Use of IMPLAN to Assess Economic Impacts of Recreation and Tourism: Chronology and Trends

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Abstract: This paper traces the evolution of the use of IMPLAN, and software developed by researchers at Michigan State University, to estimate the economic impacts of recreation and tourism. Technological innovations and modeling have changed IMPLAN 's role. Current software allows analysts to avoid the use of IMPLAN altogether and create complete and thorough economic impact reports in minutes. A potential disadvantage of such speed and efficiency is the lack of understanding of the bases and assumptions upon which the impact estimates are built. Quality expenditure and demand data continue to be vital needs.

Introduction

The full title of the computer system, "IMpact Analysis for PLANning", indicates its original intent. Certain planning requirements of the National Forest Management Act of 1976 (P.L. 94-588) and its associated regulations (36 C.F.R. 219, Subpart A, September 1979) called for economic analyses of proposed national forest management plans. Specifically, these mandates require investigation of the role of forest activities on regional economies. Input-output (I-O) analysis was deemed by US Forest Service researchers to be an appropriate method for conducting such investigations. To this end, Charles Palmer and Greg Alward of the US Forest Service's Land Management Planning Unit in Ft. Collins, Colorado developed IMPLAN to assist the agency's forest management planning requirements involving regional economic impact assessment (Alward and Palmer, 1983; Alward and Lofting, 1985).

The first overview of the databases, the model and the analytic capabilities of IMPLAN was co-authored by Alward and Palmer and published in 1983 in the Proceedings of the First North American Conference on Forest Sector Modeling. In the developers' own words, "The IMPLAN system utilizes input-output analysis procedures and provides forest planners with the capability to develop non-survey based interindustry models and apply them to the evaluation of alternative management programs." (Alward and Palmer 1983: 1).

A series of studies and literature published from the late 60's through the early 80's indicated that a "nonsurvey" approach[2] to conducting input-output studies might hold the key to overcoming a major disadvantage of I-O analysis: its high cost and length of time required (Bourque and Hansen, 1967; Schaffer and Chu, 1969; Strang, 1970; Jensen, 1980; Round, 1983; Stevens et al.,1983). As such, Forest Service staff in Fort Collins developed IMPLAN using a series of secondary databases from the Survey of Current Business and the U.S. Department of Commerce's Bureau of Economic Analysis (Alward and Palmer 1983, Palmer et al. 1985). Despite advances in computer technology, the inclusion of social accounting matrices or SAM's (Engineering-Economics Associates 1985, Alward 1985), further development of the software (Minnesota IMPLAN Group, 1996), and other refinements (Stynes and Propst, 1992, 1995), the fundamental structure of IMPLAN as a nonsurvey I-O system has withstood the test of time.[3]

Since the US Forest Service operates under a multiple use mandate (Cubbage et al., 1993), attention soon turned to using IMPLAN to evaluate the economic impacts of, not just timber or range

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[2] A variation of the nonsurvey approach is the "hybrid" (i.e., semi-survey) approach. The hybrid input-output procedure consists of primary data for final demand and the sectors of interest with production and demand data for the remaining sectors derived from secondary sources (Propst and Gavrilis, 1987).

[3] Other nonsurvey or hybrid input-output systems have come and gone, are used on a limited basis or still exist. Perhaps the most well-known of the existing systems is RIMS II (Cartwright et al., 1981). For a review of other nonsurvey and hybrid systems, see Brucker et al. (1987, 1990).

alternatives, but recreation and tourism activity as well (Alward and Lofting, 1985).[4] The purpose of this paper is to describe the major modifications to IMPLAN from 1983 to present, highlighting the ways these changes have affected the procedures for assessing the economic impacts of recreation and tourism (Figure 1). It will be shown how experience with the IMPLAN system during the past 16 years and advances in computer technology led researchers as Michigan State University to develop a series of software additions to IMPLAN. These additions have streamlined the process and shortened the time required to perform economic impacts analyses of recreation and tourism. These improvements have also increased the accuracy and credibility of the results. The role of IMPLAN has evolved from one of always being needed to estimate the economic impacts of recreation and tourism to one of only occasionally being necessary or to update the multipliers in the secondary database. Minimizing the constant requirement for IMPLAN lowers the cost of each analysis, makes the analytical tools more user-friendly, and reduces the amount of training or technology transfer resources needed.

Event	*Year*	
IMPLAN	1983	IMPLAN: Always required
MSU Conference	1984	
IMPLAN-DOS	1990	
Importable Bridge Table	1993	
MIREC	1993	
IMPLAN-Windows	1996	
Importable Type SAM Multipliers	1997	IMPLAN: Sometimes required
MITEIM	1998	
MGM2	2000	

Figure 1. Major events and changes in the use of IMPLAN to assess the economic impacts of recreation and tourism.

The "Early" Years: 1983-1993

The development of a system like IMPLAN was only the necessary first step in placing the power of input-output analysis into the hands of researchers, analysts and planners. In the case of recreation and tourism, it quickly became apparent that IMPLAN was still not "user-friendly" in that an understanding of regional economic concepts and credible recreation and tourism expenditure and demand data were required. Once acquired, such data still had to be massaged in numerous ways to prepare them for entry into the IMPLAN system. Technical support was limited to one or two persons in the Forest Service's Ft. Collins office. Development and maintenance of the system was well-funded. Technical support was not. Yet, the demand from "the field" for estimates of the regional impacts of recreation and tourism spending proliferated. There was a clear need to place IMPLAN or IMPLAN-like technology in the hands of federal and state agency staff so that they could benefit from the power of the system in the analysis of policy or planning alternatives. However, the funding or infrastructure for such technology transfer did not exist.

1984 Economic Impact Conference

To begin to understand how to deal with this issue, a the US Forest Service and Army Corps of Engineers, via a grant awarded to Michigan State University's Department of Park and Recreation

[4] Early explanations of the conceptual and mathematical components of input-output analysis appear in Isard (1960, 1975), Miernyk (1965) and Richardson (1972). The earliest attempts to assess the economic impacts of recreation and tourism using economic base and input-output techniques were by Gamble and Raphael (1965), Kalter and Lord (1968), Strang (1970) and Archer and Owen (1972). Applications in the mid to late-70's include the Hawaii tourism expenditure and impact studies (Research and Economic Analysis Division, 1980) and a series of reports pertaining to the tourism industry in Massachusetts (Cournoyer and Kindahl, 1974-1979). However, such studies were generally conducted on an ad hoc basis since there was no standardized input-output software available; hence the development of these regional models was costly in time and money.

Resources, facilitated a conference and workshop in 1984 (see Figure 1). The workshop had two goals pertaining to assessing the economic impacts of recreation and tourism: (1) to explore and assess the best available technology (as of 1984) and (2) to recommend research strategies for meeting methodological and data needs. Prior to the gathering, a variety of academicians and agency researchers were polled to identify the key issues that needed to be addressed to develop more accurate and timely estimates of the economic impacts of recreation and tourism. Prior to the workshop, regional scientists presented background, technical papers related to these issues. During the ensuing workshop, regional scientists, agency staff and recreation professionals (see Table 1) worked in small groups to recommend solutions to the same issues addressed during the formal presentations. The set of seven technical papers and workshop recommendations were published as a collection by the Southeastern Forest Experiment Station of the US Forest Service (Propst, 1985). The recommendations contained in this publication launched a series of studies funded initially by the US Forest Service and subsequently by the US Army Corps of Engineers. The findings of these studies led to numerous enhancements in the databases and user-friendliness of the systems required to evaluate the economic impacts of recreation and tourism associated with federal lands and waters.

Table 1. Participants in the conference and workshop on "Assessing the Economic Impacts of Recreation and Tourism," May 14-16, 1984, Michigan State University.

Participants	*Affiliation in 1984*
Greg Alward	Land Mgt. Planning Unit, USDA Forest Service (Ft. Collins, CO)
Robert Bushnell	Dept. of Finance & Economics, Wayne State University
Daniel Chappelle	Dept. of Resource Development, Michigan State University
H. Ken Cordell	Forest Sciences Laboratory, USDA Forest Service (Athens, GA)
Dimitris Gavrilis	Dept. of Park and Recreation Resources, Michigan State University
William Hansen	Waterways Experiment Station, US Army Corps of Engineers (Vicksburg, MS)
Donald Holecek	Dept. of Park and Recreation Resources, Michigan State University
Matthew Hyle	Dept. of Finance & Economics, Wayne State University
Jay Leitch	Dept. of Agricultural Economics, North Dakota State University
Wilbur Maki	Dept. of Agricultural & Applied Economics, University of Minnesota
Charles Palmer	Resources Planning Assessment, USDA Forest Service (Denver, CO)
Dennis Propst	Dept. of Park and Recreation Resources, Michigan State University
Adam Rose	College of Mineral and Energy Resources, West Virginia University
William Schaffer	Dept. of Industrial Management, Georgia Institute of Technology
Eric Siverts	Land Mgt. Planning Unit, USDA Forest Service (Ft. Collins, CO)
Benjamin Stevens	Regional Science Research Institute (Peace Dale, RI)
Daniel Stynes	Dept. of Park and Recreation Resources, Michigan State University
Nancy Tessaro	Natural Resources Mgt. Branch, US Army Corps of Engineers (Washington, DC)
Tim Tyrrell	Dept. of Resource Economics, University of Rhode Island

The first set of studies was aimed at using IMPLAN and an existing recreation expenditure database (PARVS) to estimate the economic impacts associated with national forest visitors (Propst, 1988). The PARVS (Public Area Recreation Visitor Survey) was a national survey of, among other things, the amount of expenditures associated with outdoor recreation trips to public lands in the US[5]. The only version of IMPLAN available at that time was stored on a mainframe computer at the US Forest Service's branch office in Ft. Collins, CO. Analysis and reporting were cumbersome and time-consuming. Not only did visitor expenditures have to be converted by hand to input-output model sectors and appropriately

[5] In existence since 1960, the PARVS, its predecessors and its contemporaries have provided national outdoor recreation activity and other vital trend information for planning purposes. The PARVS and its current version, NSRE (National Survey on Recreation and the Environment) were coordinated by H. Ken Cordell at the US Forest Service's Southeastern Experiment Station in Athens, GA (Cordell et al. 1999).

margined to retail, wholesale and transportation sectors (Propst and Siverts, 1990), construction of a regional input-output model and printing the results were not simple tasks. Batch jobs were submitted via a Radio Shack TS-100 portable computer to the mainframe in Ft. Collins where they were typically completed in a day or so. The output was then sent from Ft. Collins to the Forest Service's "high speed" printer in East Lansing, Michigan. The analysts would call the Forest Service office to ascertain that the printed output was available and then arrange for pick up by personal automobile. If there was even a simple mistake in the batch job or if the analyst wanted to make a minor sensitivity-type change and re-run the job, the whole process was repeated. Not included in this description of steps is the fact that the analyst had to be reasonably well versed in economic impact and input-output analysis concepts and trained in the use of the IMPLAN software. Clearly, the goal of placing the power of IMPLAN in the hands of more regional planners and analysts was far from being a reality.

Early 1990's Research and Innovations

However, this research did reveal what was required to perform these kinds of economic impact analyses. In particular it revealed the need for the development of a "bridge" table for outdoor recreation and tourism expenditures to greatly shorten the time required to perform an IMPLAN analysis (Propst and Siverts, 1990; Stynes and Propst, 1992, 1995). It also revealed the need for better data.

At that point in its developmental history, the PARVS consisted of a lengthy personal interview that was administered to visitors on-site. The interviews took place on a variety of public lands across the US. Because of the length of the interview, the accuracy of the expenditure data was not always clear. Furthermore, for some local applications (i.e., computing economic impacts for subnational regions), the sample sizes were rather small. The PARVS served its primary purpose well. But its primary purpose was not to generate the type of visitor expenditure data required to perform local economic impact analyses.[6]

The Forest Service, Army Corps of Engineers and researchers at Michigan State University began a series of efforts in the late 1980's and early 90's to address the bridge table and expenditure and database issues. The Corps of Engineers (CE), wanting a recreation expenditure database that reflected the water-oriented and primary destination nature of its clientele, awarded a grant to Michigan State University. Covering the summers of 1989 and 1990, the grant provided funds for trained interviewers to spend anywhere from four to twelve weeks at one of twelve CE projects across the continental US. Following a sampling schedule, the interviewers queried over 3,000 visitors during the two summers. Researchers used the interview results to produce a database (Propst et al. 1992a, b) which the CE utilized during the 90's for a variety of economic impact studies and applications that are described later in this paper. The database contains spending data in as many as 33 detailed trip-related and durable goods items for up to 12 visitor segments that are homogeneous with respect to their spending behavior at CE projects (e.g., day users who boat, campers who do not boat). The location of spending can be divided into two zones: spending within 30 miles of the CE project's borders (roughly corresponding to contiguous counties) and spending outside the 30-mile radius. In this manner, both local and broader regional economic impacts may be derived (Jackson et al., 1992; Propst et al., 1998; Stynes et al., 1998).

The database was extremely useful but IMPLAN analysis was still tedious and time-consuming. The Forest Service staff in Ft. Collins developed a DOS version of IMPLAN (Figure 1) which made the software available for installation on personal computers (Taylor et al. 1992). This greatly cut down on the amount of time required to obtain printed output. However, it still was not unusual, even with the most powerful PC's available at the time, to begin the construction of a regional input-output model when one left the office for the day so that the results would be available by the next morning when the analyst returned to work[7]. In addition, the analyst still faced the laborious task of bridging the 33 (or however many) survey expenditure items to the sectors contained in the input-output model. This step involved

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[6] The U.S. Fish and Wildlife Service had also conducted a national survey (in 1985) that collected recreation expenditure data. However, such data were collected from hunters and anglers only and suffered from the same sample size restrictions in subnational regions as did the PARVS.

[7] The matrix computations required to construct a full 528 X 528 sector model for the entire US economy can now be performed in a few seconds or less.

entering a large number of figures by hand, a time-consuming process prone to errors (Propst and Siverts, 1990).

Bridge Tables

Rapid enhancements in the storage capacity and speed of personal computers reduced the amount of time it took to construct regional input-output models to seconds. With funding from the Forest Service and Corps of Engineers, the bridging challenge was addressed by the author in conjunction with Dr. Alan Watson (then at Georgia Southern University) and Dr. Eric Siverts (then with the US Forest Service in Ft. Collins). Utilizing two separate visitor expenditure databases, one for the Forest Service and one for the Corps of Engineers, the author and Alan Watson created standardized bridge tables in spreadsheet format for the items in the survey instruments. The author and Eric Siverts then used database management software to create a bridge table file that IMPLAN could import (Figure 1) and have available to complete an economic impact analysis (Propst, 1994a). This importable bridge table completely standardized and automated the previously time-consuming bridging process for Corps of Engineers applications. The analyst could open IMPLAN, construct a regional model and import all the relevant margining and bridging information in a matter of minutes. Even the process of setting local purchase coefficients, or LPC's, was automated (Propst, 1994b). The analyst still had to enter spending averages for each item in the survey and an estimate of total visitation, but an economic impact analysis could be completed in minutes.

MIREC

While efficient, the new system was not extremely user-friendly. The analyst had to be trained in the use of IMPLAN and enter a vector of spending averages by hand. Even worse, the reports that were generated were voluminous and difficult to interpret. To make the system more user-friendly and make visitor spending data more widely available, Dan Stynes and the author at MSU developed a system of spreadsheets, which interacted with each other via a set of VisualBasic commands. The authors called this system MIREC for "Micro-IMPLAN Recreation Economic Analysis" (1992, 1995).[8]

With MIREC (Figure 1), the analyst does not have to engage in extensive primary data collection. The investigator can choose to accept one of the existing expenditure databases or modify it with his or her own data, if available. The analyst then supplies the necessary visitation data[9] and MIREC applies the bridge table and transforms the data into the appropriate form for input into IMPLAN. MIREC then uses IMPLAN output to generate a series of simplified tables, bar graphs and pie charts which summarize the direct visitor spending as well as estimates of indirect and induced effects in terms of output, income or employment. In short, MIREC automates many routine and technical matters so that users can focus on application and interpretation.

Recent Refinements: 1994 to Present

Throughout the 90's economic impact studies in recreation and tourism using IMPLAN alone or the MIREC system proliferated.[10] The Corps of Engineers has used and continues to use the results of the economic impact studies that it funded for several purposes (Jackson, personal communications, 2000):

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[8] The US Army Corps of Engineers, Waterways Experiment Station supported the development of the default expenditure profiles in the MIREC database and the general development of the MIREC system. The framework for the system and the research agenda to develop it were established during the economic impact conference and workshop held at Michigan State University in 1984 (Propst 1985).

[9] Obtaining reliable visitation data, transforming it into the appropriate units of analysis and disaggregating it into visitor segments can be a time-consuming task and remains one of the biggest challenges in estimating the economic impacts of recreation and tourism.

[10] See Stynes and Chang (2000) for a listing of MIREC and IMPLAN applications. The Minnesota IMPLAN Group's "IMPLAN Newsletter" and website (www.IMPLAN.com) contain citations and examples of additional IMPLAN applications.

1. General Public Information. Results are used by project[11] and district staff in public information outlets such as press releases, brochures, and presentations. Usually, the desire is to communicate very broadly and generally the total economic activity associated with current operations at the project level.
2. Facility Specific Impacts. Results focus on a specific aspect of recreational use on a specific project. For instance, the economic impact of an individual campground or potential impact of expanding a campground may be estimated for use in acquiring support for capital investments.
3. Impacts of Operational Changes. Results focus on a change in reservoir operations usually associated with water management issues at the river basin level. For example, increasing the water level on one section of a major river for navigation purposes may draw down the level and hence affect recreational access on another section. The economic impacts of the draw down can be estimated. Results may be integrated into optimization models to evaluate tradeoffs among operational alternatives.
4. Congressional Testimony. Results are used in congressional hearings by Washington level staff to characterize national economic effects at a general level of detail. Hearings may be routine appropriations hearings or specific to an individual issue such as local economic development.

Software development also progressed in the second half of the 1990's (see Figure 1). The Windows version of IMPLAN, IMPLAN-Pro became available in 1996 (Minnesota IMPLAN Group, 1996). MIREC was modified to work with IMPLAN-Pro. Given estimates of recreation demand, the whole economic impact analysis process has been reduced to a fairly quick, "push button" process. For example, an analysis of the impacts associated with Corps of Engineers recreation visitation on 42 state economies was completed in one week (Propst et al. 1998).

A major recent innovation was removing the need for IMPLAN entirely (Figure 1). After completing numerous studies for federal and state agencies, researchers at Michigan State University realized that there were relatively minor variations in multipliers for broad categories of regions based on economic complexity. Thus, they constructed a hundred or so regional models for regions of various size and complexity and made the relevant multipliers available (Chang, forthcoming; Stynes et al., 2000). The analyst can now pick multipliers from a list depending on characteristics of the study region (Becker 1997). IMPLAN can be used to modify the multipliers as the need arises. For example, major changes to a region's economy may necessitate updated multipliers.

An enhancement to the credibility of the results was switching from IMPLAN's Type II to Type SAM multipliers (Minnesota IMPLAN Group, 1996). Type II multipliers tend to overestimate the employment effects in the tourism industry, whereas Type SAM multipliers are more conservative and more appropriate for tourism and recreation applications (Stynes and Chang, 2000; Stynes et al., 2000).

The Internet has led to some important web-based applications and refinements. Analysts can now access one website (Stynes and Chang, 2000), download the appropriate software, pick the relevant data, and, depending on the study region and agency, estimate economic impacts of recreation or tourism scenarios for the state of Michigan, US Army Corps of Engineers, or National Park Service.[12] A major advantage of reducing the need for IMPLAN and making the software and data available on the World Wide Web is the speed in which future analysts can be trained. In a recent training workshop at Michigan State University, the author and his colleagues were able to train novice National Park Service staff members on the use of the web-based software (MGM2) in a day and an half. The staff members who brought specific data and applications with them were able to complete the training and leave with draft reports.

Issues and Trends

[11] In Corps of Engineers' jargon, a "project" refers to a water resource development project, which may include reservoirs, locks and dams and other projects.

[12] The relevant software for Michigan applications is called MITEIM ("Michigan Tourism Economic Impact Model") and for the National Park Service, MGM2 ("Money Generation Model, Version 2"). The MIREC model developed for the Corps of Engineers has been superceded by MITEIM and MGM2.

Technology has created in 17 years the ability to go from a cumbersome mainframe computer system and much training with highly skilled specialists to the situation where anyone with access to the internet can press a few buttons and quickly obtain economic impact results for a given region or scenario. IMPLAN or other input-output modeling software is no longer even necessary. There have been other, non-technological improvements as well. Some recreation and tourism expenditure databases are much more accurate than ever before. Multipliers are more realistic and credible than they have been in many past studies. It is also much easier to train field staff how to do these types of analyses than it once was.

A weak link in the system remains "demand" data – good quality, consistent visitation data that can be partitioned into visitor segments that are homogeneous with respect to their spending patterns. Some agencies (US Forest Service, US Army Corps of Engineers, National Park Service) have adjusted the ways that they collect and report their annual visitation figures to address this issue. Yet, there is still a need for much coordination across agencies. For example, units of analysis still vary widely and must be converted into party-days, party-nights, or equivalent units that make sense with respect to how visitors/tourists spend money and are asked to report it.

There is also a very real logistical concern pertaining to technical support. We have some evidence that field staff can be fairly easily and quickly trained in the use of web-based economic impact analysis systems. However, our recent experience with the training of National Park Service staff revealed that such personnel still want the "experts" in a central location to do the bulk of the analysis and interpretation of the results. Funding for technical support remains a major challenge.

A broader question that researchers must now begin to address is: "Is it too easy?" One can easily and fairly inexpensively generate economic impact results without understanding their bases and assumptions. For example, one of the major disadvantages of input-output analysis is its inherent linearity assumption. Simply stated, economic impacts (i.e., sales, income, jobs, etc.) grow in direct proportion to the number of tourists or recreationists that are attracted to a region. There are no implicit constraints to this growth, yet environmental and social systems cannot withstand unlimited human impact. It is easy to generate economic impact results, and hence easy to ignore or minimize the equivalent social and environmental impact data that can, do and should serve as constraints on the unbridled growth implied by input-output analysis.

Despite concerns about overlooked constraints and unquestioned assumptions, IMPLAN can be credited with providing a conceptual framework and analysis system for understanding the problems associated with accurately estimating the economic impacts of recreation and tourism. Refinements to IMPLAN have resulted in an easily accessible, inexpensive system for generating one type of information that decision makers in the age of accountability are demanding: regional economic impacts. The original purpose and value of IMPLAN remain, but the continual need to run IMPLAN for every economic impact analysis in recreation and tourism no longer exists.

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