society: From Roosevelt to Nixon* 9 (1976); T. Haskell, *The Emergence of Professional Social Science: The American Social Science Association and the Nineteenth-Century Crisis of Authority* 86–87 (1977); Ross, *supra* note 3, at 107–38; Hofstadter, *supra* note 10, at 199–213; Waldo, *supra* note 10, at 93.

12. W. Barber, *From New Era to New Deal: Herbert Hoover, the Economists, and American Economic Policy, 1921–1933* at 15–22 (1985); Graham, *supra* note 11, at 13; P. Warden, *A History of the National Resources Planning Board, 1933–1943* at 1–37 (1979); Clements, *Herbert Hoover and Conservation, 1921–33*, 89 *Am. Hist. Rev.* 67–88 (1984); D. Swain, *Federal Conservation Policy, 1921–1933* (1963).

13. D. Noble, *American By Design: Science, Technology, and the Rise of Corporate Capitalism* (1977).

14. A. Gallatin, *Report of the Secretary of the Treasury on the Subject of Public Roads and Canals Made in Pursuance of a Resolution of Senate, of March 2, 1807* at 1 (1808).

until after World War II that the agency decided to hire economists to do the work.¹⁵

Social and economic questions also rose in the Bureau of Reclamation. Even reclamation engineers admitted that too much emphasis had been placed on the purely engineering phases of reclamation and not enough on the "human engineering" issues, as Elwood Mead, the new Commissioner of Reclamation, called it in 1924.¹⁶ A "Fact Finders" report, written by Bureau of Reclamation engineers, surveyed reclamation history and concluded that planners must evaluate economic and social, as well as engineering, feasibility when selecting projects. Congress made this mandatory in legislation passed in 1924.¹⁷ In 1929, Alvin Johnson, editor of the *Encyclopedia of the Social Sciences*, concluded that "[r]eclamation is a policy immensely worth continuing, if it moves forward, as the times require, from its engineering achievement to equally distinguished achievements in the art of community building."¹⁸ In 1927, Congress directed the Corps to prepare general multipurpose plans to improve navigation, water power, flood control, and irrigation on the Mississippi River and alluvial valley.¹⁹ Despite its reservations about multipurpose development, the Corps responded with alacrity—and without social scientists. The resulting so-called "308 reports," named after the House document in which the cost estimates for the reports first appeared, provided basic data for multipurpose development for decades to come.²⁰ However, no social scientists addressed regional economic and social issues, and little thought was given to long-term growth. Engineers surveyed the rivers and gathered whatever data they could, sometimes resorting to rough calculations and intuition in traditional engineering fashion. Economics had become important; economists had not.

15. Rivers and Harbors Appropriation Act of 1920, 33 U.S.C. § 547 (1988); W. Holt, *The Office of the Chief of Engineers of the Army: Its Non-Military History, Activities, and Organization* 99–111 (1923) (outline of organization of the Corps); Willeke, *Social Aspects of Water Resources Planning*, in Proc. Am. Soc. of Civil Engineers, *supra* note 6, at 84; Transcript, interview with B. Joseph Tofani (Feb. 10, 1988) (conducted in Palm Coast, Florida, by M. Reuss and available in Office of History, Headquarters, United States Army Corps of Engineers, Fort Belvoir, Virginia; this depository will hereinafter be cited as OH, HQ USACE). Tofani was the first "supergrade" in the Corps of Engineers. He is now retired.

16. C. Hynning, *Water Planning* 25 (1937) (draft manuscript chapter submitted to the Water Resources Committee) (available in file on "Water Resources Committee Progress Report, 1935–1939," Gilbert F. White papers, OH, HQ USACE. The White papers are currently being inventoried, and file identification is tentative).

17. *Id.* at 25–26. See D. Dawdy, *Congress in Its Wisdom: The Bureau of Reclamation and the Public Interest* 28–29 (1989); W. Warne, *The Bureau of Reclamation* 64 (1973); A. Golze, *Reclamation in the United States* 28–29 (1961); Swain, *The Bureau of Reclamation and the New Deal*, 61 Pac. Northwest Q. 137–38 (1970).

18. Hynning, *supra* 16, at 27.

19. Rivers and Harbors Appropriation Act of 1927, 33 U.S.C. § 702 (a) (1988).

20. House of Representatives, *Estimate of Cost of Examinations, Etc., of Streams where Water Power Appears Feasible*, H.R. Doc. No. 308, 69th Cong., 1st Sess. (1926).

THE RISE OF THE SOCIAL SCIENCE PLANNERS

Although the 1920s saw little governmental promotion of social programs at the national level, an increasing number of students entered the social sciences during the decade. In the two years 1920–21, a total of 108 Ph.D.s and 678 M.A.s²¹ were awarded in economics, political science, and sociology. By the years 1928–29, the number had climbed to 357 Ph.D.s and 1,496 M.A.s. The increasing numbers reflected and contributed to the growing stature of social scientists. "Prediction is the aim of the social sciences as it is of the physical sciences," confidently proclaimed University of Chicago sociologist Ernest W. Burgess in 1929.²² That same year, the economist Beardsley Ruml observed that "high administrative officers and commissions are coming to depend on studies, and on information and advice from social scientists, just as they depend on the expert services of engineers."²³ Ruml's mentioning of engineers could hardly have been casual. At the dawn of the New Deal, they remained the example par excellence of experts in government.

Ruml himself played a critical role in helping to prepare social scientists for public administration responsibilities. As director of the general education fund of the Laura Spelman Rockefeller Memorial (amalgamated with the Rockefeller Foundation in early 1929), Ruml offered essential financial support to the Social Science Research Council (SSRC), founded in 1923 largely through the efforts of his former professor at Chicago and lifelong friend, Charles E. Merriam.²⁴ The Ruml-Merriam relationship was mutually beneficial. It brought financial stability to the SSRC, and, through the council's largess, stimulated social science research, including work on water resources. Not incidentally, it provided the financial resources that made Chicago—the city and the university—the most innovative social science laboratory in the country.

While Ruml linked money and academia, Merriam bridged academia and politics. Professor of political science at the University, Chicago

21. H. Odum, *The Development and Application of the Social Sciences and Social Research* 13 (unpublished draft, William F. Ogburn papers, box 16, folder 1, Dep't of Special Collections, The Joseph Regenstein Library, U. Chi.; this depository will hereinafter be cited as UC).

22. Burgess, *Is Prediction Feasible in Social Work? An Inquiry Based Upon A Sociological Study of Parole Records*, 7 Social Forces 533 (1929) (copy in Ernest W. Burgess papers, box 191, folder 2, UC). Burgess never lost his faith in social science to predict. Indeed, much of his professional career was spent searching for "prediction instruments." Guide to Burgess papers and lectures presented by Burgess on Theory and Methods of Predictions in the Social Sciences (1937–38) (four lectures, box 193, folders 5 and 6, Burgess papers, UC).

23. Speech by B. Ruml, *Recent Trends in Social Science*, at dedication of the Social Science Research Building of the University of Chicago (Dec. 17, 1929) (Charles Merriam papers, box CXLVIII, folder 8, UC).

24. B. Karl, Charles E. Merriam and the Study of Politics 125–33 (1974); E. Sibley, *Social Science Research Council: The First Fifty Years* 3 (1974). See Rockwell, *Institutions—Social Science Research Council*, 32 *Environment* 2–4 (1990).

alderman for a number of years, and unsuccessful candidate for mayor of Chicago in 1911, Merriam was a Progressive Republican who understood the political constraints placed on the actual application of social science. Elected as president of the American Political Science Association in 1921 and founder of the behavioral movement in political science, he was a respected classroom teacher as well as social science practitioner. Harold L. Ickes directed his mayoral campaign, which ended in narrow defeat. The enduring friendship of the two men brought Merriam to Washington in 1933, when Ickes became the new Secretary of the Interior.²⁵ In turn, Merriam recruited other University of Chicago social scientists to the banner of national resources planning.

The social scientists who came to Washington soon after Franklin D. Roosevelt became President had already amassed a great deal of data. The Brookings Institution published four reports in 1933 that, in the midst of depression, presented an optimistic picture of the nation's accomplishments and economic strengths. At the Department of Agriculture, remarkably productive individuals in the Bureau of Agricultural Economics had published detailed regional economic studies; the monographs of some academic historians and economists complemented those efforts.²⁶ However, the enterprise most germane to national planning was the two-volume, 1,500 page *Review of Findings*, published by President Herbert Hoover's Research Committee on Social Trends. In the best Progressive spirit, with its emphasis on rational management, Hoover had established this committee in September 1929, to identify America's natural resource, demographic, social, and cultural problems and to suggest appropriate remedies. The Rockefeller Foundation paid for the work, and the SSRC supplied many of the participants. Hoover, once a practicing engineer, selected Wesley C. Mitchell, a professor of economics at Columbia University, to chair the committee. He had known Mitchell since his days as Secretary of Commerce, when Mitchell had directed the department's Bureau of Economic Research. Merriam became the vice-chairman.²⁷

The *Review of Findings* said surprisingly little about water development, except to call for the development of hydropower.²⁸ However, it did urge economic planning. "Thousands of experts from thousands of places" were needed.²⁹ The task was admittedly difficult, but the commit-

25. Karl, *supra* note 24, at 66-72, 102-08; M. Clawson, *New Deal Planning: The National Resources Planning Board 60-61* (1981); T. Watkins, *Righteous Pilgrim: The Life and Times of Harold L. Ickes, 1874-1952* at 106-08 (1990).

26. Clawson, *supra* note 25, at 33-34; H. Taylor & A. Dewees Taylor, *The Story of Agricultural Economics in the United States, 1840-1932* at 277-325 (1952).

27. Karl, *supra* note 24, at 209-211. Mitchell began his professional career at the University of Chicago.

28. The President's Research Committee on Social Trends, *Review of Findings* (1933). See J. Greenan, *American Civilization Today: A Summary of Recent Social Trends* (1934) (a shorter version intended for school and college use).

29. Research Committee on Social Trends, *supra* note 28, at xxxi.

tee thought the effort should be attempted, beginning with "modest schemes."³⁰ The report even broached the idea of establishing a National Advisory Council to deal with basic social problems. It drew special attention to activities that undermined good government, such as lobbying organizations that represented economic rather than political interests, large-scale economic mergers, and poor political leadership. However, there was a positive note. In the last few decades, "the expert has been recognized because his utility and indispensability in the practical operations of the government," a trend the committee clearly endorsed.³¹

With the advent of the New Deal administration of President Franklin D. Roosevelt, a major conduit between social scientists and the executive branch became the National Planning Board (NPB). Secretary of Interior Ickes established this board in July 1933, as an advisory panel for the Public Works Administration that he directed. It subsequently underwent several name and organizational changes.³² The President's uncle, Frederic A. Delano, chaired the NPB. Delano was a supporter of regional and park planning, former member of the Federal Reserve Board, and chairman of the National Capital Park and Planning Commission. Based on Ickes' recommendations, Roosevelt appointed Merriam and Mitchell to the board's other two positions. The appointments suggested at the very least that the decisions of the Committee on Recent Social Trends, which Merriam and Mitchell had headed, were not objectionable to the new Democratic Administration. Charles W. Eliot II, formerly the city planner for the National Capital Park and Planning Commission, became the executive secretary of the NPB.³³

The Social Science Research Council was anxious to become involved in New Deal planning. In response to a request from Merriam, Wil-

30. *Id.*

31. *Id.* at Lxi. Other and more popular writers such as Stuart Chase and George Soule also supported centralized planning, and the historian Charles Beard even advocated five year plans, such as existed in the Soviet Union. All these proponents were justifiably concerned that their views be summarily dismissed as socialist or even communist rhetoric. Graham, *supra* note 11, at 16-21.

32. The social science component was actually more in evidence in some of the board's work not focusing on water, such as land, mineral, science, and long-range work and relief policies. Merriam, *The National Resources Planning Board: A Chapter in American Planning Experience*, 38 *The Am. Pol. Sci. Rev.* 1075-88 (1944) (for a good overview of how the NPB and its successor boards actually operated).

33. J. Christie, Morris Llewellyn Cooke: *Progressive Engineer* 133 (1983); R. Platt, *Floods and Man: A Geographer's Agenda*, in 2 *Geography, Resources, and Environment: Themes from the Work of Gilbert F. White* 34 (R. Kates & I. Burton eds. 1986) (Platt's essay is one of the relatively few by social scientists that explicitly uses a historical approach); A. H. Dupree, *Science in the Federal Government: A History of Policies and Activities to 1940* at 354-55 (1957); Clawson, *supra* note 25, at 60-65; Warken, *supra* note 12, at 44-46; Watkins, *supra* note 25, at 376-78; Merriam, *supra* note 32, at 1075. According to B. Karl, Mitchell was appointed on the recommendation of Louis Brownlow, head of the Public Administration Clearing House in Chicago and, arguably, Merriam's closest friend. Mitchell left the NRB in December 1935. Karl, *supra* note 24, at 235.

liam F. Ogburn, the University of Chicago sociologist, who was serving as president of the SSRC, organized a SSRC committee to draft a memorandum for the National Planning Board on the uses of social science for national planning. Reflecting orthodox social science philosophy, the report pointed out that national plans "must recognize human adjustments as their ultimate goal" and social science can "rescue public policy from the vagueness and inexactness which have commonly characterized it in the past."³⁴ The authors' main point came in the concluding sentence. "With its pivotal position among the social sciences, [the SSRC] could undoubtedly render valuable aid, if called on to do so, in the formidable task of national planning."³⁵ In fact, members of the SSRC pressed their views at every opportunity. Utilizing SSRC funds that came from the Rockefeller and other foundations, they held numerous academic conferences and selectively invited government officials. A healthy symbiosis occurred between New Deal planners and social scientists.

SOCIAL SCIENTISTS, REGIONALISM, WATER RESOURCES PLANNING

Many SSRC-sponsored gatherings focused on the subject of regionalism, a subject of interest to both professors and politicians. New Deal administrators embraced the concept because they believed that national policies based on regional needs and priorities would result in better integrated and more economical plans.³⁶ The concept was not static. Regions would change over time in response to social shifts, as would the types of administrative organization. However, regardless of this elasticity, fundamental issues still needed analysis. Within academia, anthropologists studied the extent to which culture defined a region. Ecologists—a number of geographers among them—looked at plant and animal populations (including humans). Howard W. Odum of the University of North Carolina led a phalanx of sociologists doing regional investigations.³⁷ Historians' interest in regional studies dated back to Frederick Jackson Turner's "Frontier Thesis" of 1893. Charles Beard's popularization of economic history stimulated interest in comparative regional and class studies. Ag-

34. Memorandum Prepared for the National Planning Board by a Committee of the Social Science Research Council: *The Aid Which The Social Sciences Have Rendered and Can Render to National Planning* (June 1934) (William F. Ogburn papers, box 26, folder 8, UC).

35. *Id.*

36. See National Resources Committee, *Regional Factors in National Planning and Development* 197–201 (1935); Graham, *supra* note 11, at 312.

37. H. Odum, *The Regional Approach to National Social Planning, With Special Reference To A More Abundant South and its Continuing Reintegration in the National Economy* (1935); H. Odum & H. Moore, *American Regionalism: A Cultural-Historical Approach to National Integration* (1938).

ricultural economists and historians made major contributions after the turn of the century, as did city planners, who supported local history work.³⁸

Certainly, an important stimulus to regional studies was the creation of the Tennessee Valley Authority (TVA) in May, 1933. It was the first manifestation of Roosevelt's commitment to comprehensive regional natural resources planning.³⁹ The President wanted planning "not just for ourselves but planning for the generations to come, tying in industry and agriculture and forestry and flood prevention, tying them all into a unified whole."⁴⁰ When sending the Tennessee Valley Authority legislation to Congress in April 1933, Roosevelt noted, "[m]any hard lessons have taught us the human waste that results from lack of planning . . . It is time to extend planning to a wider field, in this instance comprehending in one great project many States directly concerned with the basin of one of our greatest rivers."⁴¹

For social scientists, the TVA became a vast social experiment in which they could test hypotheses against the reality of an emerging administration for an area four-fifths the size of England. Questions abounded. Did the TVA administer a cultural, geographic, or natural resource region? What objectives should the TVA have and how did the new administration threaten traditional institutions and patterns of life? Were the engineering solutions economically efficient and socially beneficial throughout the basin, and did they address both short- and long-term needs? Papers and conferences on these subjects and more became a small industry within the social science community.⁴²

The TVA itself did much to promote regional studies. It funded research at several southern universities, nearly all of which related to social science. In the post-World War II period, the pace of research accelerated. In 1952, for instance, the TVA contributed technical assistance or funds to 17 studies. Subjects included the ways states administered resource programs, the impact of land use changes on the black population, studies on local leadership, an examination of the phosphate fertilizer industry, and labor resource studies.⁴³ Industrial and university organizations initiated

38. See W. Ogburn's notes (undated but sometime in the 1930s) (Ogburn papers, box 26, folder 7, UC). See also Taylor & Taylor, *supra* note 26, at 285-325.

39. J. Arnold, *The Evolution of the 1936 Flood Control Act* 24 (1988); Graham, *supra* note 11, at 21.

40. F. Roosevelt, Speech in Montgomery, Alabama (Jan. 21, 1933), in 1 Franklin D. Roosevelt & Conservation, 1911-1945 at 133 (E. Nixon comp. and ed. 1957).

41. *Id.* at 151 (Roosevelt to the Congress, Apr. 10, 1933).

42. See letter from Burgess to E. A. Bott (Apr. 11, 1934); Letter from Bott to Burgess (Apr. 14, 1934); and Burgess's undated notes on the proposed TVA conference (Burgess papers, box 20, folder 4, UC) (for a list of some SSRC conferences and a discussion of Ernest Burgess's plans for a TVA conference in 1934).

43. Paper by A. Maass for the SSRC, Resource Research in the Southeast United States and Texas (Nov. 1952). (Arthur Maass papers, folder 12, OH, HQ USACE)

research that complemented the TVA studies. The Institute for Research in Social Science, founded by Howard Odum in 1924 at the University of North Carolina, provided much of the leadership.

Another important stimulus was the Committee of the South of the National Planning Association, headed by Duke University economics professor Calvin Hoover. While regional studies also became commonplace in other areas of the country, the South clearly dominated the field. This was not simply the result of TVA promotion or the interest of a number of state universities (and legislatures). It also reflected the concern of thoughtful Southerners that an area rich in natural resources had not been proportionately rich in economic opportunities.⁴⁴

The emphasis on regional studies led to questions about river basin planning. In December 1935, the National Resources Committee, a bureaucratic descendant of the National Planning Board, completed its study of regional factors in national planning. Focusing on the TVA, the committee reported, "The watershed area has both advantages and disadvantages as a region for planning and development purposes."⁴⁵ No area was more suitable for planning and administering water control functions, such as navigation and flood control, but matters relating to hydropower, land utilization, agriculture, industry, and transportation, the committee concluded, "cut across the boundary of the drainage basin."⁴⁶ The committee made an important point. Both the ability to define unambiguously the drainage basin and the escalating, often conflicting, claims on water helped promote multipurpose river basin planning. However, when basin planners addressed social and economic issues unrelated to water control, political divisions often became more important than physical ones.

Among social scientists, geographers tended to be most enthusiastic about multipurpose river basin planning. Harlan H. Barrows, the influential head of the University of Chicago Geography Department, of whom we shall have more to say, was a major New Deal proponent. "The basic objective in water planning," he said in 1938, "should be the coordinated control and development of water, both surface water and underground water, for all useful purposes in proper balance . . . substantial progress in dealing with the major water problems of the Nation is contingent upon acceptance of the river basin as the normal unit area in planning and in the execution of plans."⁴⁷ Another outspoken advocate was Edward A. Ackerman, who joined the University of Chicago Geography Department in the late 1940s and shortly thereafter took leave to serve first

44. *Id.*

45. National Resources Committee, *supra* note 36, at 111.

46. *Id.* at 113.

47. Speech by H. Barrows, *Fundamental Principles of Water Planning*, at the annual convention of the National Reclamation Association (1938) (Merriam papers, box CCXI, folder 1, UC).

with the Bureau of the Budget and then with the TVA. In 1950, along with a number of other social scientists, he served on the staff of President Harry S. Truman's Water Resources Policy Commission, which recommended that river basin commissions be established for all major basins.⁴⁸ The following year, he emphasized to the Connecticut Resources Council that "there is one thing crystal clear to me about the future management of our water resources: major river basins should be planned for and managed as units."⁴⁹ He encouraged his fellow geographers to engage in regional analysis and advanced several techniques and conceptual models for their consideration.⁵⁰ Implicit in Barrows' and Ackerman's enthusiasm was the assumption that water is *the* key resource that can unify a region and improve quality of life.

Other social scientists were less enamored of river basin planning, even if they may have conceded theoretical advantages. Political scientists such as Arthur Maass recommended changes in the federal planning structure, pointing to the need for better interagency coordination and more accurate technical data, but they grew frustrated over congressional resistance to basic organizational changes.⁵¹ While doubting that natural units such as river basins could serve as decision arenas, political scientists also expressed reservations about units based strictly on economic efficiency. Certainly, case studies of various forms of river basin administrations provided political scientists with useful insights about the development of public policy and formation of governmental organizations, but it also showed that political science had limited application as a predictive tool; such tools seemed more the province of geography and economics.⁵²

Agricultural economist S. V. Ciriacy-Wantrup of the University of California, Berkeley, questioned the utility of river basins as administrative units. He noted in 1946 that "the economic importance of physiographic features may change over time" and indicated that technological advances tend to reduce the importance of such features.⁵³ Subsequently,

48. The President's Water Resources Policy Commission, *A Water Policy for the American People* 10-11 (1950).

49. Speech by E. Ackerman to the Connecticut Resources Council, (Nov. 29, 1951) (Personal copy in author's file and additional copies can be found in the Edward A. Ackerman papers, accession 5363, American Heritage Center, University of Wyoming, Laramie, WY.).

50. Ackerman, *Regional Research—Emerging Concepts and Techniques in the Field of Geography*, 29 *Econ. Geography* 189-97 (1953).

51. Maass, *Congress and Water Resources*, 44 *Am. Pol. Sci. Rev.* 576-93 (1950).

52. H. Hart, *The Role of Political Science in Water Resources Management* (c. 1970) (Hart was professor of political science at the University of Wisconsin; Maass papers, folder 106, OH, HQ USACE). This unpublished paper is evidently an early version of Hart, *supra* 6, at 122-63 (the chapter footnotes provide readers with a good basic bibliography of political science case studies written in the period 1950-71).

53. Ciriacy-Wantrup, *Administrative Coordination of Conservation Policy*, 22 *J. Land & Pub. Utility Econ.* 58 (1946).

he refined his views. By 1960, he had concluded that "the physical and economic interrelations that make the watershed a unit in the social sciences operate largely on the side of production and not on the side of consumption."⁵⁴ Once policymakers shift their attention from production—whether of hydropower, timber, or grain—to consumption, the watershed model is compromised. The economic consequences of alternative courses of action within the basin must then be reexamined. Inevitably, the two objectives of regional and national development intercede and possibly conflict.

Perhaps of more concern to social scientists than the efficacy of regional planning approaches was the small impact regional studies seemed to be having on water resources planning in the 1950s. Despite new information on economic well-being, industrial and agricultural growth, and labor markets, the selection of a federal water project relied principally on showing whether it was economically feasible in terms of its stated direct purposes—flood control, irrigation, navigation, etc. Contributions—or limits—to social well-being usually were considered only as an afterthought.⁵⁵ In 1962, Gilbert F. White, then president of the Association of American Geographers, lamented that "geography's voice in policy making is modest beyond the experience and refinement of analysis which it has to offer."⁵⁶ Ackerman observed that the profession's "relative national place in policy advice by scientists has declined greatly by comparison to twenty years ago."⁵⁷ Ironically, these statements came the same year the geographers, and other social scientists, won a significant victory.

In 1962, President John F. Kennedy approved major changes in federal water policy. The changes were published in Senate Document 97.⁵⁸ Among other matters, the new policy emphasized river basin planning and—following a recommendation of a Senate Select Committee—set a goal of developing comprehensive plans for all the major river basins by 1970.⁵⁹ President Lyndon B. Johnson pursued Kennedy's objectives. In

54. Ciriacy-Wantrup, *Philosophy and Objectives of Watershed Policy*, in *Economics of Watershed Planning* 2-3 (G. Toley & F. Riggs eds. 1960).

55. G. White, *A Perspective of River Basin Development*, in 1 *Geography, Resources, and Environment: Selected Writings of Gilbert White* 56 (R. Kates & I. Burton eds. 1986) (originally published in 22 *Law & Contemp. Probs.* 157 (1957)).

56. White, *Critical Issues Concerning Geography in the Public Service—Introduction*, 52 *Annals of Ass'n Am. Geographers* 279 (1962).

57. Ackerman, *Public Policy Issues for the Professional Geographer*, 52 *Annals of Ass'n Am. Geographers* 295 (1962) (emphasis in original).

58. The President's Water Resources Council, *Policies, Standards, and Procedures in The Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources*, S. Doc. No. 97, 87th Cong., 2d Sess. (1962). The President's Water Resources Council should not be confused with the United States Water Resources Council that Congress established in 1965.

59. *Id.*; Letter from D. Bell, Director, Bureau of the Budget, to Honorable C. Vance, Secretary of the Army, (June 4, 1962)(copy in William J. Donovan papers, folder on "Comprehensive Planning—Early 1960s," OH, HQ, USACE).

response, federal water resources agencies conducted seminars and conferences and reorganized their workforce in order to increase competence in the social sciences, especially in economics.

The 1965 Water Resources Planning Act accelerated these efforts. The act created a Water Resources Council of the secretaries of Interior; Army; Agriculture; and Health, Education, and Welfare; and the chairman of the Federal Power Commission. Among other things, the council was to establish standards and procedures to guide federal participation in river basin planning, that is, to develop benefit-cost guidelines. Furthermore, the act authorized the President to establish river basin commissions of state and federal representatives, and it also authorized federal grants to the states to assist in the development of river basin programs.⁶⁰ By 1973, six river basin commissions had been formed.⁶¹

Increased emphasis on basin-wide economic analysis caused the Corps of Engineers and other water agencies to change the composition of their professional staffs. Between 1963 and the end of 1965, the Corps increased the number of economists in its field offices from 51 to 77, of whom about half were "reasonably well trained," according to the Corps' chief economist.⁶² Still, about 90 percent of the personnel involved in planning activities were engineers.⁶³ Secretary of the Army Stanley Resor wrote, "It is in the interest of the Nation, of the Department of the Army, and of the Corps of Engineers that the civil works planning organization include a far larger number of, and a distinct role for, economists and others with a professional education and background in water resources planning."⁶⁴ The Corps quickly reacted. By August 1967, the number of Corps economists had increased to 119, with persons selected for ten more positions and recruitment proceeding for another twenty.⁶⁵ In April 1969, a further step was taken when the Chief of Engineers established an Institute for Water Resources with responsibilities to monitor and perform research in all phases of water resources planning and "to develop new and

60. See generally D. Welborn & J. Burkhead, *Intergovernmental Relations in the American Administrative State: The Johnson Presidency 132-36* (1989) (for more on the Water Resources Planning Act); Senate Committee on Interior and Insular Affairs, *History of the Implementation of the Recommendations of the Senate Select Committee on National Water Resources*, 90th Cong., 2d Sess. (1969) (prepared by T. Schad & E. Boswell).

61. The six commissions were New England, Great Lakes, Pacific Northwest, Ohio, Missouri, and Upper Mississippi. A Souris-Red-Rainey commission formed in 1967 was incorporated into the Upper Mississippi Commission in 1973.

62. Letter from J. Johanson, Resources and Civil Works Division, Bureau of the Budget, to E. Staats, Director, Bureau of the Budget (Sept. 24, 1965) (folder on "Corps of Engineers", box 159, Series 61.1A, Record Group 51 (Bureau of the Budget), National Archives and Records Administration, Washington, D.C.).

63. Senate Comm. on Public Works, Report to the Secretary of the Army by the Civil Works Study Board, 89th Cong., 2d Sess. 61 (Comm. Print 1966).

64. *Id.* at VII (Letter from S. Resor to the Chief of Engineers (Oct. 28, 1965)).

65. J. Moore & D. Moore, *The Army Corps of Engineers and the Evolution of Federal Flood Plain Management Policy 84* (1989).

innovative techniques, giving particular attention to environmental quality, regional development, and interregional and international planning."⁶⁶

But political realities prevented the realization of comprehensive river basin planning. The Bureau of the Budget remained suspicious of the Water Resources Council and did not always cooperate. Commission heads did not exert strong regional leadership, federal agencies disagreed about procedures, the number of council meetings declined, and the council never was accepted as a "court of last resort" for basin concerns. Local support also dwindled as people became more concerned with urban water supply, wastewater treatment and environmental problems. Finally, strains on the federal budget precluded appropriations for large water projects and contributed to the splintering of traditional water resource constituencies. In November 1981, President Ronald Reagan abolished the six river basin commissions. One year later, he dismantled the Water Resources Council.⁶⁷

Politics aside, New Deal advocates of river basin planning may have insufficiently appreciated a basic fact: the success of regional administration depends on accurately defining problems, developing priorities, and finding solutions that actually can be implemented. To do this successfully requires planners to predict and measure a large number of diverse costs and benefits involving economic, institutional, social, and environmental developments. Unfortunately, there is little in the record to suggest that either natural or social scientists do this particularly well.⁶⁸ This being the case, political and financial factors determine and fragment the planning process. As a concept that addresses all potential functions, rather than simply attempting to identify all significant constituencies, comprehensive river basin planning remains elusive.

66. M. Reuss, *Shaping Environmental Awareness: The United States Army Corps of Engineers Environmental Advisory Board, 1970-1980* at 5-6 (1983). According to personnel office records, in 1990 the Corps employed 212 economists, 171 geographers, 96 political scientists, and 94 sociologists, as indicated by the major undergraduate field.

67. Paper presented by H. Caulfield, Jr., *Fulfilling the Promises of the Water Resources Planning Act*, at the 25th annual meeting of the Interstate Conference on Water Problems (Sept. 18, 1984). The Office of Water Policy was also finally abolished. See N. Wengert, *A Critical Review of the River Basin as a Focus for Resources Planning, Development, and Management*, in *Unified River Basin Management: Symposium Proceedings* 22-25 (R. North, L. Dworsky & D. Allee eds. 1980) (Norman Wengert's analysis of the decline of interest in river basin development is similar to this author's).

68. W. Donovan, *Economic, Social, and Environmental Requirements and Related Considerations in Planning for Water and Land Resources*, in 1 *Proceedings: Social Scientists Conference* 14-34 (United States Army Corps of Engineers ed. 1977). Donovan at the time was chief of the plan formulation and evaluation branch, planning division, civil works directorate, Office of the Chief of Engineers.

NEW APPROACHES TO RIVER BASIN PLANNING: THE INFLUENCE OF HARLAN BARROWS AND GILBERT WHITE

Charles Merriam opened government doors for a number of his colleagues at the University of Chicago during the New Deal. Partly because of Merriam, Burgess, Ogburn, and Ruml all became involved in NRB activities. Geography professor Charles C. Colby and education professor Charles H. Judd served on NRB technical committees. In water issues, however, Harlan Barrows was the most important person Merriam brought to Washington.

Along with Carl Sauer of the University of California at Berkeley, Barrows stressed that geographers should be time- as well as space-oriented, and both willingly left the study of purely physical landforms to others. However, unlike Sauer, who concentrated on cultural inquiries reaching back into antiquity, Barrows studied economic interactions between humans and the natural world and urged his colleagues to peer into the future and look at long-term changes.⁶⁹

In 1933, Barrows became one of three non-engineers appointed to the eight-member Mississippi Valley Committee (MVC) which the NRB established to study water problems in the Mississippi River drainage basin.⁷⁰ The following year, he asked one of his graduate students, Gilbert F. White, to work for him in Washington.⁷¹ His work for Barrows decisively influenced White and, through White, the evolution of floodplain management in the United States.

The MVC's October, 1934, final report detailed and endorsed a number of policies and programs to bring multipurpose development to the entire Mississippi River Valley, with a special emphasis on rural electrification, the pet interest of committee chairman Morris Cooke. With Cooke's urging, the committee argued that many economically marginal projects would become practicable if hydropower were added to them.⁷² Showing Barrow's thought and felicity of expression, the report eloquent-

69. Platt, *supra* note 33, at 32-33; Ackerman, *supra* note 50, at 190; A. Goudie, *The Human Impact on the Natural Environment* 5-6 (1986); Telephone interview with Gilbert White (June 28, 1990).

70. Federal Emergency Administration of Public Works, *Final Report of the National Planning Board, 1933-1934* (Aug. 1, 1934) (copy in Merriam papers, box CLXXI, folder 6, UC). The two other non-engineers were Harlow S. Person, an economist from New York City, and Henry Solon Graves, former director of the Yale University School of Forestry and Chief Forester of the United States Forest Service from 1910 to 1920.

71. Transcript, interview with Gilbert White (June 25, 1985) (conducted by M. Reuss; OH, HQ USACE); White, *Geographers in a Perilously Changing World*, 75 *Annals of the Ass'n of Am. Geographers* 10-11 (1985); Platt, *supra* note 33, at 32; Moore & Moore, *supra* note 65, at 34-37.

72. Report by the Mississippi Valley Committee of the Public Works Administration 45 (Oct. 1, 1934). See transcript, interview with G. White (June 25, 1985) (conducted by M. Reuss, on Cooke's interest in rural electrification; OH, HQ USACE). See generally D. Brown, *Electricity for Rural America: The Fight for the REA* 35-46 (1980); Christie, *supra* note 33, at 133-65 (for more on Cooke).

ly stated, "[p]lanning for the use and control of water is planning for most of the basic functions of the life of the Nation. . . . Land, water, and people go together . . . It is of little use to control rivers if we cannot thereby improve the quality of human living."⁷³ Barrows believed that good planning required linking land and water use, and he propagated the idea many times in the following years.

In June 1934, Roosevelt created a National Resources Board (NRB) to replace the National Planning Board. Unlike its predecessor, this new board was outside of the PWA. The members were the secretaries of Interior, War, Agriculture, Commerce, and Labor; Federal Emergency Relief Administrator Harry Hopkins; and Delano, Merriam, and Mitchell. In its December 1934, report to the White House,⁷⁴ the NRB recommended that the federal government initiate "detailed engineering, social, financial, and legal studies of water projects" in seventeen drainage basins.⁷⁵ Echoing the *Review of Findings*, it also proposed the establishment of a permanent national planning agency to coordinate all planning policies of the federal government.⁷⁶

The Mississippi Valley Committee became the Water Planning Committee of the NRB and then, in June 1935, when the NRB was renamed the National Resources Committee, the Water Planning Committee became the Water Resources Committee (WRC). Each time there was a name change, there were organizational modifications, but the missions remained essentially the same. Merriam and Delano stayed on the National Resources Committee, and Beardsley Ruml and New England businessman Henry S. Dennison were added as advisors. Internationally-known sanitary and public works engineer Abel Wolman headed the Water Resources Committee. Of the twelve men on the committee, Barrows and Ira Gabrielson, Chief of the Biological Survey, were initially the only non-engineers. Gilbert White served as secretary.

The WRC divided the country into 115 drainage basin subdivisions and assigned 15 water consultants to analyze them. The results were published in *Drainage Basin Problems and Programs*, which reached the President's desk at the end of 1936. Responding to the President's request to revise and refine its findings, the WRC established 45 drainage basin committees throughout the country. Each committee submitted extensive reports which listed recommended projects and costs. The revision, published in February 1938, contained proposals for a six-year integrated, multipurpose program of construction and investigations that addressed

73. Report of the Mississippi Valley Committee, *supra* note 72, at preface, 3.

74. National Resources Board, A Report on National Planning and Public Works in Relation to Natural Resources and Including Land Use and Water Resources with Findings and Recommendations (Dec. 1, 1934).

75. Warken, *supra* note 12, at 60.

76. *Id.*

both traditional programs in flood control, irrigation, and navigation, and also projects for beach erosion control, recreational waters, and wildlife areas.⁷⁷ The WRC advocated a national policy for pollution abatement, greater federal responsibility for gathering hydrologic data, and some changes in the procedures of water agencies, including the organization of planning and construction-operation functions into separate agencies. "More and more clearly it is seen," the committee wrote, "that only by comprehensive attacks on the interdependent problems of unit areas, in most instances drainage basins, can costly mistakes, far too common through many years, be avoided."⁷⁸ The report favored cost-sharing⁷⁹ and "a unified plan of water control and development"⁸⁰ and urged the establishment of state planning boards—some of which were actually created—and the negotiation of interstate water compacts. Indeed, the administration and some congressmen attempted to pass legislation that would have established regional river basin authorities, but all attempts ultimately failed, largely because of congressional concerns that Congress's presumed legislative prerogatives may be eroded.⁸¹ Regardless, the report became the most comprehensive national multipurpose water plan produced during the New Deal.

With one notable exception, the drainage report reflected the engineering orientation of most of its authors and generally endorsed structural solutions to water problems. The exception was the report of the Ohio-Lower Mississippi River Regulation Subcommittee, which Barrows chaired. This section contained some remarkable language: "If it would cost more to build reservoir storage than to prevent floodplain encroachment, *all relevant factors considered*, the latter procedure would appear to be the better solution."⁸² For the first time, an official government document recommended something other than building dams, floodwalls, and levees to protect life and property. The report acknowledged the difficulty

77. National Resources Committee, *Drainage Basin Problems and Programs* (1938) (1937 revision). See summary by unknown author, *The Evaluation Subcommittee of the Water Resources Committee of the National Resources Planning Board* (1941) (Merriam papers, box CCLV, folder 4, UC); The National Resources Committee, *Water Planning* (Feb. 1938) (a 40-page popular version of the WRC report); 7 *Civil Engineering* 167-77 (1937) (for earlier work of the WRC); in particular, see Wolman, *Resume of the Drainage Basin Study Report*, 7 *Civil Engineering* at 167-171; and Fowler, *The National Drainage Basin Study*, 7 *Civil Engineering* at 171-72.

78. National Resources Committee, *supra* note 77, at 3.

79. *Id.* at 97.

80. *Id.* at 7.

81. 1, Franklin D. Roosevelt and Conservation, 1911-1945 at 341 n.1 (E. Nixon comp. and ed. 1957); *Id.* at 361-62 (letter from D. Bell, Acting Director, Bureau of the Budget, to F. Roosevelt (Mar. 5, 1935)); 2, Franklin D. Roosevelt and Conservation, 1911-1945 at 68-71 (E. Nixon comp. and ed. 1957) (address from F. Roosevelt to Congress (June 3 1937)); W. Leuchtenburg, *Flood Control Politics: The Connecticut River Valley Problem, 1927-1950* at 72-81 (1953).

82. National Resources Committee, *supra* note 77, at 70 (emphasis in the original).

of molding nature's laws to man's: "Too often the habits of the rivers have been ignored. . . . The lure of cheap land, low rentals, or other advantages has prevailed despite the fact that man cannot flout the laws of nature with impunity."⁸³ Barrows' subcommittee (which included the Chief of Engineers) recommended the consideration of zoning laws and relocation. It warned that flood control reservoirs simply promoted the occupation of previously flood-prone lands, and this inevitably produced new demands for protection. The committee also proposed that flood insurance appraisals be used to determine the practicality of floodplain development.⁸⁴ The WRC's receptivity to the subcommittee report must have encouraged Barrows. The full committee explicitly noted that most of the subcommittee recommendations applied equally to other basins and were "essential elements in a sound national flood-control policy."⁸⁵

Barrows was not content to publish his views in the drainage report. He looked for definite changes in policy. He saw an opportunity when President Roosevelt forwarded to the WRC in January 1938, a Corps of Engineers document entitled "Information on Flood Control in the Mississippi River Basin." In it, the Corps of Engineers called for the construction of 82 reservoirs, primarily for flood control, in the Ohio and lower Mississippi basins at a cost of a little over \$700 million. This represented an increase of 13 reservoirs and nearly \$180 million over the Corps' recommendation in April 1937. Barrows wrote Wolman that further studies were needed. Then he noted, "[t]he practicability of avoiding flood damages by zoning valley bottoms and by other remedial measures with respect to the occupation and use of flood plains has not been sufficiently explored."⁸⁶

Wolman personally took Barrows' concerns to the President in April, 1938. He told Roosevelt that if all the reservoirs proposed for the Ohio Valley—over fifty—had been constructed, the only reservoir that would have made a significant difference in the flood stage at Cairo (where the Ohio emptied into the Mississippi) during the 1937 flood would have been Gilbertsville, at the mouth of the Tennessee River. This reservoir would have reduced the flood stage at Cairo by about two feet. The other reservoirs combined would have reduced the Cairo flood stage

83. *Id.* at 70–71.

84. *Id.* at 71. Major General Julian Schley, the Chief of Engineers, had originally wanted to put a disclaimer at the beginning of the subcommittee report: "General Schley neither approves nor disapproves of the report." *Id.* at 69. However, he accepted the WRC's recommendation to incorporate the following sentence in the letter of transmittal: "As might be expected, each member of a Committee of this size cannot concur with each and every part of a report of this scope and character, but the report represents the consensus of opinion of the Committee." Minutes of 35th Meeting of the Water Resources Committee (Jan. 8, 1938) (Merriam papers, box XXIX, folder 9, UC); National Resources Committee, *supra* note 77, at x.

85. National Resources Committee, *supra* note 77, at 75.

86. Letter from H. Barrows to A. Wolman (Mar. 23, 1938) (Merriam papers, box CLXXIII, folder 16, UC).

only a few inches. Repeating Barrow's message, Wolman emphasized to the attentive President that more studies were necessary.⁸⁷

Gilbert White wholeheartedly agreed with Wolman and Barrows. While serving as secretary to the Water Resources Committee, White chose the issue of floodplain occupancy as his dissertation subject and took the opportunity of discussing it with various officials from federal water resource agencies. As early as 1936, he had suggested that changes in the location and construction of buildings might be more economically advantageous than large flood control structures.⁸⁸ He was particularly interested in two related questions. First, how would the construction of water projects affect the surrounding population? Second, how does one measure the social desirability of water projects? For instance, should it be measured in regional or national terms? The questions were not simply academic. The Flood Control Act of 1936⁸⁹ determined that flood control was a legitimate federal responsibility and that federal flood control projects may be constructed "if the benefits to whomsoever they may accrue are in excess of the estimated costs, and if the lives and social security of people are otherwise adversely affected."⁹⁰ The problem was to develop a rational, equitable procedure to measure costs and benefits.⁹¹ The challenges were daunting. Who should determine what is in the national interest, what does flood "damage" mean, and what constituted tangible and intangible benefits? The legislation raised basic questions about the proper role of government in developing natural resources and assisting regional growth.

With a vast amount of data on hand, but with many questions unanswered, White began writing his dissertation. He finished it and received his degree in 1942. The dissertation was published in 1945.⁹² Water resources planners were struck by White's forceful argument that flood control involved "adjusting human occupancy to the flood plain environment so as to utilize most effectively the natural resources of the plain, and, at the same time, of applying feasible and practicable measures for minimizing the detrimental impacts of floods."⁹³ White himself thought

87. Notes, Conference at the White House (Apr. 18, 1938) (Merriam papers, box CLXXIII, folder 16, UC). Delano and Eliot also attended the meeting with the President. Barrows' subcommittee noted that if some 52 reservoirs proposed by the Army Engineers had been built on tributaries of the Ohio above Louisville, Louisville still would have had a record flood in 1937, and Cincinnati would have suffered its worst flood in eighty years. Natural Resources Committee, *supra* note 77, at 70.

88. White, *The Limit of Economic Justification for Flood Protection*, 12 J. Land & Pub. Utility Econ. 133-48 (1936).

89. 33 U.S.C. § 701 (1988).

90. 33 U.S.C. § 701(a) (1988).

91. White interview, *supra* note 71; Moore & Moore, *supra* note 65, at 13.

92. White interview, *supra* note 71; G. White, *Human Adjustment to Floods*, 29 U. Chi. Dep't Geography Research Paper (1945) (dissertation published in a limited edition in 1942).

93. White, *supra* note 92, at 2-3. See Moore & Moore, *supra* note 65, at 36.

his dissertation's most important insight was that "for any mode of resources management, finding the optimal use of a resource theoretically involves canvassing the whole range of alternatives that are open to society, and then trying to estimate what the consequences would be, both favorable and unfavorable, of undertaking any one of those alternatives or a combination of them."⁹⁴ Flood control, according to White, involves adjusting "land occupancy and floodplain phenomena in harmonious relationship."⁹⁵ A "geographical approach" to the problem "analyzes the factors affecting the success of possible uses of a floodplain. It seeks to find a use of the floodplain which yields maximum returns to society with minimum social costs, and it promotes that use."⁹⁶

White's dissertation attracted immediate interest. Political scientist Arthur Maass cited it in his own dissertation, which was subsequently published under the title *Muddy Waters: The Army Engineers and the Nation's Rivers*.⁹⁷ In their 1955 book, *Floods*, William G. Hoyt and Walter B. Langbein, two eminent U. S. Geological Survey employees, suggested that White's thesis required serious consideration.⁹⁸ The TVA became the first agency to take heed. By the early 1950s, the agency recognized that levees, reservoirs, and floodwalls were often ineffective defenses against flood damage. In 1953, TVA engineer James E. Goddard and geographer Aelred J. Gray established a new "Community Flood Damage Mitigation Assistance Program", later renamed "floodplain management", to assist local communities to develop land use controls that would lessen flood damages. Close and ongoing coordination between TVA planners and local residents was a key component of the approach. Technical data regarding the probable size and frequency of floods had to be translated into language understandable to non-engineers. Many TVA engineers were skeptical, partly fearing that the public would place too much faith in technical data that, though the best available, could not reliably predict future human development or natural hazards.⁹⁹

The federal government as a whole accepted floodplain management slowly. Bureau of the Budget Circular A-47, distributed at the end of 1952, essentially reaffirmed the structural approach to flood control within the constraints imposed by benefit-cost analysis, although it directed agencies to consider *all* methods of controlling floods and reducing damages before selecting the most effective and economical choice. Section 206

94. White interview, *supra* note 71.

95. *Id.* at 34.

96. *Id.*

97. A. Maass, *Muddy Waters: The Army Engineers and the Nation's Rivers* 145-49 (1951).

98. W. Hoyt & W. Langbein, *Floods* (1955).

99. Transcript, interview with J. Goddard (Jan. 15, 1986) (conducted by M. Reuss; OH, HQ USACE).

of the Flood Control Act of 1960¹⁰⁰ authorized the Corps to disseminate information on floods and flood damages, including engineering advice to local interests. New federal policy published in Senate Document 97 (1962) specified that agencies were to address both nonstructural and structural solutions to flood problems.¹⁰¹ In 1966, the Bureau of the Budget organized a task force chaired by Gilbert White that analyzed the successes and failures of the country's flood control efforts. Not surprisingly, the task force emphasized the importance of nonstructural solutions to flood problems. It noted that flood damages were increasing despite the more than \$7 billion the federal government had invested in flood control projects since 1936.¹⁰² Finally, President Jimmy Carter issued a set of executive orders and directives that emphasized the use of nonstructural floodplain management practices in federal water resources planning.¹⁰³

Despite—or perhaps because of—sporadic federal encouragement, many communities remained unenthusiastic about floodplain management. Local civic leaders ignored evidence that traditional structural approaches to flood control provided a false sense of security, and that human development in floodplains invited catastrophe regardless of the degree of structural protection. Concerned that economic development might be curbed, they often sided with landowners who complained that zoning regulations conflicted with basic property rights. Officials became interested only *after* floods damaged buildings that they had unwisely allowed to be constructed in flood hazard areas. By that time, of course, available remedies such as zoning restrictions were limited. Although nonstructural measures have been instituted in some localities, the history of flood control during the last thirty years shows that floodproofing, relocation, or restrictive zoning regulations may not be either politically or economically acceptable at the local level.¹⁰⁴

100. 33 U.S.C. § 709(a) (1988).

101. The President's Water Resources Council, *supra* note 58.

102. Moore & Moore, *supra* note 65, at 22, 40; Costa, *The Dilemma of Flood Control in the United States*, 2 *Env'tl. Mgmt.* 317 (1978); R. Burby & S. French with B. Cigler, E. Kaiser, D. Moreau & B. Stiffler, *Flood Plain Land Use Management: A National Assessment*, in 5 *Studies in Water Pol'y & Mgmt.* 6–8 (1985); House Committee on Public Works, *A Unified National Program for Managing Flood Losses*, H.R. Doc. No. 465, 89th Cong., 2d Sess. (1966).

103. Exec. Order No. 11,988, May 24, 1977, *Flood Plain Management*, 42 *Fed. Reg.* 26,951 (1977); Exec. Order No. 11,990, May 24, 1977, *Protection of Wetlands*, 42 *Fed. Reg.* 26,961 (1977); *Water Resources Policy Reform Message*, June 6, 1978, 1 *Pub. Papers* 1050 (1978); Presidential Memorandum for the Secretary of the Army, the Secretary of Commerce, the Secretary of Housing and Urban Development, the Secretary of the Interior, *Emphasis on Nonstructural Flood Protection Methods* (July 12, 1978) (author's files, OH, HQ USACE).

104. Burby & French, *supra* note 102, at 52; Costa, *supra* note 102, at 317–18.

MEASURING THE BENEFITS AND COSTS OF WATER PROJECTS

The economist John V. Krutilla once candidly observed, "[e]conomic analysis of benefits and costs of long-lived investments involve as much art as science."¹⁰⁵ This is particularly apparent in the public sector. The corporation president can assess benefits in terms of costs and profits accruing to the firm, but in the public sector the investment must be analyzed in terms of all costs and gains, including those charged to third parties. Both economic and social impacts become more difficult to formulate and address. One consequence is that thousands of economists and engineers have spent decades developing and redeveloping federal benefit-cost guidelines.

The necessity for benefit-cost guidelines became apparent once the 1936 Flood Control Act¹⁰⁶ was approved, and both federal water agencies and the National Resources Planning Board attempted to draft recommendations. Beginning in 1943, when Congress effectively abolished the National Resources Planning Board by denying it further funding, the quadripartite Federal Inter-Agency River Basin Committee (FIARBC or "Firebrick") assumed most of the responsibilities for developing technical guidelines in federal water resources development. The origins of this committee go back to 1939, when the Corps of Engineers, Department of Interior, and Department of Agriculture agreed to exchange information and views prior to submitting planning reports to Congress—a tentative attempt at coordination that fell far short of the desires of the New Deal planners. The Federal Power Commission joined the group in 1943.¹⁰⁷

The member agencies of FIARBC formed a number of subcommittees to address issues in hydrology, sedimentation, energy conversion procedures, and benefits and costs. In 1950, the last-named subcommittee published a report on *Proposed Practices for Economic Analysis of River Basin Projects*, more commonly called the Green Book, that recommended procedures for evaluating benefits and costs of water projects.¹⁰⁸ In general, it applied classical welfare economics to national water resources development. It addressed national benefits and costs for irrigation, flood control,

105. J. Krutilla, *The Use of Economics in Project Evaluation*, Transactions of the 40th North American Wildlife and Natural Resources Conference, 1975 at 375 (1975), reprinted in *Resources for the Future* 125 (no date).

106. 33 U.S.C. § 701 (1988).

107. B. Holmes, A History of Federal Water Resources Programs, 1800–1960 at 19–20, 23, 37–38 (1972) (United States Dep't of Agric. Econ. Res. Service misc. publication no. 1233); Maass, *supra* note 97, at 110–11; United States Army Corps of Engineers, Annual Report of the Chief of Engineers, 1951, H.R. Doc. No. 272, 82d Cong., 2d Sess., pt. 1, at 159 (1952).

108. Federal Inter-Agency River Basin Committee, Subcommittee on Benefits and Costs, *Proposed Practices for Economic Analysis of River Basin Projects* (1950). The Green Book was reissued in 1958 by President Eisenhower's Inter-Agency Committee on Water Resources (IACWR, or "Icewater").

navigation, and power, but it did not develop procedures to analyze income distribution, environmental impacts, or regional benefits and costs. It proposed that intangible effects (effects not measurable in monetary terms), such as the saving of human life or the loss of scenic or historic sites be "fully considered" and that federal water agencies develop uniform procedures to address such effects.¹⁰⁹ Federal water agencies approved the Green Book, but its recommendations were not binding, and both the Bureau of Reclamation and the Corps of Engineers rejected specific parts of it. Then, at the end of 1952, the Bureau of the Budget published Circular A-47, which decisively imposed national efficiency benefit-cost standards on all federal water resources projects, despite the protests of many congressmen (and engineers) who desired a more flexible approach.¹¹⁰

An important but sometimes overlooked influence on the development of benefit-cost analysis was Resources for the Future (RFF), a non-profit corporation established in 1952 to gather data and objectively to assess the country's present and future natural resource requirements. With funding from the Ford Foundation, the corporation assembled an impressive staff of social scientists—mainly economists—and initiated a wide-ranging research program.¹¹¹ Some early work was inspired by the report of the President's Materials Policy Commission, chaired by William S. Paley.¹¹² The commission looked at the future resource needs of the free world and recommended more research and data-gathering, improved governmental organization to handle materials problems, and greater private investment. The report emphasized efficient management of growth and addressed resources according to *use*. For instance, hydroelectric power and waterway transportation were not considered in the context of multipurpose river development but in relation, respectively, to other power sources such as coal and oil and to other methods of transportation such as highways.¹¹³ The commission's recommendations, and many other ideas, became subjects of discussion at the Mid-Century Conference on

109. *Id.* at 26–28.

110. *Id.*; C. Howe, *Water as an Economic Commodity*, in *Water and the American West: Essays in Honor of Raphael J. Moses* 58 (D. Getches ed. 1988); Holmes, *supra* note 107, at 39; N. Back & R. Gidez, *Economics in the Comprehensive River Basin Planning Program*, Paper presented at the annual meeting of the New England Agric. Econ. Council, U. Mass. (1964) (Donovan papers, box 19, OH, HQ USACE).

111. Henry Jarrett and others, *A Brief History of RFF*, in *Resources for the Future: The First 25 Years* 3–20 (1977). A scholarly history detailing the contributions of RFF to natural resources policy is needed. The papers of A. Maass, G. White, and H. Caulfield, Jr., provide much useful source material (OH, HQ USACE).

112. 12. The President's Materials Policy Commission, *Resources for Freedom* (1952) (5 volumes).

113. The President's Materials Policy Commission, *Resources for Freedom: Summary of Volume I* (1952) (for a summary of volume I of the Paley Comm. report entitled, *Foundations for Growth and Security*). Report by A. Maass to Social Science Research Council, in A. Maass to P. Herring, *Election Day* (1952) (a critique of the Commission Study) (Maass papers, folder 12, OH, HQ USACE).

Resources for the Future, a huge meeting of 1,600 organized by RFF and held in Washington on December 2–4, 1952. The assembly was consciously intended to update Theodore Roosevelt's 1908 Governors Conference and also to generate suggestions for further work by RFF.¹¹⁴

In the coming years, RFF published dozens of books that examined natural resource issues in the United States. Marked by rigorous methodology and analysis, the publications reflected the organization's interest in relating resource wealth to quality of life and economic growth. In 1958, RFF published *Multiple Purpose River Development* by John V. Krutilla and Otto Eckstein.¹¹⁵ After analyzing a number of river basin developments, the authors concluded that an economically efficient water resources program that takes into account all benefits and costs would more than likely be of limited attraction to private investors. Public investment would be necessary.¹¹⁶

Although not published by RFF, two other books appeared in 1958 that recommended changes in benefit-cost efficiency criteria to increase and, ideally, optimize social welfare benefits under budgetary constraints. The authors were Otto Eckstein and Roland McKean.¹¹⁷ Attempting to justify public investments on the same grounds as private enterprises, both writers paid close attention to analytical aids and the use of market prices to determine costs and benefits. However, their methodology could not satisfactorily account for future institutional, technological, social, and economic changes or for intangible benefits. Consequently, the authors failed to obtain the scientific authority which they clearly desired. Moreover, even conceding the desirability of optimizing social welfare, the question of how to achieve this remained. "Pareto Efficiency"—a state in which no individual in society can be made better off without making someone else worse off—was a popular economic idea in the New Deal, but basically naive, for few policy changes involve situations in which absolutely no one loses. There were other methodological problems. Welfare economists emphasized individual market preferences, but

114. Resources for the Future, *The Nation Looks At Its Resources: Report of the Mid-Century Conference on Resources for the Future* (1954) (on the background to the conference, see R. Gustavson's introduction; for the session on water resource problems, see pages 126–75. Gilbert White, then president of Haverford College, chaired the session).

115. J. Krutilla & O. Eckstein, *Multiple Purpose River Development: Studies in Applied Economic Analysis* 265–77 (1958).

116. *Id.*; Fox, *A Perspective on RFF Research*, in *Resources for the Future: The First 25 Years* 80–81 (1977).

117. R. McKean, *Efficiency in Government Through Systems Analysis, With Emphasis on Water Resources Development* (1958) (Rand Corporation Research Study, Publications in Operations Research No. 3); O. Eckstein, *Water-Resource Development: The Economics of Project Evaluation* (1958). See Ciriacy-Wantrup, *supra* note 54, at 9–12; Margolis, *The Economic Evaluation of Federal Water Resource Development: A Review Article*, 49 *Am. Econ. Rev.* 96–111 (1959); Hines, *The Economists Discover Water Resources*, 14 *J. Soil & Water Conservation* 125–26 (1959) (for comments on all three books, including Krutilla and Eckstein).

this method downplayed *community* responses; an individual's best interest may not be the same as the community's. Also, the economists insisted that the social value of income generated by a water project remained the same regardless of whether the project was located in a poor or wealthy region; the social implications of this position bothered even the formulators and forced them to defer to the political process to accommodate economically inefficient—from their point of view—objectives.

Eckstein, Krutilla, and other "new welfare economists" left their colleagues basically with the same conceptual tools they had always used. Perhaps unintentionally, their analyses clarified more what economists could not do than what they could. For the moment at least, economists remained bound to traditional benefit-cost analysis and its focus on maximizing economic efficiency or, in national terms, on producing "annual additional income to the nation."¹¹⁸ Meanwhile, political scientist Aaron Wildavsky warned about the "the omission of explicit consideration of political factors" in benefit-cost analysis,¹¹⁹ while another political scientist, Vincent Ostrom, borrowed from economic theory to suggest that his colleagues assess the social "costs" of political decisions or indecisions in water resources use given various institutional arrangements.¹²⁰ The common denominator was a belief that rational water allocation required political as well as economic calculations.

The continuing debate in Congress and the Executive Branch¹²¹ over the appropriate way to determine costs and benefits of projects confused and frustrated engineers. Within the Corps of Engineers, responses depended on position and office location. In the Washington, D.C. headquarters, more politically sensitive to policy shifts than many field offices were, senior officials attempted to stay in step with new ideas and proce-

118. Maass, *Benefit-Cost Analysis: Its Relevance to Public Investment Decisions*, in *Water Research* 311–20 (A. Kneese & S. Smith eds. 1966); Ciriacy-Wantrup, *Concepts Used as Economic Criteria for a System of Water Rights*, in *Economics and Public Policy in Water Resource Development* 263–66 (S. Smith & E. Castle eds. 1964); Howe, *supra* note 110, at 53–60.

119. Wildavsky, *The Political Economy of Efficiency: Cost-Benefit Analysis, Systems Analysis, and Program Budgeting*, in *Pol. Sci. & Pub. Pol'y* 63 (A. Ranney ed. 1968).

120. Ostrom, *Water Resource Development: Some Problems in Economic and Political Analysis of Public Policy*, in *Pol. Sci. & Pub. Pol'y* 123–50 (A. Ranney ed. 1968); J. Buchanan & G. Tullock, *The Calculus of Consent* (1962); M. Olson, Jr., *The Logic of Collective Action* (1965) (Ostrom based his ideas partly on the work of these economists).

121. A detailed discussion of the various post-World War II political efforts to address and rationalize federal water resources developments, especially in regard to benefit-cost calculations, is beyond the scope of this article. See generally Holmes, *supra* note 107, at 32–34, 40–43; United States Council on Environmental Quality, *Environmental Quality: The Eighteenth and Nineteenth Annual Reports of the Council on Environmental Quality* together with The President's Message to Congress 96–100 (1990); Senate Committee on Interior and Insular Affairs, *History of the Implementation of the Recommendations of the Senate Select Committee on Water Resources*, 90th Cong., 2d Sess. 18–19 (1969) (prepared by T. Schad & E. Boswell); M. Reuss, *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986* (1991) (United States Army Corps of Engineers Institute for Water Resources).

dures. As early as 1950, Eugene Weber, a senior civilian in the Office of the Chief of Engineers, told young Engineer officers, "[t]he land, labor and material used for Civil Works projects are, in effect, being diverted from other possible uses which might be more or less beneficial from the standpoint of satisfying human needs."¹²² Such an admission from a professional engineer-planner would have been startling a generation before. In late 1955, the Chief of Engineers established a Committee on Economic Policies to develop policies and procedures relating to economic evaluation of projects. The committee turned to the 1950 Green Book for general guidance. Subsequently, the Corps integrated the committee's new economic guidelines into a revised Engineering Manual for Civil Works published in October, 1956.¹²³

However, Corps field offices did not respond altogether positively to this heightened interest in economic evaluation. One engineer from the Corps' Seattle District office could not help smirking at the incongruity between Krutilla's and Eckstein's sophisticated analysis of Corps plans for projects on the upper Columbia and Snake rivers and the simple arithmetic computations done on scrap paper by Corps field engineers upon which the analysis was based.¹²⁴ As he candidly admitted, Seattle District planners "were not strong on economics. . . . our economist was an engineer who could not 'cut it' where project formulation was the order of work. He was arbitrarily selected to do the economics in order to keep him out of the hair of the project engineers. His assistant was a business administration major."¹²⁵ It is likely that the Corps' traditional engineering orientation resulted in some other Corps field offices treating economic matters in similar ways.

Senior officials in Corps field offices may have been more responsive to Headquarters directives and to the principles of Senate Document 97, but they remained concerned that worthwhile projects were not being built because of inappropriate economic evaluation. For instance, Brigadier General C. H. Dunn, Division Engineer of the Corps' Southwestern Division, unsuccessfully argued to the Director of Civil Works in the Washington, D.C. office, Major General Jackson Graham, that a 100-year

122. Lecture by E. Weber to the United States Army Engineer School, Fort Belvoir, Virginia (1950) (available in Civil Works Administration: Project Formulation, Justification and Cost Allocation, Donovan papers, folder on "B/C Analysis, 11/47-8/59", box 89, OH, HQ USACE).

123. See folders on Terminology of Economic Evaluation of Water Resource Projects (tentative draft; box 38) and OCE Committee on Economic Policies—Pre '58 Green Book (box 34, Donovan papers, OH, HQ USACE).

124. M. Spero, Upper Columbia River Construction, McNary Headwater To Chief Joseph Tailwater, and U. S. Army Corps of Engineers, Seattle District, Upper Columbia Tributaries Plan of Development Studies, 1952-1963 at X-20 (unpublished draft history, Spero papers, OH, HQ USACE). Spero was one of Seattle District's planning group leaders on the Upper Columbia. Krutilla & Eckstein, *supra* note 115, at 136-69.

125. Spero, *supra* note 124, at X-60.

period be used for the economic analysis of navigation projects rather than a 50-year period.¹²⁶ In another case, Major General George H. Walker, head of the Missouri River Division, complained to Lieutenant General William F. Cassidy, the Chief of Engineers, "[t]here is a marked lack of consistency in our approach to economic analysis and our approach to structural design." He noted that the Corps designs dam and reservoir projects to "take full cognizance of the possibility of occurrence of the maximum probable flood during the project life."¹²⁷ Yet, the additional cost of this approach sometimes prevented projects from obtaining the positive benefit-cost ratio needed before construction could commence. In short, General Walker asked that economic evaluation methodology accommodate the safety and durability factors that the Corps believed necessary.¹²⁸ He may not have known or appreciated the arguments against structural solutions that Gilbert White and others were then advancing.

Confusion over economic evaluation was not confined to government corridors. Indeed, some of the most vigorous debates occurred in academia. At Harvard University in 1955, Arthur Maass (political science) and Maynard Hufschmidt (public administration) initiated the Harvard Water Program, a multidisciplinary research and training program to develop new methodological techniques in water resources planning. They soon were joined by Harvard economics professors Robert Dorfman and Otto Eckstein, economics student Stephen Marglin, and engineering professors Gordon Fair, Harold Thomas, Jr., and Myron Fiering. Besides some Harvard graduate students, the program trained dozens of state and federal water resource officials. It initially received Rockefeller Foundation support, but later also obtained financial assistance from the Army Corps of Engineers, the Bureau of Reclamation, the Public Health Service, and Resources for the Future.¹²⁹

In 1962, the program's major participants published *Design of Water Systems* (see footnote 129), a work that profoundly influenced the ap-

126. Memorandum from Brigadier General C. Dunn to Major General J. Graham (Sept. 25, 1963) (entitled, Period of Economic Analysis for Navigation Projects); Memorandum from J. Graham to C. Dunn (Oct. 28, 1963) (same subject) (folder on Period of Economic Analysis for Navigation Projects, box 38, Donovan papers, OH, HQ USACE).

127. Letter from Major General G. Walker to Lieutenant General W. Cassidy (July 30, 1965) (Jerome Ackerman papers, accession 6048, box 4, American Heritage Center, University of Wyoming, Laramie, WY). Jerome Ackerman was the senior engineer in the Missouri River Division. He was not related to the geographer Edward A. Ackerman.

128. *Id.*

129. Moore & Moore, *supra* note 65, at 47; Hufschmidt, *The Harvard Program: A Summing Up*, Water Research 441-43 (A. Kneese & S. Smith eds. 1966); M. Reuss, Water Resources People and Issues: Interview with Professor Arthur Maass 6 (1989); A. Maass, M. Hufschmidt, R. Dorfman, H. Thomas, Jr., S. Marglin & G. Fair, *Design of Water-Resource Systems: New Techniques for Relating Economic Objectives, Engineering Analysis, and Governmental Planning* 10-13 (1962); D. Major, *Multi Objective Water Resource Planning* (1977) (Water Res. Monograph 4). My analysis of multiobjective analysis in this article is largely based on these sources.

proach to the planning and design of river basin systems during the next decade. The authors stressed the tremendous advantages of computer simulations to examine the physical and economic consequences of alternative designs of water systems. They also advanced the idea of synthetic or operational hydrology. This entailed using computer-generated data to predict future hydrologic activity rather than relying solely on historical records. While initially the method encountered resistance from some Corps engineers, who had always used historical streamflow records, "with some proselytizing by Thomas and Fiering," according to Maass, "the technique came to be accepted."¹³⁰ Finally, the study explained a new approach to economic evaluation, multiobjective economic analysis.

Not to be confused with multipurpose planning, which focuses on irrigation, flood control, navigation, etc., multiobjective analysis addresses actual social objectives, such as income generation, food or industrial production, and regional development. More important, unlike benefit-cost analysis, which always maximizes economic efficiency, multiobjective analysis designs water systems to address *all* the objectives sought by the planners, including noneconomic values such as environmental quality or preserving a well-established ethnic neighborhood. The method recognizes that, after all the computer simulations have been run and mathematical models constructed, the ultimate decision must rest in the political sphere. Sophisticated equipment and methodologies can show the consequences of choosing various options to reach an objective or combination of objectives, but politicians (or planners) must choose the objectives in the first place and select among various options in the end. Trade-offs are necessary. As never before, multiobjective analysis showed the importance of interdisciplinary cooperation in water resources planning.

Although dwindling enthusiasm for river basin development and continual political and bureaucratic debates over implementation measures prevented multiobjective analysis from being firmly anchored in federal procedures, many government water resource experts supported the concept.¹³¹ In 1961, the Bureau of the Budget asked Maynard Hufschmidt to chair a panel to recommend changes in federal procedures for formulating and evaluating water projects. The opportunity allowed Huf-

130. Reuss, *supra* 129, at 9.

131. Perhaps one reason why many government bureaucrats embraced multiobjective analysis was that it nicely complemented the Planning, Programming, and Budgeting System (PPBS) that the Bureau of the Budget imposed on most federal agencies in 1965. Both systems stress the importance of obtaining the most accurate, detailed information possible for a number of years into the future. Both develop options, estimates of future needs, and priorities. Perhaps most important, both are intended to be management tools and not simply economic analyses. A. Schmid, *Public Appropriations Structure and Performance: The Case of PPBS in Water Resources 8-10* (1970) (Rep. No. 153, Dep't of Agric. Econ., Mich. State U.); A. Nelson, *A History of the Office of the Assistant Secretary of the Army for Civil Works 40-48* (unpublished draft, OH, HQ USACE).

schmidt to disseminate some of the findings of the Harvard Water Program and to influence the process that led to the drafting of Senate Document 97 in 1962.¹³² That document mandated that the three objectives of federal water planning should be (1) national economic development "and development of each region within the country"; (2) preservation, including the "protection and rehabilitation of resources," recreational areas, and areas of scenic, scientific, or historical interest; and (3) the "well being of people" which "shall be the overriding determinant."¹³³ Multiobjective analysis was used in several federal river basin studies, but the debate continued over the objectives and their implementation, especially among staff members of the newly-established Water Resources Council.¹³⁴

In Section 209 of the Flood Control Act of 1970,¹³⁵ Congress formally embraced multiobjective planning and specified four objectives for federal water projects: regional economic development, environmental quality, social well-being, and national economic development. Section 122 of the River and Harbor Act of 1970 required the Corps of Engineers to "promulgate guidelines designed to assure that possible adverse economic, social and environmental effects relating to any proposed project have been fully considered."¹³⁶ The agency completed the guidelines in December 1972. Concurrently, the Corps' Institute for Water Resources contracted with a number of outside experts to do social science studies. Nevertheless, social scientists in Corps district offices were dissatisfied. The guidelines did not settle disputes about either methodologies or fundamental questions, and the inability of social scientists in the field to obtain more funding for social impact studies left them with the impression that the Corps did not assign a high priority to the subject.¹³⁷ One Corps economist said in 1976, "[n]umbers cost money. Give me more money and I'll give you more numbers. But we're told not to spend extra money on these social impact numbers, not to generate the social numbers for alternative project designs but only in depth for one alternative."¹³⁸ If true, the reason for the attitude may well have been the engineers' frustration at trying to respond to inexact results subject to numerous interpretations.

132. Hufschmidt, *supra* note 129, at 445-46.

133. The President's Water Resources Council, *supra* note 58, at 1-2.

134. Multiobjective analysis perhaps figured most prominently in the North Atlantic Regional Water Resources Study, a Corps-directed study initiated in late 1965 and completed in 1972. It covered the area from the James River basin in Virginia to the Maine-New Brunswick border. Major, *supra* note 129, at 58-62.

135. 42 U.S.C. § 1962-2 (1988).

136. Pub. L. No. 91-611, Title I, § 122, 84 Stat. 1823 (not codified).

137. S. Taylor, *Making Bureaucracies Think: The Environmental Impact Statement Strategy of Administrative Reform* 98 (1984).

138. *Id.*

The Office of Management and Budget (OMB) was not enthusiastic about either the regional development or social well-being objectives that Congress had embraced in Section 209. It attempted to limit the applicability of the former to only a relatively small number of poverty-stricken regions, while, according to the first director of the Water Resources Council, it regarded the latter as a license to sociologists and others to link water projects with "almost any other damn thing they could think of that struck them as good, as interesting, as proper."¹³⁹ For its part, Congress expressed dissatisfaction with the *Principles and Standards* (P&S) that the Water Resources Council produced to implement the multiobjective approach.¹⁴⁰ Reflecting OMB philosophy, these procedures established national economic development and environmental quality as the two objectives in water resources planning. The other two "accounts," regional development and social well-being, were relegated to "other beneficial and adverse effects" to be considered "where appropriate."¹⁴¹ Some congressmen were particularly concerned that insufficient attention was given to regional development. Finally, federal water agencies, though receptive to multiobjective analysis, protested the ambiguous language in the P&S and the amount of work the document imposed. For instance, a literal interpretation of the P&S would require agencies to develop alternatives for every major assumption concerning the future. Moreover, the Carter Administration's attempt to apply uniform, detailed evaluation procedures for water planning met strong resistance from agencies such as the Corps of Engineers because it failed to recognize the need for flexibility from agency to agency.¹⁴²

Continuing controversy over objectives and procedures lasted into the 1980s. In 1983, the Reagan Administration published its *Principles and Guidelines* (P&G) to replace the 1973 P&S.¹⁴³ While P&G retained all four accounts, it *required* only national economic development. Generally, the recommended project is the one offering the greatest net benefit to the

139. Transcript, interview with Henry P. Caulfield, Jr. 74 (Aug. 16, 1988) (conducted by M. Reuss; OH, HQ USACE).

140. United States Water Resources Council, *Water and Related Land Resources: Establishment of Principles and Standards for Planning*, 38 Fed. Reg. 24,778 (1973). See N. Grigg, *Water Resources Planning* 80-83 (1985); Reuss, *supra* note 121 (for more on the evolution of multiobjective analysis in the federal government).

141. United States Water Resources Council, *supra* note 140, at 24,782-83.

142. Disposition Form from W. Donovan to A. Shwaiko, chief, planning division, civil works directorate, Office of the Chief of Engineers (Aug. 4, 1978) (subject: Revising the Principles & Standards in the Proposed WRC Planning Manual); Disposition Form from A. Shwaiko to L. Blakey, Chief, Office of Policy, civil works directorate, Office of the Chief of Engineers (Sept. 6, 1978) (subject: WRC Memorandum of Aug. 29, 1978, Implementation of Presidential Water Policy Directives—The P&S Revisions; both in author's files, OH, HQ USACE).

143. United States Water Resources Council, *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (Mar. 10, 1983).

nation consistent with protecting the environment. Whether this emphasis on national economic development eliminates or constrains the trade-offs that are fundamental to multiobjective analysis (leaving aside the issue of nonfederal financial capability) has been a thoroughly discussed and still unresolved issue.¹⁴⁴

The debate over economic evaluation methodology undoubtedly will continue. It raises issues that have existed since Burgess and others in the 1920s challenged social scientists to discover social laws and utilize them for society's benefit. While some philosophers, political scientists, and economists have expressed concerns about ethical judgments inherent in economic evaluation, other social scientists clearly retain their vision of an administrative "rule of reason," unsullied by power politics or the public will, which can impose rational criteria. However, in a democracy the experts rarely have the last word. Alleged administrative and economic efficiencies are habitually sacrificed to democratic values, and planning includes a notion of justice that is not simply an abstract concept but a necessary tool. This is especially so when planners face a large number of uncertainties—as is usually the case with water resources—without the technology or data necessary to provide the basis for accurate, "scientific" answers. To cope with these uncertainties justly, planners need to be aware of their own evaluative assumptions and ethical biases. Ultimately, however, social values as expressed in the political process will be the arbiter in a democratic society.¹⁴⁵

CONCLUSION

Today, social scientists emphasize socially feasible choices and probable consequences. More often than not, their focus is not on developing formal criteria for policy decisions, but rather on organizing data to provide a rational framework to address social issues. Although this goal is less ambitious than developing criteria, and is far removed from the ear-

144. See T. Schad, *Present Policies and Practices*, in *Social and Environmental Objectives in Water Resources Planning and Management* 12–18 (W. Viessman, Jr. & K. Schilling eds. 1986) (for a pessimistic prognosis). But cf. E. Stakhiv, *Achieving Social and Environmental Objectives in Water Resources Planning: Theory and Practice*, in *Water Resources Planning & Management* 107–25 (W. Viessman, Jr. & K. Schilling eds. 1986) (offering an approach which Stakhiv maintains retains the system of trade-offs). This article excludes consideration of the impact of the Water Resources Development Act of 1986 (33 U.S.C. § 2201 (1988)), which stipulates much greater nonfederal cost-sharing for the construction and maintenance of water projects. At the very least, the Act makes water planning as dependent on nonfederal financial capability as on a finding of net benefit to national economic development.

145. J. Byrne, *Policy Science and the Administrative State: The Political Economy of Cost-Benefit Analysis*, in *Confronting Values in Policy Analysis: The Politics of Criteria* 70–93 (F. Fischer & J. Forester eds. 1987); K. Shrader-Frechette, *Science Policy, Ethics, and Economic Methodology* 265–68 (1985); A. Kneese, S. Ben-David & W. Schulze, *The Ethical Foundations of Benefit-Cost Analysis*, in *Energy and the Future* 59–74 (D. Maclean & P. Brown eds. 1982).

ly twentieth century desire to provide unerring predictive tools for policy-making, it is more realistic. The technique offers opportunities to make both socially and environmentally responsible decisions affecting future generations.

Yet, the approach frustrates engineers. Engineers desire to gain control over uncertainty, while social scientists concentrate on analyzing uncertainty and its probable consequences. Engineers have definite projects in mind and look for ways to build them; social scientists explore community values to determine whether the projects should be constructed at all. In short, the engineers are product-oriented, while social scientists engage (and extend) the process.

Because of their professional orientation, social scientists are better attuned than engineers to the organizational culture of federal water agencies in the environmental era. New laws, shifting public values, and financial constraints compelled federal water resources agencies to focus more on the planning process than they had in the two decades following World War II. Unquestionably, the law that stimulated the most dramatic change was the National Environmental Policy Act of 1969.¹⁴⁶ Its requirement that federal agencies draft an environmental impact statement for every major federal activity "significantly affecting the quality of the human environment" forced agencies to hire both natural and social scientists and significantly lengthened the planning period for major construction projects.¹⁴⁷ Other federal and state environmental laws likewise extended pre-construction planning. In a sense, a credible, comprehensive planning process became a product in itself.¹⁴⁸

Of course, social scientists were among those most concerned that significant options and impacts be considered before construction began. Today, they continue to influence planning *procedures* and to sensitize planners to social impacts. Nevertheless, many of the *objectives* of Progressive and New Deal era social scientists have all but been abandoned. Comprehensive river-basin planning had some early success, but the actual management of river basins has floundered in the face of political realities, and the various river basin planning commissions established pursuant to the Water Resources Planning Act of 1965 have been abol-

146. 42 U.S.C. § 4321-4347 (1988).

147. 42 U.S.C. § 4332 (1988). The environmental impact statement requirement probably resulted in hiring more archaeologists than any other kind of social scientist since the National Environmental Policy Act charged federal agencies to "preserve important historic, cultural, and natural aspect of our national heritage." 42 U.S.C. § 4331, Title 1, section 101 (b) (4).

148. The Corps of Engineers recently has established a life cycle project management system that eliminates some steps of a feedback, process-oriented planning model and utilizes elements of a sequential, product-oriented (project-oriented) model. This approach emphasizes individual responsibility, particularly with the project manager. However, it is too early to assess its effect on social scientists within the Corps.

ished. Nonstructural flood control measures were utilized in some areas of the country, but insufficient economic incentives apparently exist to insure that these measures are given equal weight with traditional structural approaches. Federal water resource planners accept multiobjective analysis but continue to debate appropriate methodologies. Finally, social scientists no longer seek laws, but analyze social processes and develop models that enhance our understanding of how these processes relate to one another. More often than not, the future is portrayed in terms of probabilities and options. Indeed, there is some irony that social scientists appear to offer more when they are less "scientific," that is, less concerned about objective laws of social behavior. It may be that as social scientists gain more appreciation for the unique and the problematical, they will exploit more history and less theory.

Social scientists (and historians) must work to insure that engineers' understanding of social process is sensitive both to temporal and spatial dimensions. Incorporating this understanding into the planning of water projects has, of course, been the great challenge. Given continual demands that planning funds be reduced and the planning period shortened, it may be that social scientists should concentrate less on procedures and more on changing the perspective of engineers, who still remain the project managers. The challenge then becomes to convince engineers that planning does not end with project construction but extends to the project's short- and long-range human and environmental impacts. Engineers must establish an ongoing responsibility with the land and people they have affected. To develop this relationship effectively, they must thoroughly integrate the social sciences into the engineering process, for no ethics of responsibility can neglect the social and environmental consequences of decisionmaking. The social scientists who examine the potential effects of water projects on human activity are vital participants in the engineering process.