Introduction

This chapter deals with why we need a book on travel costs methodology (TCM) models, what they achieve and the plan of the book.

Why do we need a book on TCM models?

Humankind relies on natural resources for continued existence, in common with other living species. Natural resources have historically supplied food, clothing, shelter, the means to care for our persons and both the environment and tools needed for various forms of relaxation and spiritual rejuvenation. Over millennia, people settled in all the continents except Antarctica and developed their various ethnic characteristics and cultures. One characteristic common to all was their reliance on nature to survive and flourish; another was their profound impacts on their local flora and fauna. They changed the relative abundance of various species.

In more modern times, the great European migrations placed Europeans with their cultures in new lands. Instead of adapting their cultural practises to new environments, by and large they tried to adapt the environments to their cultures. One result has been the considerable depletion of natural resources. More than sixty per cent of US timber reserves, for example, were cut in the nineteenth century. Another result has been the generally unanticipated change in populations of untargeted species. A third effect has been a huge increase in human standards of living over the last two hundred years accompanied by large scale transformation of natural resources into useful tools and products that have made our lives easier and longer.

All human cultures use and value environmental resources both in their natural state and for conversion into commodities such as irrigation water, power, minerals and farmland (Krutilla, 1967). Some of these conversions into commodities have caused considerable environmental damage. For example, an oil spill of Exxon Valdez proportions has substantial consequences in both the short and longer term — oil-fouled beaches, the suffering and loss of wildlife, the loss of fish stocks and fishers' livelihoods. Still, elaborately converted petroleum produces immense human benefit for transportation, space heating and materials. An important question faced by governments thus centers around the appropriate mix of policies to provide a
balance in uses of environments in their natural state versus commodity production. Information on the economic values of preservation versus development of natural environments provides policy makers with essential information in making more informed decisions.

Environmental debates have raged around the world generally since the early 1970s. These have involved issues regarding the appropriate use of natural environments at all levels. A local concern, for example, may be the pollution of a creek running through a city with industrial waste such as oil or paint thinner from a motor vehicle repair shop. By the time that creek reaches the sea, the concern may be regional and additional groups such as fishers may be involved. If the creek empties into the sea near a world natural heritage treasure such as the Great Barrier Reef, the issue may become national or global.

The political process often suffers from the problem that little is done about an environmental issue until it becomes acute. Nevertheless, concern about environmental degradation has reached the world political stage. In 1992, the Rio Earth Summit was held, and a further International Conference on Greenhouse Gas Emissions Trading was held at Kyoto in Japan in 1997. Proponents for change at these forums have argued that considerable policy changes must be made in order to improve environmental quality. Opponents worry about the high cost of reducing environmental damages.

Arguments on environmental policy questions usually revolve around potential benefits and costs to both current and future generations. In drafting and considering legislation, governments often wish to know if benefits to be enjoyed by current and future generations will outweigh the costs of procuring those benefits. Sometimes these decisions are easy to make, but usually they are not. For example, if nearly everyone wants to set aside a certain patch of land as habitat for an endangered species and the land has no particular or valuable alternative use, there is no problem in making a decision. We simply set the land aside. If many people want the land for the species and the rest simply don't care, we can reserve the land uncontentiously. Those who prefer the project are better off and those who are indifferent are neither better nor worse off. Difficulty in choice occurs when many people approve of a project but many also disapprove.

Nearly all public environmental policy decisions have effects that cause some people to gain while others lose. Policymakers and voters want to know if a new decision will yield greater benefits than it will cost. Because economic impacts are a major factor in influencing public policy outcomes, economic analysis should be done objectively and fairly. This is especially true when outcomes of the analyses do not suit the interests of those who
stand to lose something. The economic analysis tool of choice for environmental policy analysis is benefit-cost analysis (BCA).

BCA is an economic tool for comparing the desirable and undesirable impacts of proposed policies (Arrow et al., 1996). In particular, it is a method for ranking the economic performance of natural resource projects, policies and programs in which impacts are measured in non-technical terms and estimated by scientific methods (McAllister, 1980). It is a process of comparing all the gains and losses resulting from some action in common units. BCA organizes information in a way to promote the conduct of rational policy analysis. Rational policy analysis considers all the relevant alternatives, identifies and evaluates all the known consequences which would follow from the adoption of each alternative, and selects that alternative and its associated consequences which would be preferable in terms of society’s most valued ends (Sander, 1983). A complete BCA compares alternative actions to determine which option provides society with the most economically beneficial use of its resources (Loomis, 1993). BCA helps make better management decisions by using a time-tested economic framework for organizing economic data.

In environmental and natural resources, there are plenty of ways governments can make bad decisions. Management by tradition is a widely-applied method for making poor decisions. Resource agencies pursue activities, such as stocking $x$ pounds of trout at a $y$ sized lake or selling $z$ board feet of timber from a national forest, simply because that's what they've done for years. Without information on benefits and costs, resource agencies often have no choice but to manage by tradition.

Fear of change also promotes bad decisions. Machiavelli warned there is nothing more difficult to do, more perilous to conduct or more uncertain of its success, than taking the lead in the introduction of a new order of things, because the innovator faces as enemies all who have done well under the old conditions. While change is resisted by virtually everybody, BCA nevertheless gives a quantitative basis for deciding which changes are worthwhile and which ones should be rejected.

Poor decisions are also promoted by the desire or necessity of government resource agencies to appease special interests. In the western US, for example, many policies have been enacted to please special interests (Gardner, 1997). The US Congress subsidizes federal timber, water, recreation, minerals and forage because powerful special interests benefit economically.

Finally, poor decisions are promoted when public resource managers' personal biases are allowed to influence decisions instead of sound economic analyses based on economic principles and carried out consistently. In the
realm of natural resource management, local bureaucrats violate the national interest when they are permitted to decide the mix of grazing and recreation on public
lands based on personal biases or political connections. The decision should be made through the consistent and objective application of time-tested economic
principles. These principles should be set up at the national level and applied to resources and resource issues at the local level.

In principle, the benefit of any natural resource management decision is measured by what resource users are willing to pay for it. Costs are benefits displaced by the
decision. These are two pivotal concepts which underlie much of what is in this book. These concepts apply to both market goods and non-market goods.

For the case of market goods, suppose the US Secretary of the Interior proposes limiting logging in the southwest to produce more critical habitat for the Mexican
spotted owl. The benefits lost (costs) from such a policy are timber. Timber is sold in markets. The total cost of the policy is thus the sum of prices times quantities of
timber precluded by the decision.

The same concepts apply to decisions affecting non-market goods. Imagine that the US Congress is considering passing a law that requires shipbuilders to build
double-hulled oil tankers, in order to reduce future environmental damages from oil spills. The benefit is the value of fish not killed, beaches not fouled by spilled oil,
marine wildlife not killed, and ecosystems not damaged. For these non-market goods, prices typically must be estimated by some indirect method.

The TCM is one of the few techniques available for estimating values of environmental policy decisions, decisions which we define as any public or private action that
has some influence on human benefits received from the environment in current or future generations. There is currently no book-length treatment of TCM. There are
brief accounts of the method in most environmental and natural resource economics textbooks, but these are typically too sketchy to be of much use to the
professional resource manager who needs a TCM to provide information on environmental policy decisions. Conversely, articles dealing with TCM in the published
economics journal literature usually presume intimacy with the method and knowledge of advanced microeconomics and econometrics. Hence, we have assigned
ourselves the task of filling the void in the literature and providing an accessible manual on the methodology so that resource managers may start to use TCM as a part
of their decision-making processes.
What do TCM models achieve?

Many people believe that communities should invest in natural resource facilities and possibly even take natural environments out of commodity production to promote outdoor recreation, because these investments provide important human benefits, such as better health, a place to develop and improve skills and a place to relax and have a good time. However, getting and keeping these facilities and natural environments call for both the money and the natural resources of suitable quality and amount, whilst these resources typically have values in other uses that are also important to people. For example, in places like the dry western US and Australia, streams, lakes and reservoirs are used for fishing, boating and other outdoor recreation, but the water is also used for drinking, crop irrigation and power production.

People who make the decisions that allocate resources to outdoor recreation are well aware that these alternative uses produce important benefits that are valued in organized markets. Hence, analyses of price data collected in these markets, such as the price of water that cities charge customers in a water bill, provide estimates of benefits accruing to people who would rather use the resources for something outside recreation and the environment. Moreover these estimates may be presented with a fair degree of confidence in their accuracy. Conversely, recreation and environmental managers are called upon to defend their outdoor recreation and environmental programs in the face of little or no data that indicate what those benefits are worth. TCM is one method for estimating recreational values, so that these values can be compared with competing values consistently.

Apart from recreational and environmental policy applications, TCM models have been used to estimate user benefits of a very wide range of unpriced goods and services, based on users' travel patterns. There are rarely established markets for enjoying such benefits as breathing crisp clean air, sight-seeing, watching whales sporting in the seas or, in some cases, benefits from gaining valuable information. An example of this final instance is the value of additional information derived by livestock producers who go physically to watch a livestock sale, rather than relying on radio broadcasts or published data of the results. TCM models have been used with success to value that additional information.

Despite its wider applicability, TCM has been mostly used to support environmental policy decisions, such as investments in nature-based recreational infrastructure, on-site recreational enhancement decisions and various proposed environmental regulations. Examples of applications
include benefits arising from fish stocking programs, mammal breeding programs for recreational hunters, enhanced hiking trails and facilities, better picnicking facilities at lakes and dams and improved campgrounds in national parks and forest reserves. It has also been used to estimate the environmental cost of private decisions, such as schemes to drain fishing lakes in droughts to provide water for crops and private coal-fired power plant developments near national parks. A study has been under way in the US for some time, in which TCM estimates of on-site recreation benefits in natural areas are being used to evaluate proposed national policies that would regulate air pollution more stringently.

TCM has had five decades of development since the germ of the concept was first suggested by Harold Hotelling in 1947. TCM is a method for estimating economic benefits of a recreation site based on observed travel patterns of people who visit that site. Analysts who estimate these benefits using TCM apply the principle that people who live closer to a site overcome less travel distance and are subject to lower travel time barriers than more distant visitors, and therefore receive more benefit due to the site's presence.

Numerous issues have been examined and canvassed in the academic literature, and some hundreds of estimations have been made. US economists have probably produced the largest volume of TCM analyses. Theoretical development of the method has been promoted by pressure brought to bear by many US legislative and judicial bodies' requiring environmental benefit or opportunity cost estimates before environmentally-damaging developments can be approved. Legislative and judicial process in many other countries appears to be not so far advanced, possibly because of a greater need for and value of material services provided by natural environments. However, there have still been some important contributions to the literature with studies reported from the UK, continental Europe, Canada, Australia, New Zealand and Asia.

Several reviews of TCM have been published, for example, Ward and Loomis (1986), Durden and Shogren (1988), and Smith (1989; 1990; 1993). They have generally concluded that the methodology is robust and produces an acceptable estimate of benefits accruing to users of natural resources for nature-based recreation. Additionally, they all provide some insight into how TCM can be used to evaluate policies, programs and plans that damage or improve that recreation.
The Plan of This Book

The intent of this book is to present a self-contained treatment of TCM along with a wide range of applications to natural resource and environmental policy questions, for readers who have little formal background in economic theory or statistics. It should be of great professional and personal interest to policy analysts, biologists, foresters, hydrologists and others who need to formulate, implement or evaluate proposed environmental policies, projects, or programs. This manual has been written to pass onto you the insights gained over the last half-century on the development and use of this important methodology.

To this end, Chapter I discusses some of the environmental and natural resource decisions which TCM models can support. The chapter starts with a brief review of the economic framework for benefit-cost analysis, shows the kinds of decisions which need recreation benefits data, touches on outdoor recreation program planning and considers more fully the evaluation of management actions. Chapter 2 gives a brief history and overview of TCM. TCM models are concerned with the estimation of demand; thus, an understanding of the theory of demand is essential if the methodology is to be used successfully. Chapter 3 takes you through the necessary demand theory without burdening you with unnecessary theoretical sophistication. Some of the concepts underlying demand theory are discussed, followed by some of the mechanics of demand estimation. The theory and measurement of benefits are then examined in Chapter 4. The crux of the use of TCM lies in the estimation of consumer surplus, compensating variation or equivalent variation, depending on the circumstances of each case. This chapter gives a comprehensive account of these measurements.

Chapter 5 continues the examination of the various forms of TCM models and discusses their applicability to differing situations. Principles for the design of models are examined. Chapter 6 considers some important aspects of the administration of surveys — identifying the population, selecting a sample, developing and testing a questionnaire, planning survey procedures and finally considering response rates. An important question considered is what response rate is sufficient to give reliable data.

No matter how much thought is given in the survey planning stage to the definition of variables, survey respondents manage to introduce new situations which analysts had not previously considered. Hence, it is important to develop protocols (rules) to deal with the many variations in the reported data. These can be developed in the planning stage and later as the data are recorded. Similarly, respondents may encounter difficulties in
providing information and it is important to give guidance on the questionnaire. These issues are discussed in Chapter 7.

One variant of TCM is the zonal TCM (ZTCM) model. Chapter 7 also briefly considers the definition and identification of zones. Should they be concentric or based on existing administrative units such as countries, states, or counties, or city blocks? ZTCM models pose several requirements for structuring, gathering and analysing data, but they present important advantages for being able to analyse an impressive range of policy questions.

Chapter 8 introduces data management and analysis. PCs, spreadsheets and database management programs have taken much of the drudgery out of survey-based research in recent years. This chapter presents helpful hints for designing a questionnaire and organising the data storage and retrieval system to make data input and output flow easily and efficiently. Anyone who has organized, planned for and conducted a TCM for policy analysis is well aware of the costs incurred by poor foresight in planning. This lack of forethought causes the majority of time to be spent on struggling with the data flow, diverting precious resources and time away from model estimation and policy analysis. It has been our experience that TCM studies are often under-budgeted and conducted under the umbrella of another job or program. Many well-intentioned efforts to estimate a TCM were shelved for a lack of good planning. The chapter also considers several issues surrounding regression analysis. As with demand theory in Chapter 3, regression analysis is viewed as an instrument for estimating TCMs and not as an end in itself. So you are taken through only the aspects of regression you need to know to understand what is being achieved with the TCM models. After a brief introduction, the chapter examines the interpretation of regression coefficients for policy analysis. It then mentions suitable regression software. The selection of an algebraic functional form is shown to be critical to the usefulness of a regression model used for policy analysis. This chapter also discusses the various test statistics which are available to evaluate the estimated model.

As a reader, your needs will differ depending on the policy issues you face, your budget, available time and other circumstances. Lest you think that all the problems and issues surrounding TCM are resolved, Chapter 9 introduces some of the many unresolved and emerging issues. These are principally the issues of what travel costs should be counted, the value of time both during travel and on site, multi-purpose or multiple destination trips and varying lengths of visits. The chapter also points you towards the most significant journals that publish TCM papers. TCM continues to undergo development by economists and other policy analysts who have interests in public and private decisions that affect the environment, natural resources and recreation. Whilst managers at a recreation site who face compelling day-to-day issues are the main focus of this book, the TCM framework is relevant to the study of a wide range of policy and planning.

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day pressures may believe themselves less interested in academic debates, they still may wish to stay abreast of the various issues both in TCM itself and in emerging policies for which TCM can effectively support decisions. For example, in the realm of US water policy, the Bureau of Reclamation and Army Corps of Engineers have invested considerable money and staff in recent years on studies that measure the value of water-based recreation. These values influence how their reservoirs and associated streamflows are operated in an environment of legally-mandated multiple use benefits maximisation. Similarly the US Forest Service and Bureau of Land Management are both mandated by 1970s legislation to manage public forests and rangelands to account for all uses and benefits of these lands.

A little crystal ball work is included in the Conclusion, together with a few numbers on the worth of outdoor nature-based recreation which have come from review papers. The book ends with an annotated bibliography, listing many of the papers that have dealt with TCM. The papers are coded to guide readers through the list. The book concludes with one of the most important features of any useful manual, an index.

We have tried to write this manual for natural resource site managers, policy analysts and others who face responsibilities in planning, programming, budgeting and project operations. Accordingly, we hope we have described sufficient material to allow you to use TCM in your own analyses. We hope you find the book intellectually stimulating in its own right as well as useful for analysis that underpins the formulation, implementation and evaluation of decisions affecting recreation and the environment. Additionally, we hope this book will give you insight into the current professional debates and that you can follow up in the journals any aspects which particularly intrigue you.

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References


