Wilderness Use Projection:

The State of Available Techniques

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by

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Abstract

With increased use of outdoor recreation facilities and wilderness areas during the past three decades, the need for reliable methods of predicting use and demand for existing and proposed sites has become more pressing. Techniques for projection exist in several forms, but many of them have serious drawbacks, and their application, without modification, to wilderness could produce misleading results. Although techniques in existence for predicting use and demand for other outdoor recreation facilities have not been applied widely to wilderness, they may form a basis for better ways of projecting use and demand for existing and proposed wilderness areas.

Introduction

During the past three decades, outdoor recreation use has increased rapidly. This increase has led to overcrowding of specific sites, and in some instances, to adverse impacts on recreation sites as well as on other important uses of forests and rangelands. Wilderness recreation has shown an even greater increase than other forms of outdoor recreation with roughly a 15-fold increase since World War II (Forest Service, 1977). Future increases in population, available leisure time, disposable income, and mobility will almost certainly contribute to increased use of and demand for outdoor recreation facilities although the increases may not be as large as in years past.

With this increased use and demand, and with visitors indicating distaste for congested areas (Cicchetti, 1973), it is evident that there is a need for a sound method for determining future use of and demand for recreation resources ~~at future dates~~. This is particularly true of wilderness areas. If steps are not taken soon to supply adequate wilderness areas for the future, areas which presently qualify for inclusion in the wilderness system may undergo changes which prevent their inclusion later. Conversely, inclusion of too many areas either in total, or within specific regions would mean vast amounts of land removed from uses which might be more productive if these areas are not needed for wilderness in the future.

Several techniques are available for projecting use or demand for

outdoor recreation, but many have serious shortcomings, and they have not been widely used in attempts to project demand for wilderness. Depending on the situation, any one of the following can cause misleading results: failure to clearly specify the intended use for the projection technique, failure to distinguish between use of a site and economic demand for the site, and failure to account for substitute activities which may be available. Other lesser problems exist which will be discussed in the course of this report.

Visitor Use or Economic Demand

There is a tendency for researchers and laymen alike to apply the words "use" and "demand", when talking about outdoor recreation sites, as if the two were synonymous (Burdge and Hendee, 1972). The two are generally not interchangeable, and this has led to confusion on the part of laymen and misinformed statements on the part of researchers and land managers. Outdoor recreation "use" is the measured number of visits or number of visitor days to a specific site. It is, thus, the consumption under a particular set of circumstances. On the other hand, "demand" in the economic sense is "a conditional statement of the participation that would result at a given time and in a given place under a specific set of conditions and assumptions about an individual and his/her social relationships and the availability of recreation resources" (National Academy of Sciences, 1975). It is then a relationship between quantities that would be consumed at varying prices. Thus, for any given price

there would be an amount demanded. To illustrate the difference between use and demand, take a hypothetical case of an area which has no lakes large enough for waterskiing. Use of existing lakes for waterskiing is, therefore, zero because of size limitations. There may be, however, a significant number of people in the area who would waterski if the opportunity were provided through a large enough lake. The amount of waterskiing done would vary depending upon the price at which the opportunity was provided. This relationship between amount of waterskiing done and price of opportunity would be the demand. Once a lake was provided, a price for the opportunity would be known, and a certain amount of waterskiing would be demanded. Thus, "use" is a measure of consumption and is not a measure of demand. Further "use" can be construed as an amount demanded at a given price only if supply does not limit consumption. The assumption that supply does not limit consumption of outdoor recreation may not be valid in many cases.

Depending on the information needs of land planners and managers, use projection may provide valid information for the planning process. Certainly if the manager's aim is to supply adequate facilities at a particular recreation site, and the planning horizons are short, use projection will supply useful information. One must keep in mind, however, that as plans are extended further into the future, the possibility of changes in user preferences, supply of similar recreation sites, or supply of substitute activities will cause projected use figures to become less meaningful. "Improper accounting of supply considerations

leads, for instance, to the assumption that people demand only increasing quantities of what they now have, thereby perpetuating present imbalances" (Knetsch, 1969).

Similar problems can arise when attempting to develop demand curves based on time series data. If allowances are not made for shifts in supply and demand curves over time, time series data may not yield the expected demand curve (Working, 1927).

If the aim is to make long range plans for a specific site, or to determine an optimum number, type, and location of sites, then projection techniques which incorporate concepts of supply and substitution must be used.

The Problem of Substitutes

While overlooking the aspect of supply can lead to serious errors, it may be true that overlooking substitute sites and activities is equally serious. "The substitutability concept refers to the interchangeability of recreation activities in satisfying participants' motives, needs, and preferences" (Hendee and Burdge, 1974). Substitutability is a two-edged sword, however. If there are effective substitutes for wilderness type recreation, failure to account for them will almost certainly lead to projected demand in excess of actual demand. Alternatively, if there are no substitutes for wilderness recreation, this should be made apparent to prevent policies which "...would completely disfranchise habitual users and unique values, creating a far more serious impact than if substitutes are available" (Hendee and Burdge, 1974).

Techniques Presently Available

With these problems in mind, it is possible to review existing techniques for projection with the idea that they may form a basis for a useful projection system for wilderness use.

Projection techniques center on three basic data sources as identified by Cicchetti (1973). The three are, population-specific, site-specific user oriented, and site-specific area oriented. Information generated by population-specific studies can be used to forecast expected use levels by activity for a region using data from household surveys. While the ability to forecast for a region is highly desireable for the wilderness problem, techniques project use rather than demand, and currently available population-specific data may be one of the weakest data sources since it includes such activities as hiking and camping with no indication whether they occur in wilderness areas.

Site-specific user oriented techniques rely on on-site interviews to forecast use at a specific site and may yield necessary information for efficient management of the site (Hendee et al., 1968). Without modification, this technique will not provide information useful in evaluating proposed sites.

Through counts of users, site-specific area oriented techniques are useful for evaluation of short-run benefits provided by a site, but the technique is not readily adaptable to wilderness use projection problems in the long range planning process.

A review of specific techniques available in each of these categories will illustrate their strong points and shortcomings.

Population-Specific Techniques

Perhaps the most widely known population-specific technique is that used by the Outdoor Recreation Resources Review Commission (ORRRC) in 1962 to make projections for 17 outdoor recreation activities for the years 1976 and 2000. Data for the study came from a sample of persons 12 years of age and older (ORRRC, 1962). While the study purports to project demand for the activities listed, what is actually being projected is number of visits, and thus use, not demand, is actually being projected.

As with many techniques in use, socioeconomic factors are used in an attempt to find a relation between number of visits and a set of socioeconomic variables in hopes that the relationship will continue unchanged at least through the projection period. The ORRRC study regressed visits on various combinations of family income, education, employment, place of residence, sex, and age. This approach produced coefficients of determination from 0.95 to 0.99, results which would make the approach extremely useful for projection of use three to five years into the future.

Two factors make more distant projections questionable. First, in order to make a use projection, one must project the levels of socioeconomic variables to the future. Consequently, errors in projection of socioeconomic variables will certainly result in errors in projected use. Unfortunately, this is a shortcoming of all such techniques and the only remedy appears to lie in improvement of projection techniques for the socioeconomic variables. The second problem lies in the assumption that the relationship between use and the independent variables will remain

constant over long periods of time. There are at least two reasons to believe this is not so. Use levels at a particular site may change due to major improvements, new developments, different activity patterns, or changes in user preferences (Campbell, 1976). Such changes may take place in as little as three to five years, and since these variables are not included in the model, it is not capable of discerning such changes. A second factor responsible for changes in use relationships is that of supply. As shifts in the supply of recreation areas occur, it is not unreasonable to assume that people who previously showed little or no inclination toward outdoor recreation may begin to participate. Since the ORRRC model contains no supply variables, such changes will go undetected unless the model is "recalibrated" every few years and projections are limited to time spans of perhaps five years or less.

A second study of this nature was carried out for the state of Iowa in 1973 (Manning et al., 1973). Like the ORRRC study, a sample of Iowa residents 12 years of age and over was taken. Twelve independent variables were used to predict participation levels for 24 activities for the years 1976 and 1980. The only major difference between this study and the ORRRC study is that age squared and income squared were used to determing whether use was related in a nonlinear fashion to changes in age and education. The technique for making predictions was the same as for the ORRRC study and again, no substitute or supply variables were used. The one advantage is that the projections were made for a shorter period than the ORRRC study which probably reduced the seriousness of error due to changing relationships between variables.

To remedy some of the difficulties in previous studies, Cicchetti (1973) has developed a method for forecasting participation in certain recreation activities which incorporates, to some extent, supply and substitute variables, and a method for deflating estimates where congestion occurs on the site. In addition to these improvements, Cicchetti also uses a two-step approach to estimate total days of participation for various activities of interest. In the first step, he estimates the probability that a person will participate in a particular activity. To do this, Cicchetti uses the same sort of socioeconomic variables used by the ORRRC study. In addition to these, however, he uses such variables as number of acres of high intensity recreation land per capita in the sampling area, distance from a major body of water, other commercial recreation establishments, number of overnight visitors to recreation areas in the state, and other similar variables as measures of supply, depending on the activity being dealt with. Supply variables are deflated by dividing by total population in the area. From this, the expected number of participants from the total population is determined.

The second step involves determination of days of recreation per participant. Again, socioeconomic variables and supply variables are used to make the prediction, but supply variables are now divided by number of participants in an attempt to measure congestion. Once number of participants and number of recreation days per participant have been determined for the activities of interest, total recreation days for each activity are determined by multiplying the two estimates together.

Schreuder (1975) states that this two-step approach reduces the standard error in comparison with those methods which try to predict participation rates for an activity for participants and non-participants alike. He further contends, however, that Cicchetti uses too many independent variables (as many as 20 per equation) for prediction purposes.

The adjusted coefficients of determination for the two equations are quite low for the various activities, typically ranging from 0.15 to 0.22. In addition, no mention is made of the error associated with the final estimate of days of participation by activity. One cannot but wonder about the error associated with the final prediction, however, since it combines error from the probability equation, error from the participation equation, and error in the projection of socioeconomic and supply variables.

The approach has been carried one step further in the Upper Great Lakes Regional Recreation Planning Study (Cooper et al., 1974). This study used a sample of households in the area defined by the nine states of Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, Wisconsin, North Dakota and South Dakota. Rather than the two-step approach used by Cicchetti, however, this study used a four-step approach.

> "The first step of the analysis identifies the group that takes recreational trips and, specifically, trips to the Upper Great Lakes Region. The second step of the analysis determines the subset that participates in outdoor recreation activities on an activity by activity basis. The third step concentrates on families who take trips and participate in a given activity, and generates the level of participation for each of the twelve recreation activities. And, the fourth step involves distributing the total days of participation over the Upper Great Lakes multicounty zones" (Cooper et al., 1974).

The study includes socioeconomic variables, youth-related variables, and supply variables. Despite the four-step approach, coefficients of determination remain low, and no estimate of error for the final projection is made.

These four studies are indicative of the approach based on population-specific data. Improvements in the technique probably do not lie in the direction of more variables and more conditional steps. Careful selection of a limited number of variables which include measures of substitution as well as supply will be needed to generate long range use projections suitable for planning. The general approach, however, has merit in that regional and national projections for wilderness will be most readily made once appropriate variables are determined and data located or collected.

Site-Specific User Oriented Techniques

Site-specific user oriented data is obtained from interviews conducted on the recreation site of interest. The information obtained through such interviews can be used in three ways, 1) user preferences can be used as a basis for short term planning and management of the site and to gain insight into the types of additional sites users may prefer, 2) information on use rates and socioeconomic factors coupled with supply variables can be used to project future use for the site and 3) using an approach developed by Clawson (1959), a demand curve for the site can be approximated.

With further exploration into site-specific data, a fourth use may evolve. Site-specific data is, quite often, more abundant than population-

specific data, and with modification in techniques of projection, site-specific user oriented data may be used in making regional projections. Certainly it seems reasonable that similar sites in similar locations would have similar use. It may be possible, through proper accounting of important factors, to project use of one site based on use of different sites, and ultimately to make projections for proposed sites based on projections for existing sites. Somewhat similar techniques have been developed for estimating use on some sites based on use of other sites in the area (Bury and Margolies, 1964, James and Rich, 1966, and Wagar, 1964). Two examples will illustrate the uses of site-specific user oriented data.

In order to properly manage wilderness areas, managers must be sensitive to the aspects of wilderness valued by users (Hendee et al., 1968). One way to obtain such information is to interview wilderness users on site. The type of information one can obtain from such procedures is nearly unlimited, and along with user preferences, rather extensive lists of user-related socioeconomic and demographic information can be obtained (Lucas, 1970). Information regarding tastes and preferences can be used to evaluate present management goals and may serve as an indicator of need for new sites. If supply and substitute variables are accounted for, future use of the site may be approximated.

Since interviews are conducted only on those people actually using the site, care must be exercised in making generalizations about regional use based on site use. There does, however, seem to be potential for

developing measures of similarity between sites, either existing or proposed, and between surrounding areas which will allow use of site-specific information in regional projections.

Perhaps the most widely known method for projecting recreation demand curves was developed by Clawson (1959). By interviewing visitors to certain recreation areas, he was able to develop a technique which estimates the demand curve for a particular site. The method uses two stages, the first developing demand for the total recreation experience, and the second developing a demand curve for the recreation resource.

Information necessary to estimate demand for the total recreation experience consists of distance traveled by the party to reach the site, estimated cost to the party per visit and estimated number of visits during some time period of interest. In addition, the area surrounding the site must be broken up into distance zones and the population within each zone determined. Thus, people traveling 18 miles to the site might be placed in a "less than 50 miles" zone, persons traveling 70 miles in a "50 to 100 miles" zone and so on. From this, it is possible to determine visits per 1000 base population from which a graph can be constructed. Using hypothetical data from Clawson and Knetsch (1966), the graph in figure 2 can be produced.

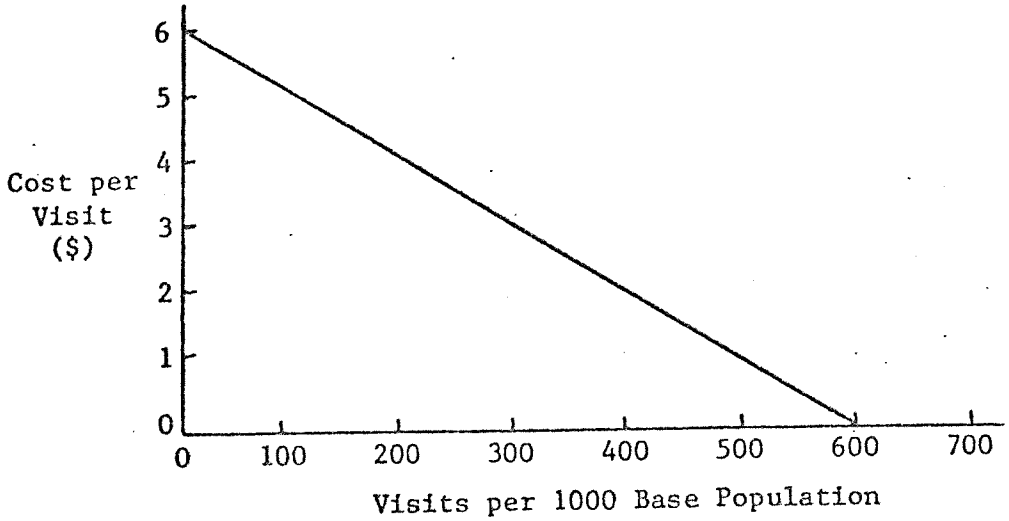

Figure 2. Demand for the total recreation experience

Once this relationship has been determined, it is possible to construct a demand curve for the recreation resource. For instance, when cost per visit is five dollars, there are 100 visits per 1000 base population. If this price were to rise to six dollars per visit due perhaps to imposition of a one dollar entrance fee, the assumption is that number of visits would fall to zero as indicated by the present visitation rate at a price of six dollars. This information coupled with base population for the appropriate distance zone will give the expected number of visits from that zone assuming a one dollar increase. If the effect of a one dollar increase is calculated for each zone and the results for each zone are added together, the result is total expected visits after the increase (in this case, 1200 visits). If the same calculation is carried out for several different prices, a demand curve such as the one in figure 3 will be traced out.

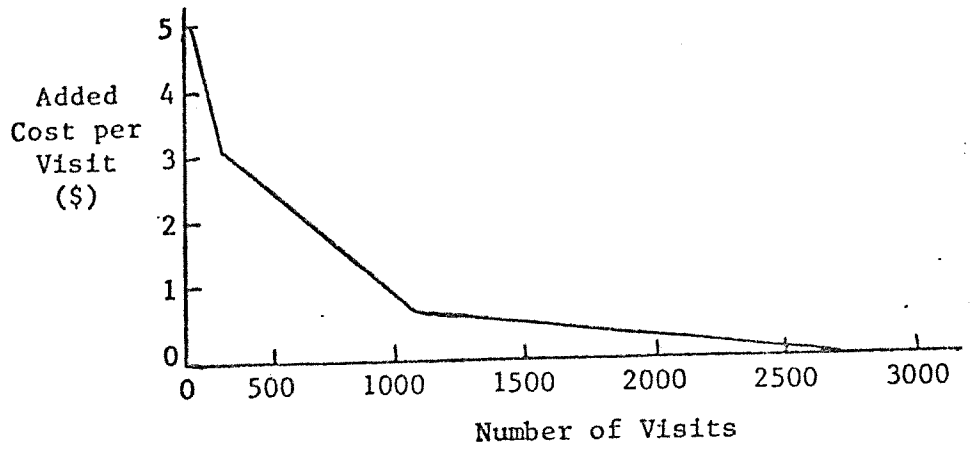

Figure 3. Estimated demand curve for a hypothetical recreation site

While this is a demand curve in the true sense of the word, there are limitations. The approach deals with supply only at the time the curve is constructed and consequently is subject to possible error if projected too far into the future. There is also a problem in that the time cost of the trip is ignored (Cesario, 1976). Take, for example, trips to a recreation site from two zones of origin, zone 1 which is 5 minutes away, and zone two 20 minutes away. Further assume that the cost of a visit from zone 1 is two dollars, from zone 2, three dollars, and that present visitation rates are 500 and 300 visits, respectively. The Clawson approach would infer a visitation rate of 300 from zone 1 if cost per visit to zone 1 visitors increased by one dollar. That is, since the price to zone 1 is now three dollars, the visitation rate must drop to that level shown by zone 2 when its cost was three dollars. However, since people in zone 1 are closer to the site than are people in zone 2,

they may continue visitation at a higher rate since their time cost is less. This problem can be corrected by incorporating travel time along with costs as an independent variable in the analysis used to establish the demand curve (Beardsley, 1971).

Other reasons for doubting the assumption that the demand schedule is the same for all zones is the fact that the propensity to visit a park may vary with income, age, population densities, available alternatives, other close substitutes and other socioeconomic variables (Knetsch, 1963). These factors would certainly be expected to change from zone to zone if the area of study is large enough to accomodate a majority of the users of a particular wilderness site.

As a result, Clawson's approach is useful (with modification to reflect differences in demand schedules from zone to zone) in developing a demand curve for a specific wilderness area under varying costs to the user. Whether the method would be useful for wilderness demand projection would depend on modification of the technique to allow development of a demand curve for proposed sites based on the demand for similar existing sites.

Site-Specific Area Oriented Techniques

The third type of projection technique will be mentioned only briefly since models of this type are intended for estimation of use for a specific site over rather limited time spans. The technique normally involves double sampling during a calibration year in order to relate number of visits or number of visitor days to more easily measured

variables such as traffic meter readings or water meter readings (Prommitz et al., 1976, James, 1967, and James and Tyre, 1967). Because the technique was developed specifically for use estimation at existing sites it is not practical for wilderness use estimation although use estimates for other types of sites based on this technique could provide useful information for determining if wilderness substitutes exist.

Summary

While there are many variations of the three basic techniques available for use projection, none are completely acceptable for wilderness use projection. The most desirable type of technique would be one based on population-specific data since this provides the easiest means of making regional projections. Unfortunately, at present, population-specific data involving wilderness areas is rather limited. It will probably be necessary to bridge the gap by developing a technique which utilizes both population-specific and site-specific user oriented data.

If care is exercised in selecting variables, it should be possible to develop a model which incorporates the best aspects of both techniques.

To improve the use projections, it will be necessary to develop measures of substitute activities and measures of wilderness supply which can be incorporated into the model.

While projections made for the present study must, of necessity, rely on existing data, it is the intent that data deficiencies be pointed out in the course of the study so that both data and projection techniques can be improved in the future.

Literature Cited

Beardsley, W. G. 1971. Bias and noncomparability in recreation evaluation models. Land Economics 47(2):175-180.

Burdge, R. J., and J. C. Hendee. 1972. The demand survey dilemma: assessing the credibility of state outdoor recreation plans. U.S.D.A. Forest Service Guideline 2(6):65-68.

Bury, R. L., and R. Margolies. 1964. A method for estimating current attendance on sets of campgrounds: a pilot study. U.S.D.A. Forest Service Research Note PSW-42. 6 pp.

Campbell, G. E. 1976. Site manager's guide. In A System for Inventory of Recreation Use and Facilities, Vol. 1. Forestry Department, Iowa State University, Ames, Iowa.

Cesario, F. J. 1976. Value of time in recreation benefit studies. Land Economics 52(1):32-40.

Cicchetti, C. J. 1973. Forecasting recreation in the United States. Lexington Mass.: Heath and Co. 200 pp.

_____, and V. K. Smith. 1973. Congestion, quality deterioration, and optimal use: wilderness recreation in the Spanish Peaks Primitive Area. Resources for the Future, Inc. Reprint number 109.

Clawson, M. 1959. Methods of measuring the demand for and value of outdoor recreation. Resources for the Future, Inc. Reprint number 10.

Clawson, M., and J. L. Knetsch. 1966. Economics of outdoor recreation. The Johns Hopkins Press. 320 pp.

Cooper, R. B., A. Somerson, N. Enosh, and S. McKinney. 1974. Upper Great Lakes regional recreation planning study part 2: recreation demand survey and forecasts. Recreation Resources Center, University of Wisconsin--Extension. 149 pp.

Hendee, J. C., and R. J. Burdge. 1974. The substitutability concept: implications for recreation research and management. Journal of Leisure Research 6(spring):157-162.

_____, W. R. Calton, Jr., L. D. Marlow, and C. F. Brockman. 1968. Wilderness users in the Pacific Northwest--their characteristics, values, and management preferences. U.S.D.A. Forest Service Research Paper PNW-61. 91 pp.

James, G. A. 1967. Recreation use estimation on Forest Service lands in the United States. U.S.D.A. Forest Service Research Paper SE-79. 8 pp.

_____, and J. L. Rich. 1966. Estimating recreation use on a complex of developed sites. U.S.D.A. Forest Service Research Note SE-64. 8 pp.

_____, and G. L. Tyre. 1967. Use of water meter records to estimate recreation visits and use on developed sites. U.S.D.A. Forest Service Research Note SE-73. 3 pp.

Knetsch, J. L. 1963. Outdoor recreation demands and benefits. Land Economics 39:387-396.

_____. 1969. Assessing the demand for outdoor recreation. Journal of Leisure Research 1(3):85-87.

Lucas, R. C. 1970. Survey of visitors to seven wilderness and related areas in Montana, preliminary tabulations. Intermountain Forest and Range Experiment Station, Missoula, Montana.

Manning, G. H., H. H. Webster, F. S. Hopkins, and R. D. Hickman. 1973. Projecting Iowa's outdoor recreation needs to 1980. Agriculture and Home Economics Experiment Station, Iowa State University, Research Bulletin 575. 21 pp.

National Academy of Sciences. 1975. Assessing demand for outdoor recreation. U. S. Government Printing Office, Stock number 624-016-00081-1. 120 pp.

Outdoor Recreation Resources Review Commission. 1962. Prospective demand for outdoor recreation. ORRRC study report 26, U. S. Government Printing Office. 61 pp.

Prommitz, L. C., W. G. Beardsley, S. E. Jungst, C. W. Ramm, G. E. Campbell, and T. Burk. 1976. A system for inventory of recreation use and facilities. Forestry Department, Iowa State University.

Schreuder, G. F. 1975. Forecasting recreation participation: a theoretical model. Washington State Comprehensive Outdoor Recreation Plan. Technical Report No. 2. 26 pp.

U. S. Forest Service. 1977. The nation's renewable resources--an assessment, 1975. U. S. Government Printing Office. Forest Resource Report No. 21. pp. 51-81.

Wagar, J. A. 1964. Estimating number of campers on unsupervised campgrounds. U.S.D.A. Forest Service Research Paper NE-18. 16 pp.

Working, E. J. 1927. What do statistical 'demand curves' show? The Quarterly Journal of Economics 41(February 1927):212-235.