



# Consumer Surplus with Apology: A Historical Perspective on Nonmarket Valuation and Recreation Demand

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## Abstract

When economists first turned to applied benefit-cost analysis in the 1930s and 1940s, prices were the only widely accepted measure of benefits. Perhaps surprisingly, economists did not consider measures like consumer surplus, which seemed quite foreign. Consequently, when they turned to nonmarket valuation for goods like outdoor recreation, their constructed demand curves seemed less informative than a simple equilibrium price. As they struggled with how to make use of such information, natural resource economists set important precedents for the larger profession in coming to consumer surplus as a new measure of benefits. By creating important precedents and learning through practice, they shaped the discipline as much as they were shaped by received theory. At the same time, by coming to these notions in the context of political debates, they were also shaped by the norms of the state.

*[T]hat part of social welfare that can be brought directly or indirectly into relation with the measuring-rod of money . . . may be called economic welfare. It is not, indeed, possible to separate it in any rigid way from other parts, for the part which can be brought into relation with a money measure will be different according as we mean by can, “can easily” or “can with mild restraining” or “can with violent straining.” The outline of our territory is, therefore, necessarily vague.*

—A.C. Pigou

## INTRODUCTION

As environmental economists know well, one of the greatest challenges of applied benefit-cost analysis is to quantify environmental benefits using Pigou’s measuring rod of money. To meet that challenge, environmental economists have developed a number of valuation tools over the past half century, from travel cost models of recreation demand to stated preference models of nonuse values (see, e.g., Champ et al. 2003, Freeman 2003, and Mäler & Vincent 2005). Today, we tend to frame the problem as one of implementation, of empirically measuring a well-formulated theoretical construct such as consumer surplus.

What most environmental economists may not realize is that even as their predecessors were developing these empirical tools during the 1950s and 1960s, the more fundamental questions remained far from settled. Indeed, the very meaning of economic benefits was still unstable. For most economists working during the time, there was simply no single coherent concept of benefits to go forth and measure. In particular, despite its earlier origins in the writings of Marshall and Dupuit, and despite its attempted resurrection by Hotelling and Hicks, to them consumer surplus did not seem an obvious choice.<sup>1</sup> Thus, *pace* Willig (1976), once economists did turn to consumer surplus, they did so with apology, in both senses of the word.

Environmental economists sell themselves short when they suppose they have been merely implementing established theory. As they wrestled with practical problems in the trenches, natural resource economists set important precedents for the profession at large. Their work on the value of outdoor recreation, in particular, was among the very first attempts at actually measuring consumer surplus.<sup>2</sup> In this way, they very much shaped the larger profession of economics.

This paper tells the story of how environmental and natural resource economists wrestled with valuation issues during the middle third of the twentieth century. It focuses especially on applications to outdoor recreation, which were a priority during the period. It is not a story of pure intellectual progress. Rather, it is a very human story of intellectual development through trial and error; of confusion, misunderstanding, and debate; and of tension between academic ideals and bureaucratic imperatives. It is a story of how, as economic science has been acted out, theory and practice are not disjunctive, but copulative. Progress was conceived in the trenches.

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<sup>1</sup>This point is not a new one to those who have followed the history closely. See especially Ekelund & Hébert (1985), Hanemann (undated), and Morey (1984). Smith (1988) also emphasizes the role of applied environmental and resource economics in shaping welfare economics.

<sup>2</sup>See Parsons (2003) and Phaneuf & Smith (2005) on more recent work in recreation demand modeling. Phaneuf & Smith in particular provide a historical context for recent work.

## BACKGROUND

This section begins by providing background and context on the policy arena, the players, and the legacy of theoretical welfare economics that the players had to work with.

### The Policy Arena

Professional benefit-cost analysis grew up in the United States in response to congressional mandates accompanying authorization for water resources projects, including the Reclamation Act of 1902 and the Flood Control Act of 1936. In these first decades, most analyses were performed by professional engineers, with little input from economists. But in the postwar period, several factors contributed to the drive for new thought and new participation by economists.<sup>3</sup> Certainly, more was at stake economically than ever before. As Otto Eckstein (1958) noted, with the expanding economy, the value of property vulnerable to floods, the demand for electric power, and the traffic on rivers all were greater. Correspondingly, annual federal expenditures had risen to \$800 million by 1955, “much the largest share of all the civil public works activities carried on at the federal level of the government” (Eckstein 1958, p. 1). Moreover, some \$8 billion dollars of projects were backlogged (Eckstein 1958, p. 3).

Of course, political pressure also followed the money. Water has always been a source of controversy in the western United States, and by extension so too have water projects that would divert water from one region, or from one group of users, to another. Competition over water resources extended to the bureaucratic jurisdiction overseeing them. The Army Corps of Engineers; the Department of Interior’s (DOI) Bureau of Reclamation (USBR), Fish and Wildlife Service (FWS), and National Park Service (NPS); the Department of Agriculture (USDA); the Department of Commerce; and the Bureau of the Budget all had a stake in water programs.

In such a setting, an objective authority would be needed to adjudicate the conflicting claims. Benefit-cost analysis could play that role (Porter 1995). But to do so with integrity, benefit-cost analysis needed reformation. One problem was that across this wide array of agencies, there was an equally wide array of inconsistent benefit-cost practices. These inconsistencies were unsettling, as they undermined the authority that benefit-cost analysis had to have if it would serve to settle disputes. As Porter (1995), Desrosières (1998), and Stapleford (2009) have emphasized, disputes about the measurement of social facts undermine the utility of those facts in settling social debates. But the participants themselves were well aware of this tension. As J.M. Clark, Eugene Grant (a prominent professor of industrial engineering), and Maurice Kelso (a prominent agricultural economist) would put it in a consultant’s report to the USBR: “Democracy has to rely on technicians in matters inscrutable to the non-specialist, but preferably where the specialist is following a well-authenticated technique. In this case, the disagreements among the specialists are evidence that they do not possess an authenticated technique. . .” (Clark et al. 1952, p. 11, AMP 68).<sup>4</sup>

<sup>3</sup>Berkman & Viscusi (1973) provide a very detailed study of the bureaucratic maneuvers during the latter part of this period, making use of many interviews with insiders, and Porter (1995) offers the perspective of a historian. Hanemann (1992) provides an excellent overview of the history of benefits measurement and benefit-cost analysis, also with a focus on recreation. See also Castle et al. (1981), Hanemann (2006), and Hufschmidt (2000) for additional overviews.

<sup>4</sup>Throughout this article, references to archives used are given as follows: AMP, Arthur Maass Papers; MMR, Mark M. Regan Papers; NA, U.S. National Archives; RCP, Reginald C. Price Papers. Archive information and location are listed below.

To lend benefit-cost analysis more authenticity, in 1946 the agencies formed the Federal Inter-Agency River Basin Committee, with a Subcommittee on Benefits and Costs, to coordinate their benefit-cost practices. The subcommittee was staffed by a number of agricultural economists, including Nathaniel Back (USDA), Reginald Price (USBR), Mark Regan [Bureau of Agricultural Economics (BAE)], E.C. Weitzell (BAE), and at times Roy Prewitt (NPS) (see, e.g., NA 79.99.70). The subcommittee released its report, *Proposed Practices for Economic Analysis of River Basin Projects*, in 1950 (Inter-Agency Comm. 1950). The so-called Green Book, it is widely considered a landmark in the development of benefit-cost analysis and served as a blueprint for discussions in the ensuing years (e.g., Hanemann 1992, Porter 1995). The committee continued to meet over the 1950s and released a revised edition in 1958.

Among other things, the committee considered how to measure the benefits of outdoor recreation. Naturally, recreation was not at the top of its list: flood control, irrigation and drainage of agricultural land, navigation, hydroelectric power, and municipal water supplies were all more burning policy issues. But outdoor recreation arguably received disproportionate attention.<sup>5</sup>

The attention given to recreation can be attributed to five factors. First, and most simply, recreation is not sold in the market, so it was one of the most difficult nuts to crack. Second, it was a locus of interagency friction. In particular, the NPS and FWS were tasked with estimating recreation values for their cousin agency, the USBR, but their incentives were not necessarily aligned, creating a kind of principal-agent problem. This was precisely the kind of problem the interagency committee was created to overcome.

Third, frankly, including recreation as a benefit would pump up the benefit-cost ratios. Benefit-cost analysis is unfortunately all too susceptible to political pressures. Internal memoranda from the period frequently pressured analysts to tweak their methods to improve the benefit-cost ratios.<sup>6</sup> In this context, finding a satisfactory method to incorporate recreation would uphold the integrity of benefit-cost analysis while at the same time satisfying the more cynical manipulators of the system.

Particularly intriguingly, a fourth and related factor was the role of recreation in cost-sharing formulae. Since the Reclamation Act of 1902, reclamation projects could go forward only if they could be reimbursed by farmers and other beneficiaries (Teale 1927). But costs that were explicitly incurred for other objectives, such as recreation, would not need to be recovered, nor would the totality of any joint costs for multipurpose projects. If a portion of joint costs could be allocated to recreation, it would correspondingly reduce the net costs to be recovered from farmers. And because joint costs are by definition inseparable, the only way to allocate them seemed to be through benefit shares.<sup>7</sup>

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<sup>5</sup>By 1964, one bibliography listed 160 books and articles on recreation, indicating its policy importance during the period (Wolfe 1964).

<sup>6</sup>E.g., R.D. Searles, acting Secretary of the Interior, to Commissioner of the USBR, December 12, 1951 (RCP 88B); Michael Strauss, Commissioner of the USBR, to Secretary of the Interior, September 17, 1952 (AMP 68), Strauss to Secretary of the Interior J.A. Krug, November 1, 1948 (NA 79.99.2299). For a later example, see the discussion of some of the pressures on the Water Resources Council in Banzhaf (2009) and Berkman & Viscusi (1973, chapter 8).

<sup>7</sup>Mark Regan, a BAE economist on the Green Book, spent much of his career on the issue of cost sharing (MMR *passim*). He suggested just this approach of allocating costs based on proportional benefits (Regan & Weitzell 1947, Regan 1958). The problem of recovering joint costs continued to be a vexing problem in water resources planning for many years, and other approaches have been proposed. Freeman & Norris (1988) considered pricing outputs above marginal costs, whereas Loehman & Whinston (1974) followed the axiomatic approach of Shapley. The problem continues to be an area of active research (e.g., Moulin 2002).

So increasing recreation benefits would reduce the net costs to be recovered. Through this serpentine syllogism, outdoor recreation benefits actually became an indirect subsidy to farmers—always popular in Washington. Congressmen, bureaucrats, and lobbyists understood this logic perfectly well.<sup>8</sup>

Each of these four factors can be illustrated with a single anecdote. In 1946, the USBR sent an “urgent request” to the NPS to expedite its recreation benefits estimates for Reclamation projects, and for a time the NPS complied. However, the NPS had difficulty finding a satisfactory approach, and the effort was using up too much staff time. Accordingly, the NPS’s director, Conrad Wirth, ordered his staff to stop estimating benefits and to simply invoke the expediency that benefits were equal to costs. In 1948, Michael Strauss, the commissioner of the USBR, sent a blistering memo to the Secretary of the Interior appealing this decision. As he pointed out, the expediency would dilute benefit-cost ratios, as a ratio of 1 was being averaged in. Moreover, if joint costs subsequently were allocated to recreation, the recreation benefit-cost ratio would be less than 1. Chastened, the NPS reversed itself: For the next several years, it assumed that benefits were equal to two times costs!<sup>9</sup>

Finally, and most importantly, recreation was becoming increasingly important for the management of federal lands, as participation skyrocketed following World War II. In a report conducted for the Bureau of Census, Marion Clawson (1958) estimated that recreation trips were increasing much faster than the population. **Figure 1** reproduces a figure from Clawson & Knetsch (1966, p. 44). It shows long-run annual growth rates of 8–10% for most types of recreational sites, with the wartime dip more than compensated for by postwar acceleration. National Park attendance was up approximately 50-fold from 1920 levels by 1955. The consequence of this increasing popularity of recreation was overcrowding, a strain on land managers, and a demand for more facilities (see also U.S. Senate 1957, pp. 11–12; Clawson 1959a; ORRRC 1961).

This “crisis in outdoor recreation,” as Clawson termed it, provoked a wide range of federal responses. In 1956, the NPS drew up its Mission 66 plan to improve facilities to meet anticipated 1966 demand, and the U.S. Forest Service followed. In 1958, Congress created the Outdoor Recreation Resources Review Commission (ORRRC), chaired by Laurance Rockefeller (ORRRC 1961). And in the 1964 Land and Water Conservation Act, Congress created a new source of funds for state and federal conservation acquisitions. Clawson & Knetsch (1966) summarized, “money is going to be invested in outdoor recreation—large amounts, by all indications” (p. vi).<sup>10</sup>

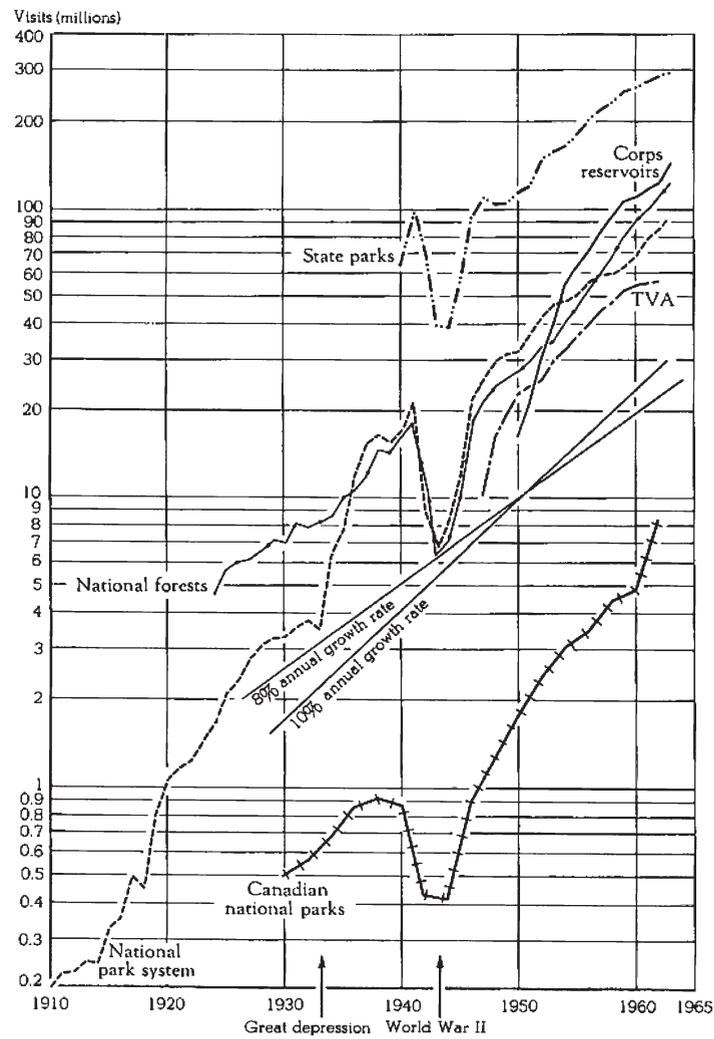
For all these reasons, in 1962 (after five years of debate), Congress actually required that recreation be considered in benefit-cost analyses for water projects. At the same time, it was increasingly obvious to economists that careful work would be needed to ensure that

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<sup>8</sup>Congressional hearings on a bill to require including recreation benefits bear this out. See, e.g., the line of questioning from Senator Francis Case of South Dakota (U.S. Senate 1957, pp. 18–19, 35–39, 104–5). The game could get quite devious. For example, in an obvious effort to improve his industry’s competitive position, the railway representative suggested that shipping should also pay user fees (U.S. Senate 1957, p. 103ff). [Historically, shipping was exempt from tolls (Ashton et al. 1976).]

<sup>9</sup>NPS Director Newton B. Drury to regional directors, June 28, 1946, and Commissioner Strauss to Secretary of the Interior Krug, November 1, 1948 (NA 79.99.2299), NPS “Method of Evaluating Recreational Benefits for Water-Control Projects” (NA 79.11.2227), Trice & Wood (1958, pp. 200–1).

<sup>10</sup>For more on this policy history, see Siehl (2008). A new Outdoor Resources Review Group is now continuing the tradition of the ORRC; see Walls et al. (2009) for its report.



**Figure 1**

Attendance at recreation facilities, 1910–1964 (Clawson & Knetsch 1966, p. 44)

resources were allocated efficiently. In other words, there was demand for and willingness to supply work on recreation.

### The Players

As professional economists first became involved in benefit-cost analysis, land and agricultural economists were most strategically placed to do the job. Importantly, they were by far the largest group of economists in government. By 1930, the BAE alone employed more social scientists than the rest of the federal government combined (Hawley 1990), and many additional agricultural economists were employed in the various agencies of the Department of the Interior.

Agricultural economists also had perhaps the longest tradition of planning in American economics, predating the New Deal.<sup>11</sup> Understanding the unique culture of agricultural economists and the role it allowed them to play is crucial for understanding the history of benefit-cost analysis. From the beginning, they viewed their purpose as service to the farmer and cooperated with extension agents to ensure their work reached their constituents. Moreover, as they swelled the ranks of the USDA in the 1910s and 1920s, they developed a culture of statist planning that was comfortable with the institutions involved, including interest group politics and the interactions between Congress, bureaucrats, and scientific experts.<sup>12</sup> In other words, unlike the neoclassical and Columbia-style institutional schools, they viewed themselves as being within a decision-making process, self-aware of their constituencies and the way their research was used in the policy process. As new planning paradigms from neoclassical economics began to dominate benefit-cost analysis in the 1960s, many agricultural economists would bemoan the loss of an appreciation for those institutions (e.g., Bromley et al. 1971).

In addition, agricultural economists had a long tradition of empirical work, with origins in agronomy and mid-nineteenth-century agricultural censuses. By the 1920s, these economists were leaders in estimating empirical demand relationships (Morgan 1990, Banzhaf 2006). Finally, they brought to both their empirical work and their planning perspective a viable synthesis of neoclassical and institutionalist paradigms (Banzhaf 2006, Rutherford 2009). In their descriptive work, they fully appreciated the institutional factors that guided the behavior of farmers and the markets in which they operated. As noted above, they also appreciated the institutional setting in which they themselves operated as planners. But in their prescriptive work, they recognized the power of marginal analysis and other neoclassical theories in producing efficient outcomes.

Although they were the first on the applied welfare scene, agricultural economists did not hold that position forever. By the late 1940s, a new school of economic planning was arriving, a school that emphasized the role of economics as constrained optimization and brought with it new methods of operations research (OR), linear programming, and game theory. Economists of this school could be found in such institutions as the Cowles Commission and the RAND Corporation. They recast Walrasian economics in terms of these new mathematical tools, so that the whole Walrasian economy could be viewed as a planning program in the sense of the market socialism of Oskar Lange and Abba Lerner. (See Mirowski 2002 for discussion.) Moreover, this paradigm was infused with welfare interpretations.

This school's most practical contributions to planning were developed at RAND. There, systems analysis and benefit-cost analysis were refined to help with military budgeting (Hitch & McKean 1960). Naturally, RAND's researchers found many parallels in their work to previous issues addressed in the appraisal of water projects. Not the least of these was the problem of nonmarket valuation of military outcomes, which at RAND was referred to as the "criterion problem."<sup>13</sup> Not surprisingly, then, some of RAND's earliest

<sup>11</sup>On this history, see Taylor & Taylor (1952), McDean (1983), Hawley (1990), and Banzhaf (2006).

<sup>12</sup>Hawley (1990) particularly emphasizes this theme, contrasting the statism of agricultural economists with the antistatist corporatism of the National Bureau of Economic Research. Hawley suggests that, in this respect, agricultural economists were unique in the federal government, but Stapleford (2009) has recently shown that a similar culture could be found among the social scientists in the Bureau of Labor Statistics during the same period.

<sup>13</sup>For example, in its first big application of systems analysis, RAND concluded that aerial bombing should be conducted with numerous inexpensive aircraft. But it reached this conclusion only because it failed to account for

nondefense projects were applications of benefit-cost analysis to water resource problems (De Haven & Hirshleifer 1957, McKean 1958, Hirshleifer et al. 1960).

But there were other water applications from this new school of OR as well. Particularly important was the Harvard Water Program, which began in earnest in 1956. At Harvard, Arthur Maass, a political scientist, and Maynard Hufschmidt, a professor of public administration, recruited an interdisciplinary team of social and physical scientists to study water resource problems (see Hufschmidt 1967 and Banzhaf 2009 for background). The economists included Otto Eckstein, Robert Dorfman, and Dorfman's student Stephen Marglin. The group's most famous output, *Design of Water-Resource Systems* (Maass et al. 1962), for example, used new methods of nonlinear and stochastic programming to model the planners' optimization problem.

Importantly for our story, these two broad schools of economics, representing an older and a newer approach to planning, interacted in many settings. In addition to encounters at RAND and the Harvard Water Program, Resources for the Future (RFF) was a particularly important place for such cross-fertilization. Established in 1952, RFF has been a leading think tank for studying natural resource and environmental policy (RFF 1977, Goodwin 1981, Banzhaf 2009). It hired leaders from the ranks of the agricultural economists with substantial experience in government planning agencies, such as Marion Clawson, whom we encounter in more detail below. But over the years it also had many links with RAND (Sam H. Schurr, Harold Barnett, and eventually even its president Charles Hitch) and the Harvard Water Program (especially Eckstein, who worked at RFF for a short time and whose student Jack Knetsch would later come to RFF). And behind it all, the Ford Foundation was the key source of funding for RFF and for RAND's nondefense work as well as a major source for the Harvard Water Program. As we shall see in this story, such interactions were crucial in shaping developments in applied welfare economics and, in particular, the actual estimation of consumer surplus measures.

### The Conceptual Legacy

Consumer surplus is of course an old concept, dating to the work of Marshall and Dupuit.<sup>14</sup> But already by the turn of the century, it was under attack for dubiously requiring a constant marginal utility of income and interpersonally comparable utility. By the end of his career, Marshall himself viewed it as a failure. (See Currie et al. 1971 and Ekelund & Hébert 1985 for overviews of this history.) Thus thoroughly discredited, consumer surplus was dead and almost forgotten as a welfare measure in the first third of the twentieth century, but it lived on in a weird zombie-like existence in the analysis of industrial

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the lives of the bomber crews. As a result of this failure, RAND received a dressing down from its Air Force patrons (Jardini 1996, pp. 52–63). The response at RAND was divided. The prevailing view was that modesty was the better part of wisdom and that future studies should avoid giving the impression that everything could be quantified and maximized by a computer. But others would press on in search for methods capable of quantifying these factors. Thus, at the same time that agricultural economists were thinking about the value of nonmarket goods like recreation, RAND economists were struggling with quantifying the value of life (Carlson 1963, Schelling 1968).

<sup>14</sup>There are suggestive parallels between this history and the nineteenth-century French engineering tradition, which was also a synthesis of engineering and economics for planning public works. (See Etner 1987 and Ekelund & Hébert 1999 for more on the French engineering tradition.) Yet Porter (1991, 1995) has emphasized important differences. In particular, because it did not arise in the context of open democratic policy debates, the earlier French tradition did not require standardization to bolster its credibility, whereas the drive to standardization plays a key role in the modern history described here. Indeed, Porter suggests that modern French public economics draws more on Anglo-American economics than on its own engineering tradition.

structure. Marshall himself discussed monopolies' pricing in terms of the consumer surplus they could extract, and later Cambridge economists from Pigou to Joan Robinson thought of it almost exclusively in those terms. In this way, consumer surplus, despite its name, was ironically becoming a *revenue* concept in the theory of the firm rather than an element of consumer theory. In America, midcentury texts either explained it in those terms (e.g., Boulding 1955), ignored it altogether (e.g., Stigler 1947), or treated it with contempt (e.g., Samuelson 1947, Little 1950). Others, although not disavowing the theory per se, felt it was so far from operational as to be virtually useless, at least for groups if not for individuals as well (Baumol 1952). Thus, in the judgment of a young Baumol, Pigou's "measuring rod of money...bends and stretches, and ultimately falls to pieces in our hands" [Baumol 1952 (1965), p. 164].

There were two prominent exceptions to this rule. In the United Kingdom, J.R. Hicks attempted to "rehabilitate" consumer surplus in ordinal terms while also accounting for income effects (Hicks 1941, 1943). But Hicks's proposals were all but ignored by applied workers for decades, probably for three reasons. First, it did not seem that compensated demand curves could be observed in the "real world" (e.g., Knight 1944). Second, as Hanemann (undated) has pointed out, the proliferating variants of Hicksian surplus must have made the exercise seem all the more absurd. Reflecting this cavalcade of historical interpretations, Morey (1984) has delightfully dubbed the concept "confuser surplus." Third, the distributional problem of aggregation remained (Little 1950, Baumol 1952).

The second exception, more important to this story, is Harold Hotelling. Hotelling had a tremendous influence on the development of modern economics generally, but there is opportunity here only to sketch his role roughly (for more, see Hands & Mirowski 1998, Mirowski & Hands 1998, Mirowski 2002). Through his work at Stanford's Food Research Institute and in his collaboration with Henry Schultz, Hotelling grounded his work in the applied problems of agricultural economists. For planning, he advocated consumer surplus as the benefit measure. He defended it from "open attacks," which he said were due to "an excessive emphasis on [its] shortcomings," with a model of ordinary demand that met the integrability conditions (Hotelling 1932; see Hands & Mirowski 1998 and Mirowski & Hands 1998 for discussion).<sup>15</sup> Moreover, as discussed in more detail below, for the specific issue of the economics of recreation, he proposed the method that would become one of the first applications of actually estimating consumer surplus. Finally, as a professor at Columbia, his indirect influence was substantial, training Kenneth Arrow, Dorfman, Milton Friedman, and other next-generation architects of neoclassical welfare economics.

But for the time being, Hotelling's suggestions, like Hicks's, were all but neglected. Instead, empirical work in welfare economics through the 1950s continued to ignore consumer surplus and took a much different track. For example, in its conceptual framework for benefit-cost analysis, the Green Book took as archetypical an "irrigation project which makes available a supply of water for agriculture. The farmer uses the water in conjunction with land, labor, and materials to produce wheat. The wheat, in turn, is transported to and processed through an elevator and a mill to produce flour which is utilized by a baker to make bread for sale to a consumer" (Inter-Agency Comm. 1950, p. 8). Using this example, the Green Book identified a taxonomy of benefits and costs. For benefits, it focused on the "primary benefits" of the savings to the farmer from a shift

<sup>15</sup>This model would continue to be used in the literature for many years. See, e.g. Maass et al. (1962), Burt & Brewer (1971), and Cicchetti et al. (1976).

down in his marginal costs of production. It generally assumed that the project would not affect output prices, but noted that if output prices adjusted to the supply increase, secondary benefits (downstream rents and Keynesian multiplier effects) might accrue downstream for the mill and the baker. It makes no mention of similar downstream benefits for the final end user who eats the bread. Thus, the Green Book's central concept of benefits was net income to productive factors, not consumer surplus. It was price times quantity: geometrically, a rectangle, not a triangle.

The popularity of net income as the criterion during this period can be attributed to several factors. First, the marginalist revolution had focused attention on marginal values, which of course could be identified with price. Price seeming more objective than preference, this move comfortingly put value theory on a more scientific footing (Winch 1972). Second, all the policy priorities during the first half of the century were most naturally income concepts rather than concepts related to the satisfaction of the consumer. Natural resources policies aimed to develop western resources, and agricultural policy was focused on its farming constituents. More broadly, Depression-era policies were of course focused on economic recovery, which gave way to the postwar focus on "growthmanship" (Collins 1990). Finally, and not coincidentally, the national income accounts were being developed over the same time period. Understanding these contextual differences is crucial for interpreting earlier authors, for often they used terms familiar to us today but with very different meanings. For example, "willingness to pay" often meant marginal value or marginal value times quantity, rather than the total value under the demand curve.

Although most economists involved with planning recognized a distinction between marginal value and total value (e.g., Clark 1936, Gray & Regan 1940, Price 1948), they believed that there was no measurable way to capture the distinction. Consequently, they had no choice but to use the tools at hand. As Regan & Weitzell (1947) put it, quoting J.M. Clark,

[N]o adequate guides are available for the quantitative expression of most social values. Until additional tools are developed, it will be necessary to use those that are available, even though it is recognized that some of these tools are not completely adaptable. As J.M. Clark so aptly states "... simple fiscal calculations must continue to be used, with the proviso that they need adjustment, but that radical adjustments should not be made unless sufficient cause is shown in the particular situation involved. Ordinary economic prudence should continue to take as its point of departure the calculation of whether the works concerned are worth the amount of money spent, in the usual fiscal terms." (p. 1289)<sup>16</sup>

In this spirit, income (or expenditure) provided a coherent, empirically tractable, and socially relevant concept for benefits.

## MEASURING THE INTANGIBLE: EARLY CONSIDERATION

But whether the abstract concept of benefits was income or consumer surplus, recreation benefits posed a particularly vexing problem: Prices are not observed. The NPS had been wrestling with this problem since at least 1941 in partnership with the National Resources

<sup>16</sup>The reference to J.M. Clark is to Clark (1935), p. 57.

Planning Board.<sup>17</sup> Attitudes to the problem ranged from a despairing refusal to quantify recreation benefits, to the cynical benefits-equal-two-times-cost approach noted above, to the optimistic search for the most justifiable method.

In 1947, A.E. Demaray, the associate director of the NPS, contacted ten economists and other analysts to elicit their opinions about the potential “to evaluate the benefits of the national parks to the national economy, to the states and to local communities” (U.S. NPS 1949). For the most part, the economists discouraged attempts to quantify such intangible services. Edgar M. Hoover, then at the University of Michigan, was particularly explicit. He concluded, “I don’t think the overall utility or justification of the park system can be measured at all in statistical terms, and it would be dangerous to try to argue the issue in dollars and cents.” Elaborating the point, he explained his reasoning as follows.

The park system may justify its existence in two ways:

1. By increasing the productive efficiency of those who find recreation in the parks, and thus indirectly increasing national income in the form of other products.
2. By providing more or better recreation per dollar spent than alternative forms would. This involves no change in national money income or expenditure, but means we get more fun out of the money we earn and spend.

It seems evident to me that neither of the above types of ultimate gain is measurable. (U.S. NPS 1949)<sup>18</sup>

However, Hoover conceded that it might be feasible to evaluate the “more restricted question” of local economic impacts.

Reviewing this correspondence and consulting with other federal agencies, NPS economist Roy Prewitt thoroughly studied whether it would be feasible to measure recreation benefits. He concluded that it would not be:

Recreation is, first of all, an intangible—a service. It is not a standardized or homogeneous service; it varies with every individual and it cannot be considered separate and apart from the individual. It is of the mind and body, it cannot be stored or transported, it is a psychic value and it cannot be measured in objective terms. Finally, the recreational values supplied by the National Park Service are not sold for a price under marketplace rules. (U.S. NPS 1949, p. 12)

Prewitt identified two obstacles. First, recreation benefits are intangible and personal. They cannot be measured scientifically by an outside observer. Second, conceding that, in fact, the ultimate benefits of many economic goods—a radio, for example— are psychic and personal, he noted that, unlike such goods, parks are not priced. Although an economist

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<sup>17</sup>See the memo, “A Study of a Method for Evaluating Recreation Where Recreation is a Collateral Use,” February 15, 1941 (RCP 91).

<sup>18</sup>Proposals to model the benefit of parks on the supply side of the economy, by viewing them as investments in human capital that enhanced labor productivity, were frequent during the period but appear never to have been followed up.

can observe the price of radios and infer that people are willing to pay that price, he cannot do so for recreation trips.

It seems that, although neither obstacle would be decisive alone, in combination they were. On the one hand, regardless of the nature of the service, a market price would reveal its value. On the other hand, even when unpriced, a very tangible service such as a cost savings could be measured indirectly. Recreation benefits satisfied neither criterion. Prewitt concluded that “it might be better to forget the words ‘economic value of recreation’ and focus attention on the expenditures induced by recreation. . . . It is in this area that an objective approach can be made. . . .” (U.S. NPS 1949, p. 19, emphasis in original). He thus proposed Hoover’s less ambitious suggestion, although he extended it to include not just local effects but the forecasted effects on net national income, on the basis of on the net incomes received per dollar of expenditures in various measurable categories (travel, food, lodging, etc.) (U.S. NPS 1949, pp. 19–21).

Of the economists initially consulted by the NPS, one dissenter held out hope for measurement of recreation benefits: Harold Hotelling. He was all but ignored by Prewitt, with the exception of a brief remark, almost as one remarks upon a curiosity, that “he would use the consumer surplus approach, based on travel costs, from which he would derive a demand curve for park services” (U.S. NPS 1949, p. 9). Yet it was Hotelling’s basic suggestion that would become the basis for later work.

Despite having been inactive in economics for many years, Hotelling was stimulated by the problem and, in his letter, hearkened back to his “long-term interest” in evaluating public benefits. Hotelling suggested that concentric zones of approximately equal travel times to the park be drawn around it. Then, the trips to the park from each distance would be tallied and interpreted as a point on a demand curve with prices determined by travel distance.

If we assume that the benefits are the same no matter what the distance, we have, for those living near the park, a consumers’ surplus consisting of the differences in transportation costs. The comparison of the cost of coming from a zone with the number of people who do come from it, together with a count of the population of the zone, enables us to plot one point for each zone on a demand curve for the service of the park. By a judicious process of fitting it should be possible to get a good enough approximation of this demand curve to provide, through integration, a measure of the consumers’ surplus resulting from the availability of the park. It is this consumers surplus (calculated by the above process with deduction for the cost of operating the park) which measures the benefits to the public in the particular year. (U.S. NPS 1949)

Hotelling went on to suggest that one could also estimate a set of demand functions accounting for the relations between different parks, continuing to use consumer surplus.

For all the well-deserved credit now accorded to Hotelling in standard histories of nonmarket valuation, Hotelling’s suggestion was actually quite vague. Many of the steps in the logic of the now-standard model are missing. Is the operational quantity gross trips from each zone or trips per capita? Is the integration over travel costs or park fees, and what would be the respective limits of integration? Whether for its lack of clarity or his awkward insistence on consumer surplus or some other reason, the NPS all but forgot Hotelling’s suggestion.

At this juncture, the NPS was hemmed in. Its own economists were unable to find a way to estimate benefits. Its outside experts were discouraging (or, in Hotelling’s case, at best

vague and unpersuasive). Its sister agencies in the DOI refused to allow them to give up. And the interagency Green Book economists, safeguarding the integrity of benefit-cost analysis, disallowed their cynical ploy to arbitrarily set benefits at two times costs. Seeing no other alternative, the NPS would soon begin gathering data on expenditures. It also gathered data on entrance costs at parks and private recreation facilities, which might be considered substitutes for national parks, that is, which might provide a proxy for prices that would or could be charged at national parks. Using this approach, the NPS estimated a price of \$1.41 for a visit, which it interpreted as a lower bound to value, as the proxies were of lower quality. In 1957, the NPS officially began using this so-called unit-day approach. Nevertheless, Doris Carlton (later Doris Knapp), the NPS economist supervising the project, felt that “no matter what method you use. . . , you are bound to come up with arbitrary figures.” Accordingly, she supported a bill in Congress that would value trips at \$1 per visitor day on the basis that it would be a fair lower bound and highlight the arbitrary nature of the calculation (U.S. Senate 1957, pp. 119–22).<sup>19</sup>

## THE TRAVEL COST MODEL

Meanwhile, however, other economists did take up Hotelling’s idea based on travel costs. The State of California commissioned a benefit-cost study of potential reservoir projects in the Feather River basin (State of California 1957). The study was conducted by Samuel Wood and his consulting firm Pacific Planning and Research, together with Andrew Trice, an assistant professor at Sacramento State University. Wood was a land economist who earned his MA from Berkeley in 1933, and Trice received his PhD in economics from Berkeley in 1955.

Trice & Wood were the first to implement Hotelling’s travel cost suggestion, publishing their study in *Land Economics* entitled “Measurement of Recreation Benefits” (Trice & Wood 1958). Using data collected by the California Department of Water Resources, they traced out a distance-decay function, giving the number of trips taken by people from a given distance. Using an estimated cost of 6.5 cents per mile traveled, they then changed the scale of this function from miles to dollars, calling it the demand curve for trips to the site. The demand curves for three related sites are reproduced as **Figure 2**.

Using this demand curve, Trice & Wood (1958) measured the value of the park. But their concept of value is somewhat curious. They invoke a measure that they describe as “involving” a consumer surplus concept. Discussing consumer surplus in relation to the perfectly discriminating monopolist, they comment that “the problem is to find a method for determining what a monopolist would charge if he were a mind reader as well as a monopolist” (Trice & Wood 1958, p. 198). Such wry comments suggest some ambivalence about consumer surplus as a measure of welfare, as well as the continued interpretation of consumer surplus as revenue.

In any case, Trice & Wood (1958) actually defined their benefit measure as the difference between the 90th percentile of their demand curve and the median price actually paid. The concept is illustrated in **Figure 2** together with their estimate of approximately \$2.00 per trip. Although they refer to this measure as a consumer surplus, clearly it is not the area under the

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<sup>19</sup>A compromise was enshrined in the implementation of Senate Document 97, adopted by President Kennedy and federal agencies in 1962, which allowed discretion for types of recreation activities within the range of unit-day values of \$0.50 to \$1.50 for common activities and \$2 to \$6 for very specialized activities like big game hunting (Inter-Agency Comm. 1960; see also White 1965).

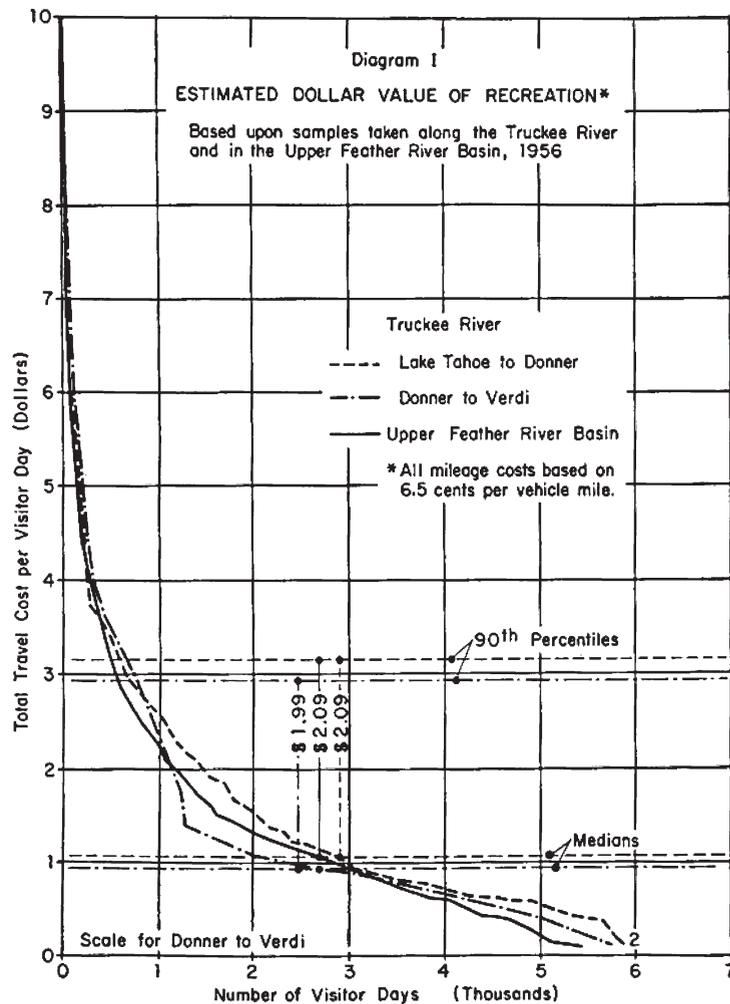


Figure 2

Demand curve and illustration of surplus measure (Trice & Wood 1958, p. 205)

demand curve. Their confusion seems to have stemmed from Hotelling's suggestion that everybody has the same tastes. Today, we interpret this as meaning that at each point geographically the distribution of demand functions is the same. Trice & Wood interpreted Hotelling's suggestion as meaning that every individual has the same willingness to pay. They then took the neighborhood of the choke price to be that homogeneous value.<sup>20</sup>

<sup>20</sup>More precisely, they used the price that would choke off 90% of demand, which they call the bulk-line value. This concept appears to be analogous to Taussig's (1919) concept of the bulk-line price, or the price that would bring forth the bulk (say, 90%) of the supply of a commodity. The concept was used in the economics of rationing. Be that as it may, the procedure remains a very curious way to identify surplus. If demand were binary, everybody in the market closer than the bulk-line distance would make trips. In that case, their benefit measure would be consistent with consumer surplus, but demand would not slope downward. If demand were not binary, it might slope downward, but it would not make sense to measure only the value of the first trip (i.e., to use something in the neighborhood of the choke price).

In fact, Trice & Wood's (1958) article was not well received. In the following issue of *Land Economics*, Lawrence Hines, a well-known public economist at Dartmouth, criticized Trice & Wood for looking at the price of travel, which is an ancillary expenditure only indirectly related to the park (Hines 1958). The only true measure would be a market price of the park. Drawing an analogy to the theater, he suggested that the cost of transportation to the theater and other ancillary expenses "may be relevant to evaluation but these data are no substitute for knowledge of the price of the theater tickets" (Hines 1958, p. 366). In addition, Hines pointed out that the assumption of identical preferences was "total[ly] unrealistic." Finally, he argued that the whole idea of consumer's surplus, although "beguiling," has serious problems, including the assumption of constant marginal utility of income (p. 367).

In the next attempt to measure recreation benefits, Marion Clawson would reinterpret the recreation demand curve, addressing many of these criticisms. Yet Clawson himself at first had no more interest in consumer surplus as a concept of value than had his predecessors.

### Marion Clawson

Marion Clawson (1905–1998) was an agricultural economist and lifetime scholar of public lands, publishing some 36 books. He grew up on small mines and ranches, raised by parents who had not attended high school.<sup>21</sup> He earned his bachelor's degree from the University of Nevada, taking mostly practical agricultural courses, with a little calculus and economics. He then worked at the BAE for 18 years, winning the patronage of Mordecai Ezekiel. In the meantime, using one year of leave and spare time over six years, he earned his PhD in economics from Harvard, studying under the agricultural economist John D. Black. In 1947, Clawson went to Washington to take the job of Director of the Bureau of Land Management (BLM). After Eisenhower's election, he took a position at the newly formed RFF, where he published most of his work and spent the rest of his professional career. Although fundamentally a marginalist, Clawson reflected the pluralism of American economics in the 1920s and 1930s, with interests covering wide ground, from the psychology of preference formation to the historical evolution of social institutions. First coming to government work in the New Deal years, Clawson was also a strong believer in planning.<sup>22</sup>

As noted above, one of Clawson's chief concerns was the rapid growth in recreation demand and consequent overcrowding. He was adamant that more recreational sites were needed and that careful planning was required to do it rightly. But it may come as a surprise to some readers of this article that benefit-cost analysis was not necessarily a part of those plans. Earlier, while advocating a kind of qualitative analysis, Clawson had argued that it was "practically impossible to measure the monetary value of recreation" quantitatively (Clawson 1951, p. 172). One can infer that people are willing to pay at least the expenditures they make in executing a trip, but that does not speak to their actual value:

<sup>21</sup>These and other details are from his autobiography (Clawson 1987).

<sup>22</sup>In his *Uncle Sam's Acres*, for example, written while he was Director of the BLM to explain the history of public lands, he breezily commented that all future water development should be done by the federal government (Clawson 1951, p. 326–32). Much later, he would write a (qualified) panegyric to the National Resources Planning Board, suggesting its resurrection (Clawson 1981). In Balisciano's (1998) taxonomy, Clawson was a technical-industrial planner.

Many of the benefits of resource development and land management programs produce benefits which are not monetary in character. . . . It is impossible to compare the comparative advantage of game with that of domestic livestock, because they do not produce the same kind of benefit. Likewise, the advantages of superlative scenery cannot be directly compared with the advantages of a given amount of hydro-electric power, because the advantages are in different coin. Comparisons can be made, of course, and must be made; but the items compared are different, and no nice balance between them is possible. (Clawson 1951, p. 336)

In other words, recreation and its various opportunity costs cannot be compared in dollars.

Later, Clawson modified this position, believing recreation resources could be priced, yet benefit-cost tests were never his chief interest. Rather, his priorities were to plan the locations and attributes of recreation facilities to meet demand (Clawson 1959b, Clawson & Knetsch 1963). Obtaining the data to set entry fees intelligently was also a strong concern, both to raise much-needed funds and to manage congestion (Clawson 1959a,b; Clawson & Knetsch 1963).

Clawson's first attempt to estimate recreation demand, although widely cited at the time and to this day, circulated only as an RFF discussion paper (Clawson 1959b). Entitled "Methods of Measuring the Demand for and Value of Outdoor Recreation," it was a paper delivered to the Taylor-Hibbard club, a student organization at the University of Wisconsin. In this work, after quickly dispensing with expenditures or value added as a measure of benefits, Clawson turned to the method of Trice & Wood (1958) as his point of departure.<sup>23</sup>

In that paper, Clawson made two important adaptations to Trice & Wood's (1958) approach. First, he assumed that *groups* of people, at each location, have the same *distribution* of demand relationships. In contrast, Trice and Wood had implicitly made the stronger assumption that each *individual* has the same demand relationship. Second, Clawson distinguished two different demand concepts, the demand for "the total recreation experience" (which he thought Trice & Wood valued) and the demand for "the recreation opportunity per se." The total recreation experience includes transportation, lodging, etc., and its price is the travel cost. Moving upward along the demand curve from a given point represents the effect on trips of an increase in costs, for people coming from that particular distance. However, Clawson wanted the demand for the recreation opportunity per se. To derive this demand curve, he simulated the effect of charging entrance fees to the site. Depending on the local elasticities of demand for the total experience, the relative drop-off in trips would be different from different points of origin.

In many respects, Clawson's vision of travel cost demand models remains in force today. But his concept of benefits does not. Like Trice and Wood, Clawson struggled with the embarrassment of riches—or was it the poverty?—associated with having the entire demand curve instead of a single prevailing market price. For many, a market price was more informative than the entire demand curve. That may seem paradoxical, as a price is

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<sup>23</sup>It is not clear to what extent Clawson was familiar with Hotelling's original suggestion. It is mentioned in Trice & Wood's (1958) paper, and Clawson cites, in a general way, the Prewitt report in which it appeared, but he never directly mentions it. Knetsch (personal telephone conversation, May 15, 2003) recalls that he had the impression Clawson had never seen it.

only one point off the demand curve. But a demand curve represents many possible marginal values, raising the question of what to do with it once one estimates it. A market price narrows the problem by providing the most salient marginal value.

Clawson's concept of benefits was inextricably linked to actual prices. On the one hand, "the value of recreation would provide a ceiling to any fees that might be charged for its use" (Clawson 1959b, p. 2). On the other hand, the revenues that can be collected represent people's value. To find this value, he computed the revenue-maximizing nondiscriminatory price based on the demand curve—that is, the largest possible rectangle. Although conceding that one would never actually want to charge the revenue-maximizing price, the difference between it and the revenue at a lower price can be considered a socially desirable transfer (Clawson 1959b, pp. 29, 35).

Considering consumer surplus as an alternative candidate, Clawson (1959b) observed, as was then commonplace, that it is equivalent to the revenue charged by a discriminatory monopolist. And like Trice & Wood (1958), he suggested that such a monopolist would have to really exist for consumer surplus to have any real meaning. Wrote Clawson,

Under a scheme of discriminatory pricing, a monopolist might somehow manage to separate his potential customers or market into groups or segments, and to exploit each to the limit of its willingness to pay. . . . To the extent that anything like this is possible, the monopolist would reap for himself the consumer surplus. In practice, pricing of this sort would probably but not always be illegal; perhaps more important, it would be extremely difficult if not impossible to separate the total market so neatly in segments from each other of which a different price could be extracted. (Clawson 1959b, pp. 30-31)

And after some detailed examples, he continued with the following:

In general, consumer's surplus is equal to monopolist's possible gain; to the extent the latter is realized, it reduces consumer surplus. In practice, it is hard to see how consumer's surplus can be captured, by either public or private provider of recreation.

In fact, the usefulness of estimating consumer's surplus is questionable in any situation. Under almost any circumstances some users of outdoor recreation will gain more from it than they would have been willing to pay if necessary. This may be taken for granted; but how can you capture it, would public policy permit you to try, and what is to be gained from estimating its amount? (Clawson 1959b, p. 31)

In other words, the logic was that (a) consumer surplus is the revenue captured by a perfectly discriminating monopolist, (b) there is no perfectly discriminating monopolist, and (c) therefore consumer surplus is an irrelevant concept. Instead, a single price consistent with the institutions and the level of output is needed. It is a logic repeated by numerous other contemporary resource economists [e.g., Rendel Allredge;<sup>24</sup> Bromley, Schmid, and Lord (Bromley et al. 1971); Brown, Singh, and Castle (Brown et al. 1962);

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<sup>24</sup>"Review of Clawson/Knetsch," April 30, 1965 (NA 79.11.1597); memo to NPS Director, May 26, 1953 (NA 79.11.2227).

Crutchfield 1962; Eckstein 1958; Howard Ellis in U.S. NPS 1949; Irving Fox 1950;<sup>25</sup> William Lord;<sup>26</sup> Neil Newton;<sup>27</sup> and Richard Tybout 1969<sup>28</sup>].

Put another way, by this interpretation consumer surplus is another revenue, rather than a true surplus measure. When viewed in these terms, the single-price monopoly revenue just seemed more realistic than consumer surplus. This logic seems surprising at first but becomes more intelligible when we understand Clawson and the context he operated in. The interwar period during which Clawson and other experienced scholars developed intellectually was a time of pluralism in American economics, with the institutionalist and neoclassical schools both thriving and intermingling (Morgan & Rutherford 1998). If there was one lesson to be learned from the institutional school, it was the importance of thinking in terms of historically relevant real-world institutions, rather than in abstract constructs (Rutherford 2000, 2001). If there was one lesson to be learned from the neo-classical school, it was the importance of thinking at the margin. After all, the neoclassical school's greatest achievement was to reconcile value theory and price theory by focusing on marginal value. Finally, there was the long neglect (or contempt) of consumer surplus in value theory and the fact that consumer surplus was invoked most often in studies of industrial structure. For all these reasons, it was quite natural for economists in the period to think of value in terms of the revenue that could realistically be obtained by a real-world firm.

## MEASURING SURPLUS

Other than Hotelling, the first economists who introduced consumer surplus into benefit-cost analysis of water resources projects were all next-generation scholars trained in postwar operations research. The suggestions appeared in five books over a five-year period, all linked to RFF, the Harvard Water Program, or RAND. The first three (Eckstein 1958, Krutilla & Eckstein 1958, and McKean 1958) appeared in one year. Even then, the suggestions were tentative. All three argued that for most assessments, marginal values would be sufficient because projects would be small relative to the market. However, as an aside, they conceded that sometimes large projects might affect output prices. In this case, the quantity of output could be valued at an average of the prices before and after the project (Eckstein 1958, p. 37; Krutilla & Eckstein 1958, p. 74). Note there is a certain ambiguity here. Using the average price does give consumer surplus for a linear demand curve, but this technique could also be viewed as simply splitting the difference between two index numbers.<sup>29</sup> Moreover, as if embarrassed by its history, none of the authors use the term “consumer surplus,” and McKean (1958) in particular implies that he is building on new ideas from Hotelling and Lerner.

Two additional books appeared in the next four years, each more explicit than the previous. Hirshleifer et al. (1960) advocated consumer surplus by name for large changes. Most explicitly, Marglin and Dorfman built the maximization of ordinary consumer

<sup>25</sup>Memo, December 18, 1950 (NA 79.11.2227).

<sup>26</sup>Testimony presented to the Water Resources Council Hearings, September 5, 1969 (NA 315.24.3).

<sup>27</sup>Memo to Assistant Director, Cooperative Activities, April 16, 1965 (NA 79.11.1597).

<sup>28</sup>Testimony presented to the Water Resources Council Hearings, September 5, 1969 (NA 315.24.3).

<sup>29</sup>Like the other resource economists discussed above, Eckstein too emphasized the single price that would hypothetically prevail if recreational sites were private (Eckstein 1958, p. 41).

surplus into the planner's programs [Maass et al. 1962; see also Marglin 1967 and Dasgupta, Marglin, and Sen (Dasgupta et al. 1972)]. But none of these economists actually followed through to produce such estimates.<sup>30</sup> Moreover, in the case of recreation and other nonmarket values, Eckstein, Marglin, and Dorfman were highly skeptical that economists could ever simulate markets for such goods, preferring to leave the judgments to the political process (Banzhaf 2009).<sup>31</sup>

However, their students would unite the new (or resurrected) value theories with the new travel cost model and become among the first to estimate consumer-surplus measures. The most important of these is Jack Knetsch.<sup>32</sup> Knetsch began his education in agriculture and then moved on to agricultural economics, earning his MA from Michigan State University in 1956. He earned his PhD in economics from Harvard in 1963, working with Eckstein and Dorfman. Before finishing his dissertation, he began working at the Tennessee Valley Authority, where, in his words, they were looking for new classes of benefits to augment the totals (J. Knetsch, personal phone conversation, May 15, 2003).

In 1962, Knetsch went to RFF to work with Clawson on the economics of recreation, bringing to the partnership a perspective from the newer schools of welfare economics. Knetsch (1963, 1964) suggested using consumer surplus as the operational welfare criterion, in explicit contrast to Clawson's choice of maximum (single-price) revenue. "Although the actual collection of fees is an important matter and one on which such studies as we are suggesting can provide useful information," he said, such revenues are "a separate matter" (Knetsch 1963, p. 392).<sup>33</sup>

Together, Clawson & Knetsch produced the 1966 magnum opus *Economics of Outdoor Recreation*, the pinnacle of this line of literature. Not only was it the Bible of recreation economics, it brought together the best of the various twentieth-century schools of economics, with the careful attention to social and historical context of the institutional school, the meticulous attention to data and statistics of agricultural economics, and the consumer theory of neoclassical economics. And in its empirical estimates of the value of a recreation site, it was among the first studies in all of economics to estimate consumer surplus.<sup>34</sup>

<sup>30</sup>A student of Hirshleifer's at the University of Chicago during this period did estimate the demand for water associated with one project and computed the area under it, again with no discussion (Dawson 1957).

<sup>31</sup>Dorfman appears to have been more open to the question in the early 1960s, supervising a thesis (Merewitz 1966) and organizing a conference (Dorfman 1965) on the subject, but by the close of the decade he had clearly made up his mind against such efforts.

<sup>32</sup>Another is Robert Davis. Davis took a very different approach to the problem, pioneering the use of surveys to measure recreation values (Davis 1963, Knetsch & Davis 1966). (See Hanemann 1992 and Mitchell & Carson 1989 for historical background on this approach.) A third student is Leonard Merewitz. He actually took up the travel cost approach in a 1964 undergraduate honors thesis written under Dorfman (Merewitz 1966). Merewitz went on to earn his PhD from Berkeley and continued to work in the area (see, e.g., Merewitz 1968).

<sup>33</sup>See also Davis (1963) and Wennergren (1964).

<sup>34</sup>But certainly not the only. Another important line of applied literature is the economics of transportation policy (Mohring & Harwitz 1962). As noted above, related developments were occurring at the University of Chicago. Arnold Harberger's work is the most important here (Harberger 1954; 1959a,b), but also important is Marc Nerlove's (1959). See also Dawson (1957). For more on this Chicago school of welfare economics, see Banzhaf (2010). Finally, outside of benefit-cost analysis, related developments were transpiring in the theory of cost-of-living indices. During the same decades, wrestling with the practical problem of quality change in goods, applied labor economists began to adopt a utility-based approach to indexes over the fixed-basket approach, a story with many parallels to this one (see Banzhaf 2001, 2004; Stapleford 2009).

## CONCLUSIONS

Use of benefit-cost analysis in government planning increased after the Flood Control Act of 1936 and only continued to do so through the 1950s as the growing demand for outdoor recreation added to the types of government projects requiring analysis and to the classes of benefits for such analyses. Meeting the demand for such benefit-cost analyses, agricultural economists like Trice, Wood, and Clawson found creative ways to monetize intangible benefits but were confused or ambivalent when it came to specifying precisely just what benefits were.

As these economists searched for answers to these questions, they did not find them easily. Concepts such as consumer surplus, its historical pedigree notwithstanding, simply did not appear to them to be ready to be taken off the shelf. Moreover, such concepts were not smoothly passed forward, as disembodied ideas, from Dupuit to Marshall to Hicks and Hotelling. They had to be interpreted within human communities of economists speaking the same language, and confusion resulted when they were not in fact speaking the same language. The opportunity for confusion was all the greater for a concept such as consumer surplus, with shifting meanings over time (Weintraub 1991). Thus, in the benefit-cost community, these ideas had to be learned in the trenches and reinterpreted—almost reinvented—before they could take on meaning in applied work. Or to put it in other terms, economists' knowledge of welfare economics was and is as much *techné* as *epistémé*. In this way, through the practice of their craft, environmental economists shaped the larger discipline as much as they were shaped by the received theory.

At the same time, this work did not happen solely in academic circles. It happened by negotiating solutions that would be acceptable to academic peers, bureaucrats, and interest groups. Through benefit-cost analysis, economics provided a way to mediate disputes among interests, but this in turn created an incentive on the part of interest groups to alter the terms of the analysis to make it more favorable (for them). For farmers interested in lower user fees for water and for anyone interested in higher benefit-cost ratios for projects, including recreation was one way to do this, and such interest groups ultimately forced recreation to be valued. The ball was then passed back to the economists. In this sense, environmental economics has been shaped by the state as much as it has helped appraise it (e.g., Furner & Supple 1990).

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