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An Integrated Science Plan for the Lake Tahoe Basin: Conceptual Framework and Research Strategies

Editors

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Front cover: Lake Tahoe view from Mount Rose Highway scenic pullout, looking northwest toward Tahoe City, California. Back cover: Lake Tahoe view from Mount Rose Highway scenic pullout, looking south. Both photographs by Peter Goin.

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Chapter 7: Integrating the Social Sciences in Research Planning[1]

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Introduction

The social sciences were included in the science plan to explicitly recognize that the processes underlying environmental degradation, as well as environmental conservation and restoration, are fundamentally based on human decisionmaking. Effective management of the natural environment relies on a well-grounded understanding of human behavior, the interaction of social and natural processes, and linking information from the social sciences to policymaking. This has become an explicit component of environmental management in the Lake Tahoe basin with the inclusion of the concept of the "Triple Bottom Line" in the Pathway planning process. This stresses that management should consider the well-being of the environment, the economy, and the community in the development of new regional plans (Pathway 2007). The term social science is used here to refer to the study of human behavior, typically through the use of the scientific method. The definition has been kept as broad as possible and includes different disciplinary approaches such as economics, sociology, and political science, as well as interdisciplinary fields of study such as community planning, decision sciences, policy evaluation, and socioeconomic development. It also includes applications of social science methods and knowledge in management decisions such as data collection methods, monitoring, evaluation, modeling, organizational behavior, and policy process evaluation.

Although there have been numerous academic studies calling for integrated environmental assessment that explicitly include the social sciences (see Cortner 2000, Endter-Wada et al.1998, Mascia et al. 2003, Meyer 1997, Redman et al. 2004), to our knowledge, this is the first attempt to include a social science chapter in a science plan. We have attempted to develop both a broad framework for understanding the collection and use of the social sciences as well as specific types of information requested by stakeholders in the Lake Tahoe basin. There are a wide variety of methods in the social sciences that can be brought to bear on the types of research identified in this chapter. These range from qualitative interviews to quantitative surveys, cost/benefit and cost-effectiveness analyses, program evaluation, public

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management, and policy analysis. All methods involve tradeoffs in terms of the reliability, validity, replicability, and overall utility for answering specific management needs. For some questions, such as conflict resolution and community vision development, qualitative interviews and consensus-building workshops are likely most appropriate. In others, such as ranking cost-effectiveness of various projects or models of projected fiscal revenues, more quantitative methods are preferred. The method to be used depends on the specific research questions and the methods ability to provide useful information for management decisions.

The goals of this chapter are to (1) identify social science data and research needs for management objectives that are not directly environmental, (2) describe the research needs necessary to improve policy design and implementation for managing environmental conditions, and (3) develop a framework for prioritizing social science research needs in areas that focus on the interaction between the human and natural environments. In many ways, the social sciences could be considered an overarching theme that encompasses all human-caused drivers of environmental change. However, in following the organization of issues set out in various management plans and process documents (see table 1.1, chapter 1), this chapter focuses on five subthemes determined as unique to Lake Tahoe basin social sciences: recreation, transportation, economics, noise, and scenic resources. Additional areas of research interests and cross-cutting issues identified by the various stakeholders are discussed throughout the chapter. Issues that were common across the subthemes have been organized into a section of "meta-themes" and include the following topics: collaborative information management; community management, program evaluation, policy design and policy process evaluation, management of fire and natural hazards, and climate change impacts.

Methodology

Social science research on the Lake Tahoe basin is limited in comparison to the amount of natural science investigation and data collection. The 2000 Lake Tahoe Watershed Assessment states that "relatively little comprehensive or integrated social and economic analysis has been done in the basin to date. Nearly all the recent economic studies conducted in the basin have been focused either on a specific sector or geographic region" (Murphy and Knopp 2000). There are challenges to even simple data collection and analysis in a watershed that spans two states, five counties, and one incorporated municipal area, and includes federal, state, and utility district lands as well as several special government units and private landholdings.

Information on the social science research needs for the Tahoe basin was gathered using a number of different methods. First, relevant literature on the various subthemes was reviewed. Documents included general background work on the role of social science in environmental management (Cortner 2000, Imperial and Kauneckis 2003, Mascia et al. 2003, Redman et al. 2004, Sturtevant et al. 2005). Reports specific to the Tahoe basin included the Lake Tahoe Watershed Assessment (Murphy and Knopp 2000), the Pathway Process documents (TRPA 2006c, 2006d), the Tahoe Regional Planning Agency (TRPA) Threshold Evaluations (TRPA 2006a), the Environmental Improvement Program (EIP) (TRPA 2001b, Tahoe Federal Interagency Partnership 1997), and regional work such as the Sierra Nevada Ecosystem Project (Centers for Water and Wildland Resources 1996, 1997; Elliott-Fisk et al. 1996; Nechodom et al. 2000a, 2000b) and other basinwide assessments of management and data needs (Halsing et al. 2005, Nechodom et al. 2004, Tracy 2004). Private sector activities and concerns related to economic health and community well-being were examined in various economic assessments, regional strategic plans and community development forums (Jones and Stokes 2000; North Lake Tahoe Resort Association 2004, 2007; TRPA 2006b). Particular attention was paid to studies that inform the subthemes considered in this chapter.

From the literature review, a list of topics for discussion was sent to a wide range of Tahoe stakeholders including federal, state, and regional resource management agencies; local governments and utility districts; representatives from chambers of commerce and other business associations; and environmental organizations. A letter was sent explaining the Tahoe Science Consortium's (TSC) purpose in developing a Tahoe basin science plan, asked the recipient to comment on the relative importance of the items on the list, solicited additions or modifications, and requested followup meetings and conversations. Written and verbal responses to the letter were compiled and are discussed in the relevant sections below.

The third step involved a series of focused meetings and workshops held with two important stakeholder groups: natural resource management agencies and chambers of commerce.[4] Each of the five subthemes was discussed with the resource management agencies to determine the science needs of the participants. Workshops held with both the north and south shore chambers of commerce were less explicitly oriented on the goals of this chapter, but rather sought input on developing measures and indicators of the more broadly defined concept of sustainable communities. The input of all stakeholders was reviewed to discern common areas

[4] The full array of participating organizations is too numerous to report here; however, the "Acknowledgments" section of this chapter lists the most substantive contributions and key participating organizations.

of interest for social science research and those that might best serve the widest audience. Emphasis was placed on those topics that were within the regulatory mandate of one or more Tahoe basin agencies, or that could best serve the needs of environmental management and offered opportunities for collaboration in funding, data collection, and distribution of information.

The first draft of this chapter was sent to registered attendees of the TSC's Tahoe Science Symposium, which took place in October 2006. Major themes and findings were presented to attendees and discussed in a 3-hour breakout session. Input was included in a second draft of the chapter, that was then sent to social scientists and other stakeholders who work in the Tahoe basin. Thus, key local participants have had a number of opportunities to correct, modify, and add contributions. A draft of the science plan was sent for external review by the U.S. Environmental Protection Agency, with comments received in July 2007. Reviewer comments and suggestions have been fully addressed through chapter revisions, in the response to reviewer's comments, or with additional analysis. Based on the information collected at this stage, a list of research needs was identified and is presented in the following tabulation. These included a broad array of issues related to monitoring, research, and application of social science data and methods. Individual items are listed within subthemes and organized according to whether the issue represented data collection and consolidation, monitoring for a specific management need, public agency management and collaboration, or program evaluation and policy design.

Summary of social science research needs identified

Recreation subtheme
Data collection and consolidation:
• Development of a set of core questions to be used in all recreational surveys within the Tahoe basin (R1)[a]
• Development of a 3-year recreational survey cycle as suggested by the Tahoe Regional Planning Agency (TRPA) (R2)
• Track recreation accomplishments and needs over time at the basin level (R3)
• Collection and consolidation of recreation data at larger spatial scales (e.g., regional and basinwide) (R4)
Monitoring for management needs:
• Research recreational capacity at the site and regional level (e.g., South Shore/basin) (R5)
• Quantitative evaluation of adequacy of current measures (e.g., TRPAs PAOT system and indicator) (R6)
• Statistical analysis of the factors associated with current measures of recreational quality (R7)
• Investigations of the spatial and temporal variation of the environmental impacts of recreational activities (R8)

Recreation subtheme (continued)

- Investigations of the link between recreational activities and associated infrastructure (R9)
- Research on crowding-out owing to price, incompatible activities, and infrastructure (R10)
- How vulnerable are recreational facilities to natural hazards? Can resiliency to such hazards be improved? (R11)
- How vulnerable are recreational facilities to climate change? Can resiliency to such hazards be improved? (R12)

Public agency management and collaboration:

- Develop common data-sharing infrastructure and coordination of data collection efforts (R13)
- Knowledge-sharing about effective approaches used in other alpine resort communities (R14)

Transportation subtheme

Data collection and consolidation:

- Increase the consistency, spatial and temporal coverage of current data collection efforts (T1)
- Increase collection frequency of congestion and vehicle-hours of delay (VHD) data (T2)
- Collection of bicycle use data at the basin level (for paved and unpaved trails) (T3)
- Collection of public transit ridership data to and within basin (T4)
- Study public perception of congestion, traffic levels, and transportation issues (T5)

Public agency management and collaboration:

- Increased collaboration in data collection to serve needs beyond transportation planning, such as associated infrastructure and community development (T6)
- Centralize the collection, inventory, and distribution of transportation data at the basin level (T7)
- Develop a Web-based information source about all basin-level public transportation systems (e.g., route, fares, ridership, etc.) (T8)

Program evaluation and policy design:

- Development of a transportation indicators for environmental impact, person-hours of delay and other measure of basinwide transport (T9)
- Statistical study of the link between changing demographic characteristics and travel patterns (T10)
- Feasibility study of a commuter bus from South Shore to Minden and Gardnerville areas and increased ferry service (T11)
- Research on travel behavior and consumer choice within the Tahoe basin (T12)
- Research on the impact of increased second-home ownership on transportation planning (T13)
- Research on transportation options for lower-income workers and the link to affordable housing (T14)
- Evaluation of effective policy options for increasing public transit ridership (T15)
- Evaluation of effective policy options for managing illegal parking at recreational facilities (T16)
- Evaluation of transportation research and use of alternative transportation in other alpine resort communities (T17)

Transportation subtheme (continued)

- Examination of the linkages between transportation and recreation, land use, economics, and other management issues (T18)
- How vulnerable is the transportation infrastructure to natural hazards? Can resiliency to such hazards be improved? (T19)
- Develop long-term predictive models of vehicle use, transit ridership, and demographics (T20)

Economics subtheme

Data collection and consolidation:

- Develop a reporting system of business/construction permits and permitting costs (E1)
- Increase data collection and analysis of housing trends at the community and basin level (E2)
- Increase data collection and analysis of employment trends at the community and basin level (E3)
- Increase data collection and analysis of tourism trends at the community and basin level (E4)
- Increase data collection of community quality of life variables (e.g., school enrollment, arts funding, etc.) (E5)
- Collect and consolidate basin-level demographic data (e.g., part-time residents, homeownership, commuters, etc.) (E6)
- Increase data collection on socioeconomics of populations such as low-income workers, Latinos, and Washoe Tribe members (E7)
- Increase data collection on affordable housing for year-round residents, public sector employees, and service workers (E8)
- Research on the development and use of community sustainability and well-being indicators for directing long-term planning (E9)

Monitoring for management need:

- Research the impact of redevelopment projects on housing, employment, and tourism (E10)
- Investigate the linkages between housing and land values, environmental quality, environmental regulations, tourism, economic health, and community well-being (E11)
- Research on the competitiveness of Tahoe-based businesses and leveraging the local Tahoe businesses (E12)
- Predictive, simulation modeling and forecasting of interaction of housing prices to job, wages, tourism, regional economy, and environmental regulations (E13)
- How vulnerable is economic and community well-being to natural hazards? Can resiliency to such hazards be improved? (E14)
- How vulnerable is economic and community well-being to climate change? Can resiliency to climate change be improved? (E15)

Public agency management and collaboration:

- Develop a community and basinwide information sharing infrastructure on economic and community well-being data (E16)
- Research into the system of collaborative funding involving both public and private sector for economic research (E17)
- Develop knowledge-sharing system on property valuation and housing dynamics in similar alpine tourism communities (E18)

Economics subtheme (continued)

Program evaluation and policy design:

- Evaluation, prioritization, and coordination of EIPs projects (E19)
- Feasibility studies of new environmental policy approaches (e.g., emissions trading, carbon markets, land coverage banking) (E20)
- Program evaluation of the effectiveness and cost-efficiency of existing environmental programs and regulations (E21)
- Research into effective policy options for increased affordable housing (E22)

Scenic resources subtheme

Data collection and consolidation:

- Data collection on public perceptions of the degree of light pollution and potential policy options (S1)
- Data collection on public perceptions of the scenic quality of the natural environment (e.g., forest, lake, ecosystems, etc.) (S2)
- Data collection on public perceptions of the scenic quality of the built environment (e.g., viewsheds, architecture, public space) (S3)
- Develop a meaningful TRPA Scenic Quality Indicator (S4)
- Develop community character indicators of the built environment (S5)
- Develop a scenic carrying capacity rating system (S6)

Monitoring for management need:

- Research into the links between redevelopment investment and the associated built environment (S7)
- Research on public valuation of scenic resources and link to associated management goals (S8)

Public agency management and collaboration:

- Increase the integration of TRPA indicators with other land management agencies (e.g., U.S. Forest Service, state, local governments) (S9)

Program evaluation and policy design:

- Feasibility study of new electric utility infrastructure being placed underground (S10)
- Feasibility study of a scenic easement and scenic development rights trading system (S11)
- Evaluation of effective policy options for increasing building design diversity (S12)
- Evaluation of effective policy options for improving scenic quality overall (S13)
- Evaluation of effective policy options for increasing investment in commercial, rental, and public facilities (S14)
- Evaluation of effective policy options for mitigating visual impact of private home development (S15)

Noise subtheme

Data collection and consolidation:

- Increase spatial and temporal extent of monitoring to capture single-event noise levels (N1)
- Research into the public perception and acceptability of noise levels (N2)

Noise subtheme (continued)
Program evaluation and policy design: • Evaluation of effective policy options for use of noise reduction technologies in off-road vehicles (N3) • Evaluation of effective policy options for decreasing violations of current noise levels (N4) • Evaluation of effective policy options for decreasing conflict over incompatible-noise level activities (N5)

[a] Codes in parentheses correspond to text in this chapter.

External reviewers explicitly requested prioritization of social science research needs and the inclusion of a more quantitative analyses. To develop the subset of higher priority items from the list identified in the tabulation above, an additional source of information was obtained through a Web-based survey of stakeholders conducted as an ancillary project by the University of Nevada, Reno (UNR). Survey questions were based on all comments received, as well as specific issue areas identified through conversations with data managers within each of the major resource management agencies, chambers of commerce, local governments, and environmental organizations. Invitations to participate in the survey were sent to approximately 350 natural scientists, resource managers, private and public interests, and other stakeholders identified as those who either attended the Tahoe Science Symposium or actively participate in public meetings with resource management agencies. Sixty-two responses were received from a wide variety of stakeholders (fig. 7.1). Details of the methods used and questionnaire format are available in Kauneckis and Copeland (2008).

Results from the survey are presented throughout this chapter and confirm earlier stakeholder input, as well as provide new information. Four types of information from the survey are presented in this report: (1) the relative importance of each subtheme, (2) the type of data needed, (3) the spatial scale of the data, and (4) the temporal scale of the data. The relative ranking of the importance of each issue area within each subtheme is presented in fig. 7.2. Because the purpose of the survey was to better understand social science data and research needs, questions were also asked about specific areas of research. For example, within the subtheme of transportation, the most common research topics of interest were (1) transportation choice by tourists, (2) highway use, (3) shuttle bus use, (4) alternative transportation demand, and (5) vehicle miles traveled (VMTs) (see fig. 7.3). Within each subtheme, a series of questions were asked about the type of data required for each topic, and the spatial and temporal scale necessary to make the data useful for professional decisionmaking. Results are presented in this chapter. Respondents

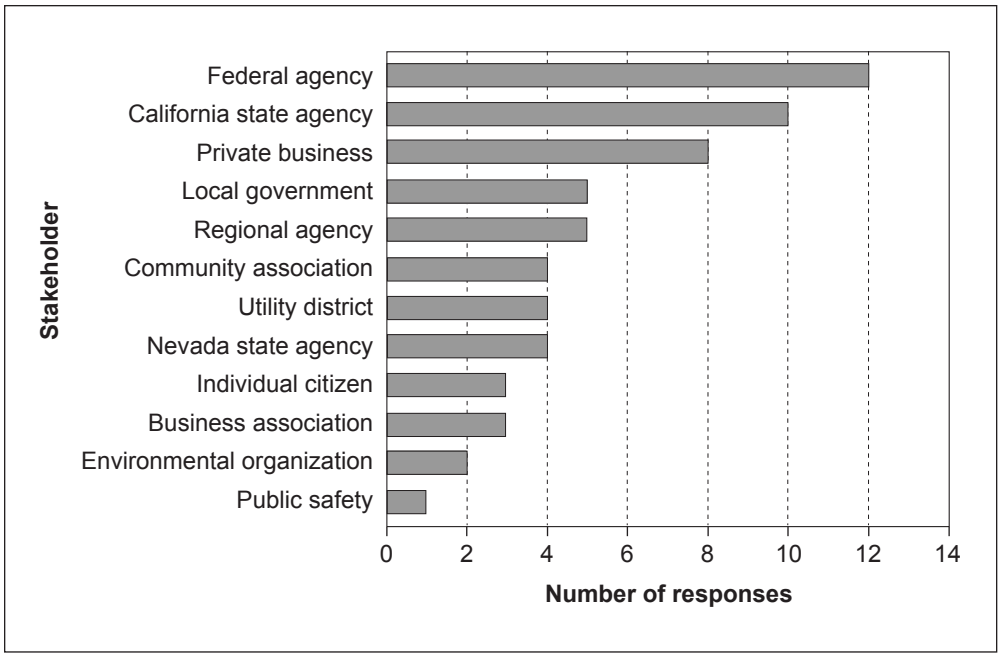

Figure 7.1— Distribution of participating stakeholders by type (n = 61). (Source: Kauneckis and Copeland 2008).

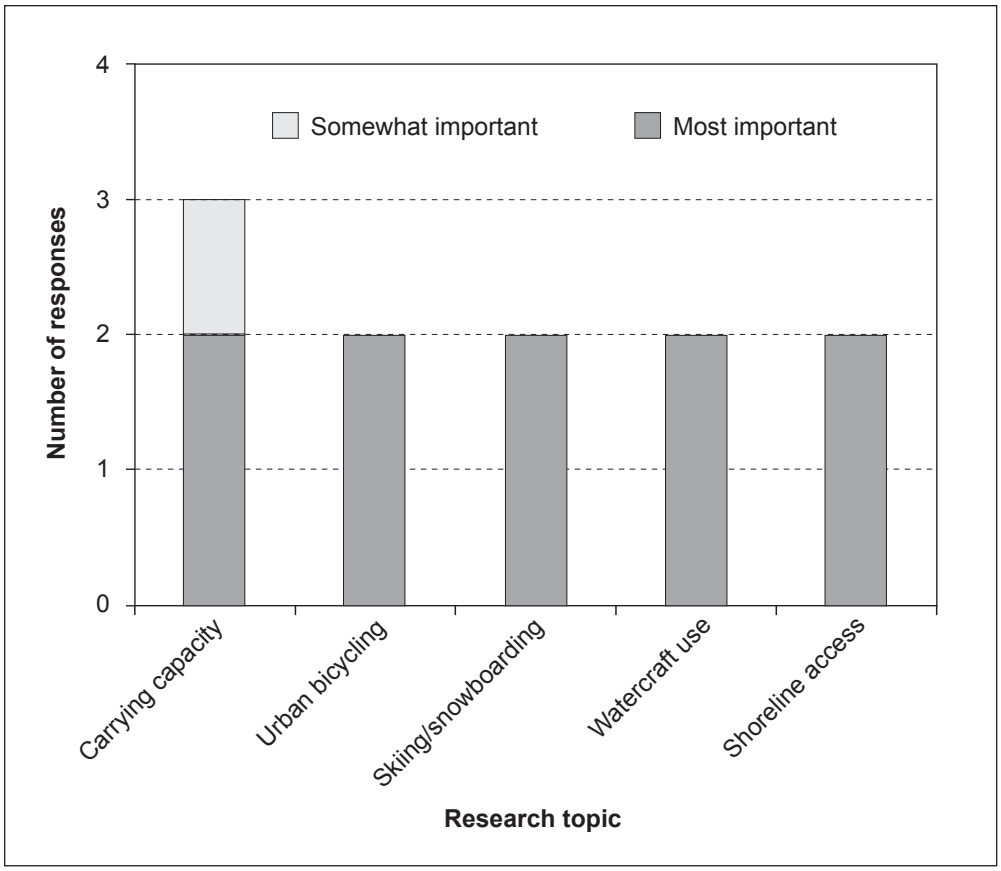

Figure 7.2—Ranked importance of recreation issues (n = 3). (Source: Kauneckis and Copeland 2008).

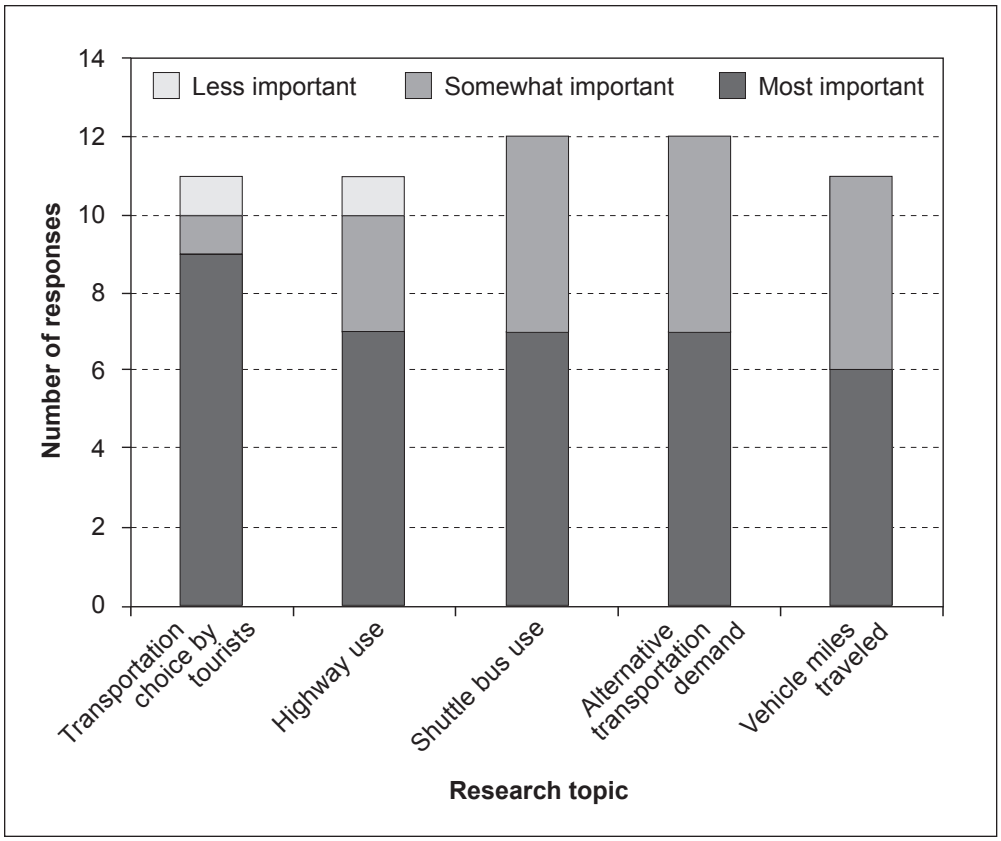

Figure 7.3—Ranked importance of transportation issues (n = 12). (Source: Kauneckis and Copeland 2008).

were given the following list of potential data types along with their definitions: current status—information on current use; future projections—expected future activity; general trends—direction of change; "what-if" scenarios—expected change if a single factor is changed; risk assessment—evaluations of potential risk; efficiency improvements—evaluations of cost effectiveness; alternative futures scenarios—expected change when multiple factors are changed; and online quick reference—single-page dashboard presentation of information. The various spatial scales of social science data were presented as follows: individual—data on individual consumer, citizen, or private landowner behavior; local political jurisdiction—information at county or municipal government level; community—information at aggregate community level (such as South Lake, North Lake, or West Shore); administrative jurisdiction—according to the government agency responsible for an area (such as U.S. Forest Service, utility district, state parks); watershed—information at the natural watershed scale (such as Emerald Bay, Truckee River, Incline Creek); habitat—information at the level of natural habitat

area (such as shoreline, forest, grassland); Tahoe basin—information at the level of the entire basin; state—information at the level of state (such as California or Nevada). Finally, in terms of temporal scale, respondents were presented with the following choices: daily, weekly, monthly, seasonally, annually, biannually, every 5 years, every 10 years. Only the most frequent responses are reported here. For the full survey results and methods, see Kauneckis and Copeland (2008).

Because the survey was designed to derive types of information different from that gained in the meetings and workshops, not all of the subthemes have a direct set of equivalent questions in the survey format. This chapter is organized on the subthemes of recreation, transportation, economics, scenic resource, noise, and five cross-cutting metathemes. The survey focused on six areas of social science research: transportation, public agency management, community well-being, economic health, public information and program participation, and recreation. So although information needs on economic activity are consolidated in one heading in this report, the survey attempted to broaden this out to include economic health of the region, various noneconomic aspect of community well-being, and cost-effectiveness of public policies. Similarly, although collaborative information management and policy evaluation are discussed in this report as separate metathemes, in the survey, aspects of public management were combined under public agency management. Survey results would be considered supplemental to those derived from the more focused stakeholder meetings, and both sources of information are complementary in informing social science research needs.

We stress that although the survey presents discrete results, it would be a misinterpretation to accept these as representing the full scope of social science needs, the priority, or even necessarily the key areas of concern by survey participants. The survey is one type of information that should be combined with others to get an accurate picture of priorities. There are important limitations of Web-based survey data collection. The survey was anonymous, and there was no attempt to screen the level of expertise in a specific issue area or the level of management responsibility. Similarly, the intensity of stakeholder preferences was not measured (the ranking does not accurately represent the weight different stakeholders assign to each item). Additionally, the survey was available for a period of 2 months, and some important stakeholders may have not had the opportunity to respond, or may have simply chosen not to respond. There are other limitations common to those familiar with online-survey methods, but the main point is that these results should be taken as evidence of interest and issues to address, not as definitive answers about the needs and priorities of research.

Based on the various sources of information examined, there was an attempt by the authors to prioritize specific research needs. These are presented in table 7.1 along with an explanation of the reasons for prioritization. Items were prioritized based on the following criteria: consistent requests across multiple information sources (publications, stakeholder meetings, and survey data), degree to which a specific item will meet a need identified by the broadest range of stakeholders (public agencies, private organizations and environmental groups), relative ease and costs through which a research priority can meet an immediate management need, and a direct link of social science research to environmental management goals. There was no attempt to reach common agreement on the priority of various research needs among the different stakeholders included in this process. Given the unique nature of questions regarding human behavior, public policy, and economics, and the different interests and management responsibilities of the diverse set of stakeholders, additional work would be recommended to find areas of common research priorities among all relevant stakeholders. The authors are of the opinion that selecting immediate priorities is best left to stakeholders and funding agencies. The priorities given here are intended only to help guide that effort.

A legitimate concern was raised by some stakeholders that by addressing the broad array of social science research questions covered in this chapter, it may distract agency effort away from their central mission of environmental management. Some of the social science issues discussed here may be better left to the private sector and local government rather than natural resource management agencies. However, research conducted during this study indicates there is more overlap between public and private sector interests than may be recognized by stakeholders, and there are multiple issue areas where research effort can be coordinated and conducted with greater collaboration. This chapter is intended to assist in that effort by summarizing the current state of knowledge, suggest some research priorities, and provide a broad framework for discussing future social science research.

Approach

The social science research discussed in this chapter can be arrayed along a continuum of simple data collection and consolidation, to more complex statistical analysis and modeling, and the process of innovation and knowledge production. Specific research topics of interest within each subtheme have been organized to indicate this complexity and placed in one of four general categories of social science research: (1) data collection and consolidation, (2) monitoring for management need, (3) public agency management and collaboration, and (4) policy

Table 7.1—Social science research priorities

Research need	Justification for prioritization
Recreation subtheme:	
Development of consistent, basinwide 3-year recreational survey cycle to track seasonal changes, crowding behavior, and long-term patterns of recreational activity change (R1, R2, and R4)	As the central economic activity of the basin, recreation is of general interest to the public as well as private stakeholders. Additional information on the quality of recreational experience, the factors perceived as increased quality experiences, and information at a basin scale can assist in planning efforts in both the public and private sectors.
Statistical analysis of the factors associated with recreational quality in order to determine visitor preference and direct future infrastructure investment (R5 and R7)	
Analysis of recreational capacity in terms of ecological impact and infrastructure at both the specific site level and basinwide (R8, R9, and R10)	
Transportation subtheme:	
Collection and analysis of current bicycle use data in order to determine road and trail use, and to determine adequacy of current bicycle routes and the potential for use as an alternative transportation mode (T3)	Identified as important information to a broad selection of stakeholders; including the local governments, resource management, and the private sectors. Items outlined here can provide baseline data for other research on public transportation.
Collection and analysis of public transit ridership data to and within basin (T4)	
Centralized collection, inventory and distribution of transportation data at a basin level (T6 and T7)	
Centralized Web-based information source about all basin-level public transportation systems (T8)	
Analysis of effective policy options for addressing parking at high-impact areas (T16)	
Predictive modeling on vehicle use, transit ridership, demographics and linkages between economic health and emergency preparedness (T18, T19, and T20)	
Economics subtheme:	
Increased data collection and analysis of housing trends at the community and basin level (E2 and E5)	There is a strong interest by the private sector in collaborating on core economic data and research questions. Affordable housing, the impacts of the growth of second-home ownership and community-well-being continue to be common issues of interest to basin stakeholders.
Increased data collection and analysis of employment trends at the community and basin level (E3 and E5)	
Increased data collection and analysis of tourism trends at the community and basin level (E4 and E5)	
Estimate affordable housing availability for year-round residents, public sector employees, and workers in service and hospitality industry (E8)	
Evaluation, prioritization, and coordination of Environmental Improvement Program projects (E19)	

Table 7.1—Social science research priorities (continued)

Research need	Justification for prioritization
Economics subtheme (continued):	
Development of community sustainability and well-being indicators (E9)	
Program evaluation of the effectiveness and cost-efficiency of existing policies (E21)	
Analysis of effective policy options for increasing affordable housing options (E22)	
Scenic resources subtheme:	
Examination of public perceptions of the scenic quality of natural and built environments (S3 and S4)	Scenic resources are directly linked to recreational experience. Although of minimal environmental impacts, they are of high importance to individual communities and planning officials. Substantial resources have already been dedicated to outlining management questions and new indicators. Additional research could assist in informing improved policy design.
Development of new Tahoe Regional Planning Agency scenic quality indicators (S4)	
Analysis of effective policy options for increasing building design diversity (S12)	
Analysis of effective policy options for improving overall scenic quality (S13)	
Noise subtheme:	
Increasing spatial and temporal monitoring to capture single-event noise levels (N1)	The research outlined here is relatively easy and directly related to processes already underway.
Research on public acceptability and perception of current noise levels (N2)	
Collaborative information management metatheme:	
Information synthesis and knowledge-sharing about effective approaches for recreation infrastructure, and about mitigating environmental impacts in other alpine resort communities.	Developing a collaborative information sharing network can facilitate data sharing across research areas, act as an information portal for both researchers as well as the public, and is the first step toward decision-support system and complex systems modeling.
Tahoe basin community management metatheme:	
Consolidation of existing information, design of new collection instruments, and examination of methods for upscaling data to the Tahoe basin level and downscaling to the community level.	Research activity needs to be able to address issues at both the basin level as well as local communities. Scaling across spatial units is critical to many of the research issues in this chapter.
Program evaluation, policy design and policy process evaluation metatheme:	
Development of policy conflict resolution mechanisms for programs working at cross purposes. Target research on policy evaluation and program design of costly programs.	Because of the highly regulated environment at Tahoe, evaluation and design issues are important both for the purpose of developing more effective and efficient policy instruments, but also for maintaining public support.

Table 7.1—Social science research priorities (continued)

Research need	Justification for prioritization
Fire and natural hazards metatheme:	
Development of a basinwide emergency communications network, implement reforms to fuels management on private parcels, and begin extensive interagency review of basinwide coordination of fuels management.	If acted on quickly, substantial reforms could be made to public agency processes and private sectors in the basin following the 2007 Angora Fire.
Climate change metatheme:	
Development of predictive models of climate change impacts on the Tahoe environment. Focus on outputs that can communicate potential outcomes to local government, the general public, and agency personnel.	Given the expected impacts of climate change to the Tahoe ecosystem and correspondingly the recreation-based economy, it would be advantageous for planning efforts to be aimed to account for projected climate impacts.

Note: Codes in parentheses reference research needs shown in figure 7.5.

analysis and program design. Data collection issues are the simplest type and involve the use of sampling methods rather than actual research and hypothesis testing. The most commonly identified social science research needs in the basin fell within this category. These tended to revolve around four issues: (1) developing more consistent questions across current data collection efforts, (2) increasing the frequency of collection efforts, (3) up or down scaling existing data to the basin and community level, and (4) expanding data collection to include new emerging management issues. Monitoring for management needs generally falls within the middle range of complexity and involves research directed at commonly identified regulatory and nonregulatory management responsibilities. Research on public agency management and collaboration is slightly more advanced and involves methods of organizational behavior and public management. Most topics mentioned in this area involve ways of increasing interagency cooperation, communication, and coordination of research results, and the development of mechanisms to mitigate perceived policy conflicts. Attention also was directed at improving the relationship between public agencies and the public. Policy analysis and program design included questions on the evaluation of current policies and programs in terms of their effectiveness and efficiency, methods to improve implementation and adoption, and examination of potential new approaches. By organizing according to relative complexity, the framework presents a tool to understand the relative ease by which the various research needs identified here can be achieved, as well as the likelihood that results can be directly incorporated into management decisions. For example, the question of whether visitors are satisfied with the selection of recreational activities available can be answered in a relatively straightforward manner through basic survey research, whereas the question of how climate change

is likely to impact recreation is quite complex and involves various projections of probable impacts and estimates of the resulting human choices based on a changing natural environment. Integrating this information into the formal planning process at a basinwide level is one step more complex as it involves multiple organizational units and the policymaking process itself. The social sciences do have methods and techniques that can address each issue, but each requires a different level of commitment and resources by the various stakeholders.

Subthemes are organized according to five topical areas and five cross-cutting metathemes. Across participant groups, the majority of the discussion focused on economics and recreation, with less attention paid to transportation, and only a few stated social science research needs on noise management and scenic resources. This deviates slightly from the ranking of priorities from the survey (fig. 7.4), but not in significant ways given the relatively small sample size and differences in the organization formats.

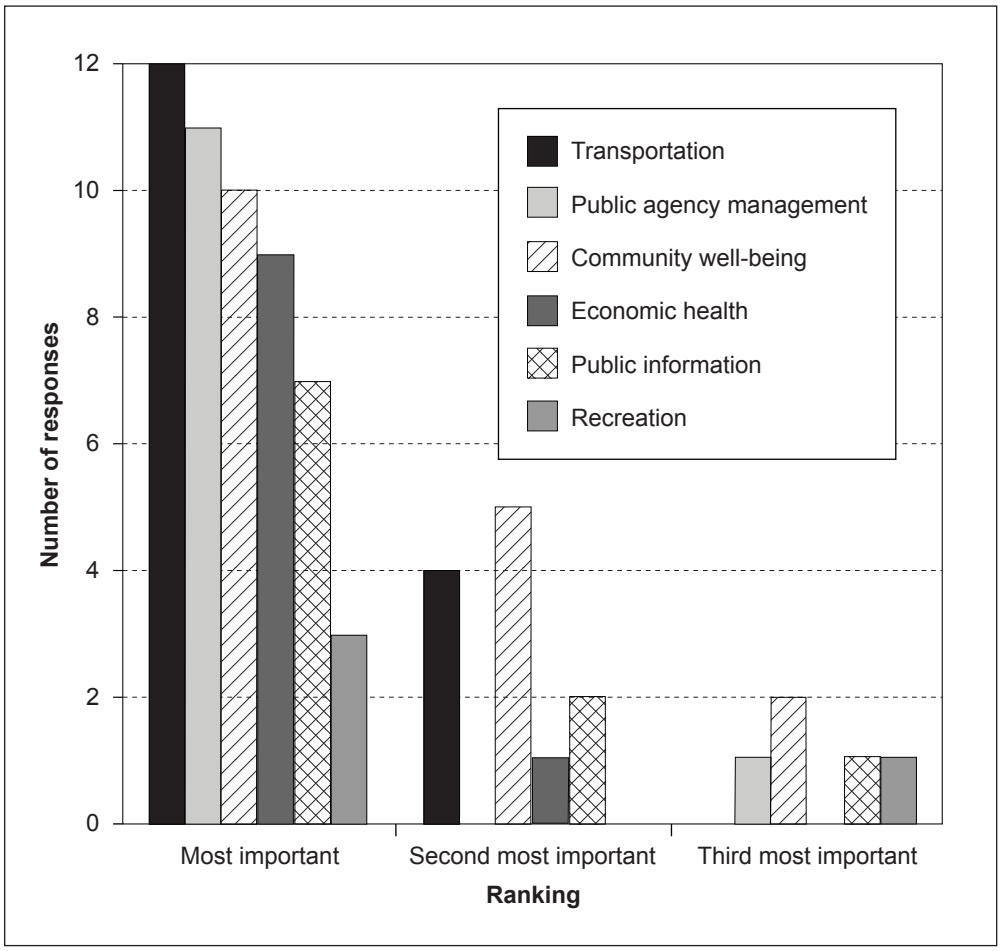

Figure 7.4—Ranked importance of social science research areas (n = 52). (Source: Kauneckis and Copeland 2008).

Conceptual Model

To develop a broad framework of how the social sciences directly impact the natural processes discussed in the other chapters, a conceptual model (fig. 7.5) is used to illustrate relations among the various subthemes and research needs discussed here. The primary drivers of the social processes impacting management at Tahoe involve broad demographic changes and dynamics of the regional economy, both of which are beyond the impact of policy decisions in the Tahoe basin. These influence visitor and resident behavior, generally referred to as choice preferences in the policy literature. Both residents and visitors make decisions regarding such

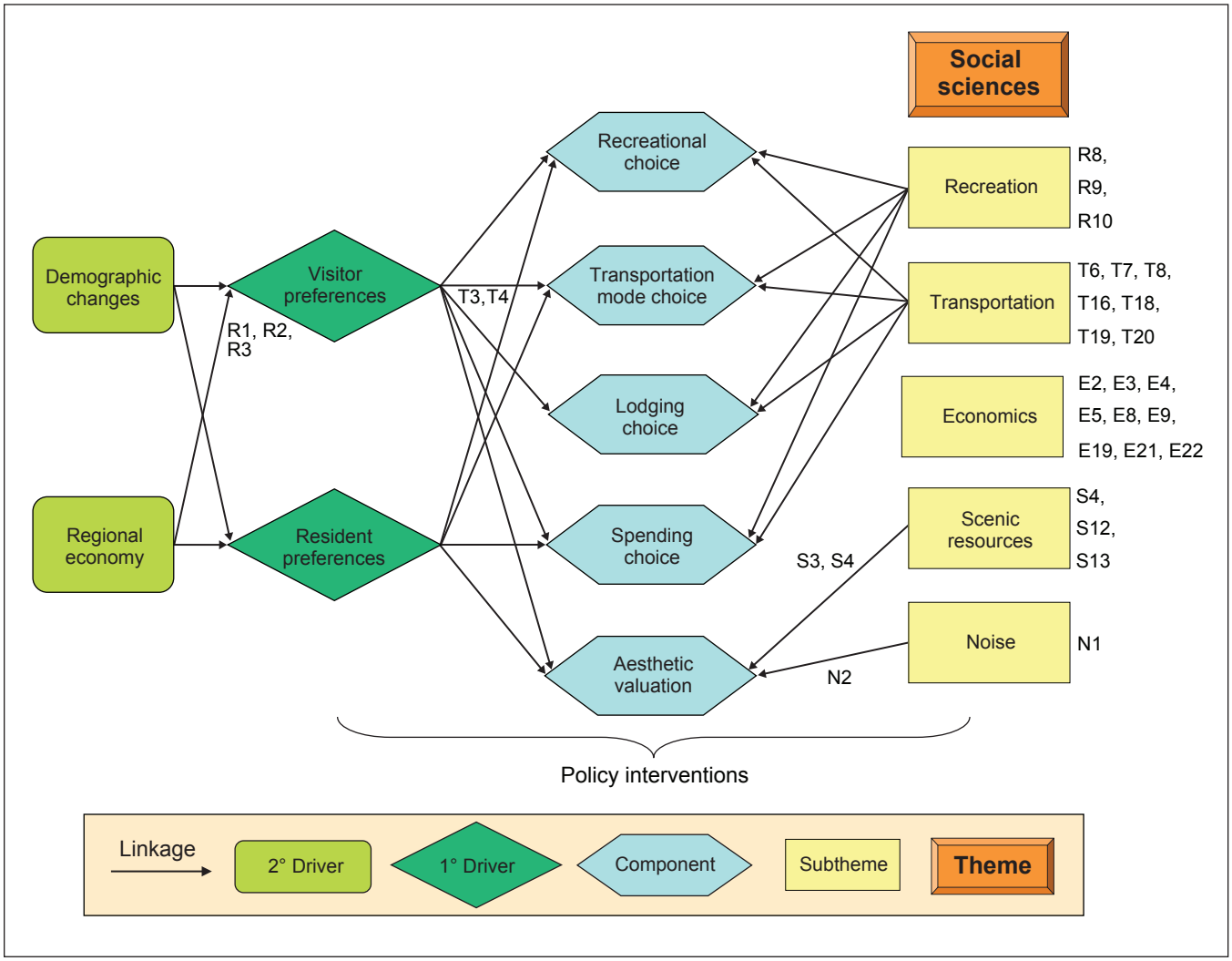

Figure 7.5.—Conceptual model for Lake Tahoe basin social sciences subthemes. Key socioeconomic components are indentified. The arrows indicate how these components are influenced by local and regional drivers as well as conditions and approaches pursued through the various subthemes. The alpha-numeric codes identify the social science research issues considered highest priority (table 7.2). Code locations indicate the conceptual model element that research would most directly influence. Near-term priorities are indicated by alpha numeric symbols (e.g., R1, T3) and correspond to the descriptions presented later in the chapter.

things as recreational activities (e.g., type, frequency, and location), transportation mode (e.g., bicycle, bus, or auto), lodging (e.g., North Shore, South Shore, or a specific hotel), and spending decisions (e.g., location of spending, amount, and item). The subtheme of recreation is impacted by a variety of different decisions, from direct recreational choices to mode of transportation, spending choice, and the aesthetic valuation of recreation sites. There are complex interactions among each of the drivers and subthemes, and the model presented here is a simple representation. Rather than outlining all the potential paths of causality, the figure is intended to illustrate the potential points of potential policy intervention by decisions made within the Tahoe basin. For example, both visitors and residents make transportation mode decisions. There are various types of interventions that can result in incentives or sanctions to influence the choice these two types of publics make. If the goal is to improve parking at specific sites for residents only, allocating parking permits to residents and issuing a threat of fines for those without permits can serve that purpose. Likewise, if increasing ridership on public transportation during periods of peak use is a goal, increasing the availability and frequency of shuttle buses makes that choice more likely. Program activity can also include providing services to account for existing patterns of behavior rather than attempting to change behavior, such as understanding the current demand for alternative transportation modes rather than explicitly attempting to increase ridership. The conceptual model is intended to explicitly outline how a policy or program change can impact the system as a whole.

Recreation

Recreation opportunities by residents and visitors are the driving force of the regional economy. Tahoe contains a wide variety of natural attractions, and tourist amenities. The natural environment provides an exceptional background for a range of multiseason activities. Managing recreation for the estimated 56,000 permanent residents, 200,000 visitors during peak holiday periods, and an estimated 15 million annual visitors—without degradation to the natural environment—presents a number of challenges. Understanding the vulnerability of recreational opportunities to both anthropogenic and natural hazards from such issues as wildfire and climate change, as well as changing consumer and citizen preferences, are important components of the long-term management of the Tahoe basin.

Courtesy of Tahoe Regional Planning Agency

Day use recreation at Sand Harbor State Park, Lake Tahoe, Nevada.

Knowledge Gaps

The most comprehensive source of data on recreational activities are the National Visitor Use Monitoring (NVUM) surveys conducted by the U.S. Forest Service (USFS) with the 2005 report for the Lake Tahoe Basin Management Unit (LTBMU) being the most recent (USDA Forest Service 2006a). A USFS document issued in preparation for a forest plan update noted that recreational visits to the LTBMU have doubled since 1988 to almost 4 million per year (USDA Forest Service 2001). These public surveys are conducted for each management unit within the USFS and are used to estimate visitation as well as activities on USFS lands. Because they are standardized for use across national forest units, they are less useful for Tahoe-specific management questions (USDA Forest Service 2006b).

The TRPA also measures recreation quality at various sites as part of their quintannual Threshold Evaluation Report process. The TRPA measures both the quality of recreation and the amount of recreation provided; the metric for this is a capacity-based system called the Persons-At-One-Time (PAOT) system. It is intended as a planning tool for examining design capacity and the provision of a fair share of recreation for public use. The PAOT works well for closed systems like ski resorts, but not as well for open areas like hiking trails. Nevertheless, PAOT

(i.e., recreation capacity) and recreation quality are both indicators of the TRPA recreation threshold. The recreation capacity indicator was attained in 2001, although the recreation quality indicator was not (TRPA 2004b); however, both indicators were attained in 2006 (TRPA 2006a).

The Lake Tahoe Watershed Assessment also contains data on the number of visitors to Tahoe and their recreational activities (Nechodom et al. 2000b). These activities include casino gaming, ski area use, dining, boating, camping, shopping, and hiking. Transportation data collected by the TRPA also contain useful information on recreational activities involving destination points. The various business organizations in the basin also use private consultant studies to collect data on specific recreational activities, spending, and the tourism market (e.g., Nozicka 2001, 2003; NuStats 2004). Much of this has been shared and published in various public reports, but to our knowledge, there has not yet been a full inventory and analysis of existing data. The Pathway planning process has begun the process of establishing new metrics and standards by developing new indicators to measure recreation quality, access, and education. These are still under refinement and discussion (Design Workshop Incorporated 2004).

Research Needs

Fourteen areas of potential research were identified for the recreation subtheme in the tabulation on page 306. These are categorized into three areas of research: data collection and consolidation, monitoring for management need, and public agency management and collaboration. Data collection and consolidation issues included requests for increased consistency and consolidation of data toward understanding trends in recreational activity across the entire basin (indicated by R1, R2, and R4 in the tabulation on page 306). Current data collection is focused on specific agency needs, and no agency is gathering adequate data for basinwide planning. Specific items discussed include more complete, frequent, and consistent surveys of recreational quality and access, recreational area usage, occupancy rates in various types of tourist accommodation units (motels, campgrounds, rented cabins), and demographic data about who partakes in various types of recreational activities and where. The TRPA has requested a 3-year cycle of surveys wherein winter recreation users are surveyed one year, summer recreation users the next, and the third year would be used for special "focus surveys" targeted to specific questions or issues (R2). It also is critical to detect differences between visitor and resident populations' opinions about recreational experiences, and usage patterns. This includes one of the most requested items, the development of a core set of survey questions to be included in all surveys conducted within the basin regardless of their specific

purpose (R1). This standardization of questionnaire data would allow for a more complete picture of general information (e.g., demographics, origin, destination, and travel cost) over a longer period and at a broader scale than what is currently collected (R4). This would enable better trend analysis and the ability to develop predictive models. Because surveys are conducted for different purposes, each survey can still have a section specific to those needs, but a subsection could be standardized. Better information is needed specifically for the capacities of open and closed recreation areas for planning parking and public transit opportunities across the basin (R4). Finally, some importance was placed on tracking accomplishments like miles of new trails or trailheads and the amount of shoreline available for public recreation (R3).

The second aspect of recreation research was characterized as issues involving specific monitoring for management need (R5–R12). There is a perceived need to go beyond simply monitoring use of recreation areas, toward understanding the environmental impacts of various types of recreation in locations with differing sensitivities (R8). For example, there is a perception that there has been a decrease in low-impact recreational activities (such as snowshoeing and hiking) and an increase in high-impact activities (such as snowmobiling and mountain biking). It would be useful to determine the different impacts of a single day of peak usage versus many days of high nonpeak usage. A very common discussion point was on exploring ways of balancing conflicting recreational use demands (R10). The potential conflicts between protecting fragile environments while providing high-quality recreational opportunities warrants research to determine the tradeoffs and means of mitigating negative impacts. Some stakeholders expressed the importance of capturing unmet demand. They wanted to know who did not participate in various recreational activities at Tahoe and why. Were they priced out, crowded out, unable to access the recreation facility, or was there some other reason (R10)?

The types of research questions presented above include statistical analysis of the factors associated with current measures toward developing a better understanding of what factors increase recreational satisfaction and how well current indicators capture the relevant management questions (R6, R7, and R8). Examples include identifying a system for capacity planning that could augment or replace the PAOT system. Specific topics for capacity-related research were parking, access, facilities, and transportation to and from the recreation areas. For example, would it be an effective strategy to design the capacities (parking, in this case) of natural recreation areas to accommodate average demand, and then augment that with free public transit on peak demand days? It was suggested that effort be made to understand the capacity differences (available and needed) between peak demand and average

demand, as well as how to choose accompanying facility designs (R9 and R10). The USFS, in particular, requested research and modeling of recreation capacity throughout the entire basin, with an emphasis on South Shore recreation areas (R7). Example research topics included the status and trends related to visitor use, visitor experience, and visitor preference on national forest lands within the Lake Tahoe basin. A study exploring the relationship between recreation capacity and recreation experience also was of particular importance to the USFS. Another proposed topic of research is the quantification of "high-quality recreational experiences" (a TRPA regulatory threshold and a major goal of the USFS and other organizations participating in the Pathway planning process) through statistical analysis of survey responses with particular quantifiable conditions in that recreation area (e.g., amount of crowding, restroom availability, interpretative signs, parking spaces, and other elements of facility design). From such analysis, predictive modeling could be completed to quantify the likely recreation experience without having to rely directly on survey responses. This type of research also included new areas of crosscutting research such as the vulnerability and resilience of tourism to natural hazards and climate change (R11 and R12), which are further discussed as crosscutting metathemes below.

The third most discussed area for social science research was the creation of a data clearinghouse or other system whereby survey results related to recreation could be better distributed to a wider variety of organizations (R11). The need for communicating information to citizens was highlighted in transportation and access to recreational areas, particularly during periods of peak use for heavily impacted areas. The dissemination of information on what other recreational communities have done to manage similar problems is another use of a data clearinghouse discussed among stakeholders (R12). The section below on "Collaborative Information Management" elaborates further on the potential uses of a data clearinghouse. Results from the survey serve to highlight some specific areas of interest; although it should be kept in mind that there were very few respondents, many respondents' likely subsumed recreational areas of interest into community well-being and economic health.

Table 7.2 illustrates the relative importance of the top five interest areas for recreation. All five issue areas were ranked the same in terms of overall importance, with the development of an indicator of carrying capacity for recreational use having the highest overall level of interest. The other areas of interest included measurement of bicycle use on trails in urban areas, skiing/snowboarding activity, watercraft use, and shoreline access. Table 7.2 presents the preferred type and format of the data. In terms of data to be collected, the majority of respondents were

Table 7.2—Recreation information

	Recreation	Carrying capacity	Urban bicycling	Skiing/ snowboarding	Watercraft use	Shoreline access
				Number of responses		
Type	General trends	**1**	0	0	0	**1**
	What-if scenarios	**1**	0	**1**	0	0
	Efficiency improvements	**2**	0	0	1	0
Spatial	Local political jurisdiction	**1**	0	**1**	**1**	0
	Administrative jurisdiction	**1**	**1**	0	0	1
	Tahoe basin	**1**	**1**	**1**	0	1
Temporal	Daily	0	0	0	**1**	**1**
	Seasonally	0	0	1	0	0
	Annually	**3**	1	1	1	1

Note: Items in bold represent the most frequent responses in each row.

interested in recreation carrying capacity and improvements in the efficiency of recreational offerings. Recreational carrying capacity is an important issue for both public and private sector interests as it impacts the use of public lands, associated public infrastructure such as parking and transportation, and the regional economy. Carrying capacity includes two aspects; the ability of infrastructure to meet public demands, and the environmental impact of recreational activities. There was a diversity of spatial extents of interest. Research on urban bicycling, skiing/snowboarding, and shoreline access was of interest at the basin level. Annual collection of data was consistently the temporal scale of interest across all recreation issues.

Transportation

The movement of people, goods, and services is an important component of the Tahoe economy and community. Creating appropriate infrastructure and mitigating the negative environmental impacts of transportation is one of the most challenging issues in the basin. Transportation issues include improving travel times for residents and visitors to the basin, reducing congestion, air pollutant emissions, runoff from road surfaces, operations and maintenance of impervious surfaces, and risk of accidents. The transportation subtheme focuses on the social science needed to understand specific patterns and modes of transportation, and their interaction with employment, recreation, and other aspects of environmental, economic, and community health. Motor vehicle transportation does generate air and water pollution, and the physical processes are described in the "Air Quality" and "Water Quality" chapters of this science plan. This section focuses on the behavioral aspects of transportation.

Knowledge Gaps

The major aspects of socioeconomic interest with regard to transportation are VMT and alternatives to private vehicle use. Also of concern are travel patterns and congestion-related delays, typically measured in vehicle-hours of delay (VHD). Lake Tahoe transportation planning is done partly by the TRPA, which has certain transportation planning responsibilities, and by the Tahoe Metropolitan Planning Organization (TMPO), which is primarily responsible for federal transportation planning. The TRPA and TMPO goals are to maintain environmental protections, plan for growth in the major population centers, and ultimately support the economic vitality of the basin. Obtaining these goals would require a functional multimodal transportation system including roads, bicycle and pedestrian paths, public transit options, and reduced traffic congestion.

The TRPA has a goal of reducing VMT by 10 percent relative to the 1981 levels, a target that has never been met. The VMT has actually increased by somewhere between 3 percent (TIIMS 2006) and 8 percent (TRPA 2004a) in the last 20 years. These rates of increase are in line with the basin's rate of population growth, but much lower than surrounding communities in California and Nevada. Growth of both human population and VMT in the Tahoe basin are constrained by limits on additional housing and roads. Despite the small increase in VMT, peak traffic volume seems to have leveled off or even declined since 1981 (TRPA 2008). The TRPA and the California Department of Transportation measure peak traffic volumes on the U.S. 50 corridor as part of their ongoing program of traffic counts. The VMT is not directly measured but rather modeled based on a program of traffic counting using both automatic permanent counters and spot counts.

The 2004 Regional Transportation Plan provides much of the available data on VMT, origin/destination, occupancy, and public transit ridership (TRPA 2004a). It also discusses those EIP that are currently underway, planned, and funded that address transportation concerns. Other sources of information are contained in the Threshold Evaluation Reports issued by TRPA every 5 years and consultant reports (see LSC Transportation Consultants 2003, 2004, 2005; Tahoe Regional Planning Agency 2008). NuStats consulting has recently conducted intercept surveys at specific locations to gather origin-destination and other data necessary for TRPA's transportation planning purposes (NuStat 2004), but nearly 30 years has passed since the same set of information was collected,[5] and some business leaders have expressed concerns about the methods and its use. A common source of tension

[5] Norberg, Keith. 2006. Personal communication. Senior planner, Transportation Department, Tahoe Regional Planning Agency (TRPA), 128 Market Street, Stateline, NV 89449.

between business and transportation planners is that a reduction in the availability of common transportation modes (typically automobiles and associated parking) may restrict economic activity. Finding the correct balance is an ongoing process.

Although there are no regulatory threshold standards for transportation, there are air quality thresholds that rely on VMT and U.S. 50 traffic volume. As a result of the Pathway planning process, a revised set of transportation indicators were presented to the TRPA governing board for approval. These proposals include an emphasis on multimodal transportation systems, viable alternatives to private automobiles (i.e., public transit that is accessible and useful to a wide range of people), and the replacement of VMT with an environmental vehicle impact indicator. If adopted, assessing the status of these proposed indicators would obviously require specific monitoring efforts (TRPA 2006c, 2006d), and these needs are discussed in the research needs section below.

The TRPA has recently replaced its transportation planning model, TRANPLAN, with another modeling software tool called TransCAD, which is being parameterized by Parsons-Brinckerhoff, Inc. The inputs are numbers and locations of occupied homes, number of workers and jobs, and travel origin and destination information for residents and visitors. The outputs are total VMT, overall delay, and alternative transportation mode splits (TRPA 2008).

Courtesy of Tahoe Regional Planning Agency

Tahoe Trolley, a seasonal public transport service running between the north and south ends of Lake Tahoe.

Although 90 percent of Tahoe visitors arrive by private vehicle and most local residents own and regularly use cars, there is a large network of public transit options, including BlueGo, the Tahoe Area Regional Transit system, the Tahoe Trolley, and private ski area shuttle buses. Ridership numbers and both temporal and spatial use patterns are available from these systems, although they have not been consolidated into a central reporting location. Overall, the network appears to be underutilized, but with "spiky" high levels of use in certain locations and periods. A system of bicycle and pedestrian paths for both recreational and transportation use exists in portions of the basin, but it is spatially incomplete enough that it does not provide a completely motor-vehicle-free experience. Finally, there are some watercraft-based transit options, including the Tahoe Queen, which ferries passengers—primarily skiers—between the north and south shores during part of the ski season, and a limited water taxi service that operates along the south shore during the summer months. There is interest in exploring expanded ferry use to mitigate congestion during other seasons.

Research Needs

Twenty areas for potential research were identified for transportation (tabulation on page 307). These were categorized into three areas of research effort: data collection and consolidation, public agency management and collaboration, and program analysis and policy design. The issue of data collection and consolidation duplicates many of the same issues in other sections, with general needs for increased volume, consistency, and replication of transportation data (T1–T5). Enhanced monitoring efforts were recommended with increased spatial and temporal coverage (T1). Data of interest included traffic counts, vehicle occupancy, origin-destination, trip purpose, number of trips per day, and others. Management agencies have stated that the base data on these topics are so spotty that there is no basinwide consensus on whether traffic volume and congestion are increasing, flat, or decreasing in recent years. Specific areas of interest include data on bicycle use on both paved and unpaved trails, in bicycle lanes, purpose of use (commute vs. recreation), miles ridden, origin-destination, and hours spent riding (T3). For mountain bike trails, interest was expressed in knowing whether people drove their cars or rode their bicycle to the trailhead. The Tahoe City Public Utility District has regularly surveyed users on its multiuse trail network over a number of years, and the methodology may serve as a model for the basin (Tahoe City Public Utility District 2007). More detailed and integrated data about public transit ridership could better inform transit operations. Particularly important would be the numbers, demographics, and transportation choices of basin visitors who did not arrive in

private vehicles. Just as important is the use of public transit to get to recreation areas or commercial cores. Better monitoring of congestion and VHD would be useful to the TRPA, as very little of that information is regularly collected (T2). It also was suggested that a metric of "person-hours of delay" be developed to include the delays experienced by people riding buses (T9).

An important addition to the collection of transportation patterns is detailed demographic information of who is going where and for what purpose, and linking this to statistical analysis of behavior (T10). Knowing the interactions between demographics and travel patterns would increase the utility of the information for general planning purposes. Similarly, it would be useful to know the differences in transportation patterns between day-use visitors, overnight visitors, and residents, especially with regard to their travel to recreation areas and commercial core areas. Collecting and analyzing these kinds of data on regular intervals is critical for presenting overall trends.

The TRPA's transportation models indicate that many of the traffic problems have stabilized or even decreased in recent years (see footnote 5), and yet prevailing public opinion is that things continue to worsen. Research into the source of these perceptions was considered useful to the TRPA and other organizations to determine to what degree this represents specific transportation infrastructure problems or just changing aesthetic values (T5). Particularly important was research to guide the development of a Transportation Environmental Impact Indicator, should it be approved. This would relate vehicle impacts directly to goals for water and air quality, wildlife, noise, and other resource areas (T7).

As with other sections, there was substantial discussion about improving interagency collaboration and developing a basinwide information infrastructure (T6–T8). It is possible that much more data exist than is acknowledged here, but there is no centralized collection, inventory, or distribution of that information. A research step of primary importance would be to review all available studies and planning documents for the purpose of compiling existing data and identifying and filling data gaps (T7). A centralized Web site with information about all public transit systems and options including route, fare, and ridership data would be tremendously useful. Broad support for this information distribution system came from both the business community and planning agencies (T8).

Many of the research issues were directly related to addressing specific questions of program analysis and policy design (T9–T20). The types of questions included determining how people and their travel behavior would respond to changes in prices of parking or gasoline, special vehicle use fees, increased or decreased congestion, mandatory public transit to certain heavily visited

destinations, and incentives to ride public transit and rideshare (T15, T16, and T17). There was discussion of the importance of understanding the linkages between transportation, recreation, land use, and population, as well as how transportation affects social, economic, and equity issues (T18). Feasibility studies of many different transportation and transit options were recommended to understand the effectiveness of various types of incentives or disincentives. There is also interest in understanding the intra- vs. interbasin traffic trends and effects on travel dynamics of job locations (T18). The trend toward second-home ownership has important impacts on transportation planning as fewer year-round residents are present (T13). Some participants requested studies of how these trends affect Tahoe basin town centers and common areas; whereas others were concerned about the impact on transit options for low-income workers (T14 and T18).

Specific studies of what it would take to increase transit ridership and reduce private vehicle use also were discussed (T15). One example given was to explore the feasibility of a commuter bus into the South Shore area from the communities of Minden and Gardnerville. Another was to study the demand and feasibility of a ferry across Lake Tahoe (T11). Currently, the approach is to increase transit options, and although many stakeholders want and value increased public transit, there has been little research done to establish the consumer demand or willingness-to-pay for public transit or the intermodal transit hubs that could accompany them. Research on the most important destinations (commercial and recreation), key locations for transfer nodes, and similar information would enable transit operations to be tailored to increase total ridership.

Parking restrictions and enforcement of violations are contentious issues in the basin. Access to recreational facilities is limited by parking capacity, yet many park illegally to access the area (Franz and Nozicka 2003). This has negative effects on the recreation destination, but it also leads to overuse and congestion on transportation corridors and to direct impacts on air quality and water quality and degradation of soil and vegetation. Research into the proper balance between increasing parking capacities, raising fees, and enforcing restrictions would benefit local communities and law enforcement, which are often at odds about this topic (T16).

The vulnerability and resilience to natural hazards (including large forest fires, earthquakes, earthquake-triggered seiche waves, and landslides) of the roads and other transportation systems in the Tahoe basin would benefit from further study both in terms of public safety and infrastructure vulnerability (T19). Finally, management would benefit from predictive modeling based on the data and insights described above: insights about long-term dynamics in vehicle use, transit ridership,

or population demographics would all improve the ability to plan for transportation infrastructure needs farther down the road (T20).

The stakeholder survey gives additional insight into the need for transportation research. Survey results (table 7.3) suggest the most important research issue is alternative transportation demand. Similar in priority were transportation mode choice by tourists, highway use, shuttle bus use, and VMT. Highway use statistics were considered of particular concern to the business community as there was a desire to distinguish destination traffic to Tahoe from that of nondestination highway traffic.

Table 7.3—Transportation information

	Transportation	Transportation choice by tourists	Highway use	Shuttle bus use	Alternative transportation demand	Vehicle miles traveled
				Number of responses		
Type	Current status	6	6	6	**8**	6
	Future projections	**7**	6	6	**7**	**7**
	What-if scenarios	5	4	4	**6**	4
Spatial	Local political jurisdiction	**3**	**3**	2	2	3
	Community level	**3**	**3**	**3**	**3**	**3**
	Tahoe basin	3	**4**	3	3	3
Temporal	Seasonally	**4**	3	**4**	2	3
	Annually	2	**3**	2	2	2
	Biannually	1	1	**2**	**2**	1

Note: Items in bold represent the most frequent responses in each row.

The most important types of data for transportation were current status and future projections (table 7.3). General trends and various forms of scenario analysis were of equal frequency depending on the specific transportation issue. Table 7.3 shows the spatial extent of concern—the Tahoe basin, community level, and local political jurisdiction—in about that order. Unsurprisingly, the temporal range for collecting transportation data across issues was seasonal, with some interest in annual data for highway use and alternative transportation demand.

Economics

For the purpose of this chapter, economics was defined as the management, use, allocation, and flow of fiscal resources. It includes aspects of the broad regional economy as well as that of specific sectors and allocation of resources among public and private organizations. Although direct interventions in the private economy

Peter Goin

Local businesses, east side of Highway 50, South Lake Tahoe, California.

should always be approached with caution, indirect impacts in terms of reducing negative externalities, producing public goods, understanding the impact of regulations, and managing the public economy are important areas of management concern.

Because economics is explicitly one-third of the "Triple Bottom Line" concept (i.e., environment, economy, and community)—and is a major part of another third (i.e., human communities)—it is not surprising that this subtheme dominated many of the workshops, symposium breakout sessions, and literature reviews. The "Triple Bottom Line" and other sustainability framework concepts arose out of the recognition that environmental management is inextricably linked with human economies and communities, and is appropriately considered in comprehensive planning strategies such as the Pathway planning process. Within the private sector, information on sector-specific economic trends can assist in improving the sustainability and competitiveness of the business community, aid in short- and long-term planning, help in developing new markets, and help in adjusting to broad demographic changes. Based on recent activity by the Chambers of Commerce, there is substantial overlap in the information demands of public and private sector organizations in the Tahoe basin.

Knowledge Gaps

There have been a number of recent attempts to identify what is known about economic activities, trends, and sensitivities at Lake Tahoe. Nechodom et al. (2000b) provided status data on the population, demographics, spending, and visitation at Lake Tahoe. However, they noted that "the broad and inconsistent range of socioeconomic data that does exist has been gathered in a piecemeal fashion, funded by the private sector or by public agencies whose missions are to support tourism and recreation." They noted that little baseline socioeconomic information is available beyond non-Tahoe specific county-level data. Other reliable information comes from the California Employment Development Department; the Nevada Departments of Employment, Transportation, and Rehabilitation; other state agencies like the Nevada Gaming Control Board; industry groups like the Reno/Sparks Convention and Visitors Authority or the California Ski Industry Association.

The TRPA releases Threshold Evaluations Reports every 5 years, which contain some information about employment and earnings distributions and housing stocks. Although socioeconomics is not one of their regulatory thresholds, various aspects are monitored as indicators of social and economic well-being (TRPA 2001a). An Affordable Housing Needs Assessment was conducted in 1997, not repeated since, which showed that 77 percent of basin employees fell into the low or very low income categories (Tahoe Regional Planning Association 1997). The Regional Travel Impact Model (RTIM) developed for the TRPA, focuses on the impacts of visitor spending both for the Lake Tahoe basin and the Greater Lake Tahoe area (which includes the city of Truckee, and ski resorts and recreational areas just outside the Tahoe basin). The RTIM model was used in the visitor spending analysis for TRPA's 2001 Threshold Evaluation Report to provide greater detail on visitor spending by visitor type and specific activities. The direct economic impacts associated with visitor spending were generated using RTIM, but were again one-time results, not trends (TRPA 2001a).

The USFS typically conducts NVUM surveys every 5 years. These surveys gather the demographics, activities, and spending data of forest visitors, but are designed for managing recreation, not for collecting economic data. The Pathway planning process draft documents set out proposed desired future conditions and proposed indicators to measure them. As part of the Pathway process, a series of place-based visioning workshops were conducted in each community around Lake Tahoe in the summer of 2006 (Regional Planning Partners 2006). The aggregated vision statements from these group discussions are available online (http://www.regionalplanningpartners.com). In addition to these Tahoe-specific efforts, county- and state-level data, as well as national census information can be brought to bear

on understanding economic trends in the basin, with various levels of difficulty involved in scaling it to Tahoe-specific aspects.

The economic and community health of Tahoe communities has also begun to be discussed as an important research need. Recent work conducted by the U.S. Army Corps of Engineers in connection with the North and South Lake Tahoe Chambers of Commerce has produced a working document outlining data collection needs for developing a set of "community sustainability indicators" that focus specifically on the human environment (U.S. Army Corps of Engineers 2008). The set of 73 initial indicators was reduced to a subset of 13 measurements deemed the most feasible and cost-effective for pursuing. The selection process used and method of prioritization provides an important model to build on for other social science research. These 13 measurements were considered in the social science priorities outlined here. Based on all of these information sources, a number of key insights emerge.

First, there is a perception that the trend toward increasing second home ownership and decreased year-round residency has serious implications for the economic viability and community character of Tahoe. The declining school enrollments have been read as a loss of families living in the basin. As in much of the country, housing prices have escalated dramatically at Tahoe. A nearly-fixed stock of housing units combined with a trend toward second homes has led to a shortage of affordable housing as less of the housing stock is available for year-round residents. Further, environmental regulations limit the ease with which additional housing can be built for lower income residents. These types of lower income workers are an important population to consider because most employment and earnings are in the service and hospitality industries. Recreation and tourism drive the local economy.

Research Needs

Twenty-two areas of research were identified for the economic subtheme (see tabulation on page 308). These are discussed in terms of the four general categories of research used in earlier sections: data collection and consolidation, research related to specific management needs, collaborative research across organizations, and program evaluation and policy design. As with the other sections, the greatest demand was in the area of basic data collection and consolidation (E1–E9). There is a need for more standardized and regularly collected data about three main topics: housing (E2), employment (E3), and tourism (E4). Given the trends toward second-home ownership, the high cost of housing for either purchase or rent, and the difficulty of adding to the housing stock, it is important to obtain the following

information in more detail and at more frequent intervals: the stocks, locations, and prices of various housing types; the numbers of full- and part-time residents; home sales figures including time-on-market and unsold inventory; number of rental properties occupied and vacant; rental rates; turnover rates of commercial and residential properties; percentage of residents who own their homes; percentage of local workers who reside in the basin; number of occupants in a residence; percentage of homes with children (and their school enrollment); percentage of median income spent on housing; percentage of households that can afford a median priced home; living conditions of low-wage earners, and assessed values/property taxes. For all of these topics, it is critical to develop estimates of the historical trends to provide the ability to project future dynamics. Some stakeholders noted that a formal and complete housing assessment, at 5-year intervals, could collect this data in a consistent manner, although others said this is akin to a local version of what the U.S. Census Bureau already does and is therefore too large an effort to conduct locally every 5 years. Further, a number of different stakeholders expressed interest in knowing how many of the current public servants (e.g., police officers, firefighters, teachers, and government employees) are able to live in the basin (E8).

With regard to employment (E3), the development of status and trends data is recommended for earnings and employment distribution, number and type of jobs, permanent vs. seasonal dynamics, place of residence of workers, poverty rates, health-insured households, the number of mid-sized businesses (10 to 25 employees), business startups and closures, and numbers of sole proprietorships (especially run out of a home). As for tourism and visitation (E4), more regular and consistent collection of community-specific data such as the number of hotel nights, total transient-occupancy tax (TOT) receipts, means of arrival and transportation around the basin, duration of stay, campground use vs. hotel stays vs. cabin rentals, the amount of uncollected TOT from cabin rentals, what activities tourists engage in and how much they spend on them are some of the data that was requested.

Community well-being indicators are included in this section as they tend to have substantial overlap with economic research needs. Survey results for this subtheme are discussed below. Many community workshop participants requested—and the proposed revised TRPA indicators would require—tracking and reporting of school enrollment, arts funding, local donation ratios (E5), and number of business/construction permits, and permitting cost distributions (E1). Interest also was expressed in understanding the socioeconomic situation of specific populations living and working in the Tahoe basin, including low-income workers, Latino populations, and Washoe tribe members (E7). Generally, this kind of information included aspects of both community well-being and interactions with other broader

areas of concern such as housing, service and tourism industry employment, tax base, and transportation (E11). A number of organizations also requested developing alternative methods of measuring economic and social well-being (E9). The Sierra Business Council developed a metric called the "Wealth Index" that includes common economic factors along with social indicators like literacy, health care, and others (Sierra Business Council 2006). There were discussions that a similar index could be developed for the Tahoe basin. This idea has moved forward in terms of the recently presented Community Sustainability Indicators (U.S. Army Corps of Engineers 2008).

Research topics related to specific management needs include an array of questions having to do with the impact of changing conditions on the basin economy (E10–E15). Topics generally revolved around understanding the elasticity (marginal change) of demand for various activities, goods, and services. This would inform decisionmakers about the expected changes in visitation, spending, home ownership, employment levels, commercial or residential rents, that might result from a change in one or more of the conditions affecting them (E10, E11, and E13). For example, how susceptible are tourism levels to changes in hotel rates or ski lift tickets? At what level of rental home increase will seasonal workers stop seeking work at Tahoe? What will be the change in property values if the air quality (visibility) or lake clarity degrades? There are a number of methods common in social science research for generating objective evidence on such questions.

A number of parties were interested in economic "leakage" of basin revenue to communities outside of the Tahoe basin. This includes workers taking their wages to homes located elsewhere, or to locals spending their income in stores in Carson City, for example. These dynamics seem to exist but have not been measured, and may provide an economic justification for expanding affordable housing in the region (E11). There also was interest in the economic impacts of special events like festivals, triathlons, or concerts (E11) and the competitiveness of Tahoe-based businesses (E12). Others mentioned broader studies on the impact of regulations on the regional economy and determinations of the marginal benefit of additional environmental quality gains (E13). This is probably the most difficult research need as it involves very complex economic interactions (discussed further below). Other complex research questions were also expressed, such as the impact of climate change and natural hazards on visitation, employment opportunities, housing values and prices, business activity, ski resort use, hotel room rentals, and the overall Tahoe economy (E14, E15). Predictive modeling and forecasting, the logical progression of many of these research efforts, might be developed to project housing prices, jobs and wages, or visitation responses to guide policy decisions more accurately (E13).

One example is projecting how redevelopment would proceed given certain incentives and market conditions (E10). Although simulations of this sort are relatively complex tasks, often producing highly uncertain results, some types of simulation modeling might produce useful information and the concept is worth exploring.

As with the other subthemes, a broad crosscutting topic was the potential for collaborative research across organizations (E16, E17, and E18). Much of the primary data are already collected periodically by various entities—the counties, the school districts, the chambers of commerce—but there is no systematic way of accessing or sharing data. The most thorough survey of existing economic data was recently conducted as part of the Community Sustainability Indicators study (U.S. Army Corps of Engineers 2008). A data clearinghouse would be particularly useful in this case, where so much of the information needed could be gathered and shared quite easily (E16). The utility of a "library" or database of land/property market valuation studies for other communities similar to Tahoe also was discussed as a component of such a clearinghouse (E18). Collaborative funding, collecting, and sharing of data will allow much more of it to be gathered at lower cost, and coordinating research efforts will allow for academic or government researchers to direct their efforts more efficiently toward needed research topics (E17).

The last category of research questions involves issues of program evaluation and policy design (E19–E22). Additional research and more extensive application of policy analysis tools were broadly included under economic research. This included consistent methods and practices for evaluating, coordinating, and prioritizing EIP projects (E19) in order to implement the projects with the greatest marginal effect first. This also included developing an implementation framework for tracking, auditing, and quantifying the benefits of various projects to maintain ongoing funding as well as broad public support. A frequently voiced concern was how to provide incentives to encourage or discourage certain behaviors. Specific research topics included understanding and quantifying incentives to increase compliance with best management practice (BMP) requirements on private lands, stimulate redevelopment of commercial or residential properties, leverage public and private investment in community spaces and green building construction (E21), provide low- and moderate-income housing (E22), slow the trend toward second-home ownership, and retain businesses in the Tahoe basin. Other research topics included studying the feasibility of trading systems for air or water pollution emissions and the expansion of land coverage "banking" systems (E20). Affordable housing issues were mentioned in this section as well as determining what housing bonuses would be needed to keep teachers or firefighters living in Tahoe communities (E22).

Overall, a number of stakeholders expressed a desire for establishing a consensus vision—or a process to establish one—for identifying and managing economic goals and ongoing monitoring of the community's social and economic well-being.

The survey of social science data needs helps to narrow the focus of this broad array of issues. The three most important items of interests were housing affordability, the economic impact of different types of visitors, and gaining access to information on similar resort economies. This was followed by redevelopment investment and general visitor profile/behavior information (fig. 7.6).

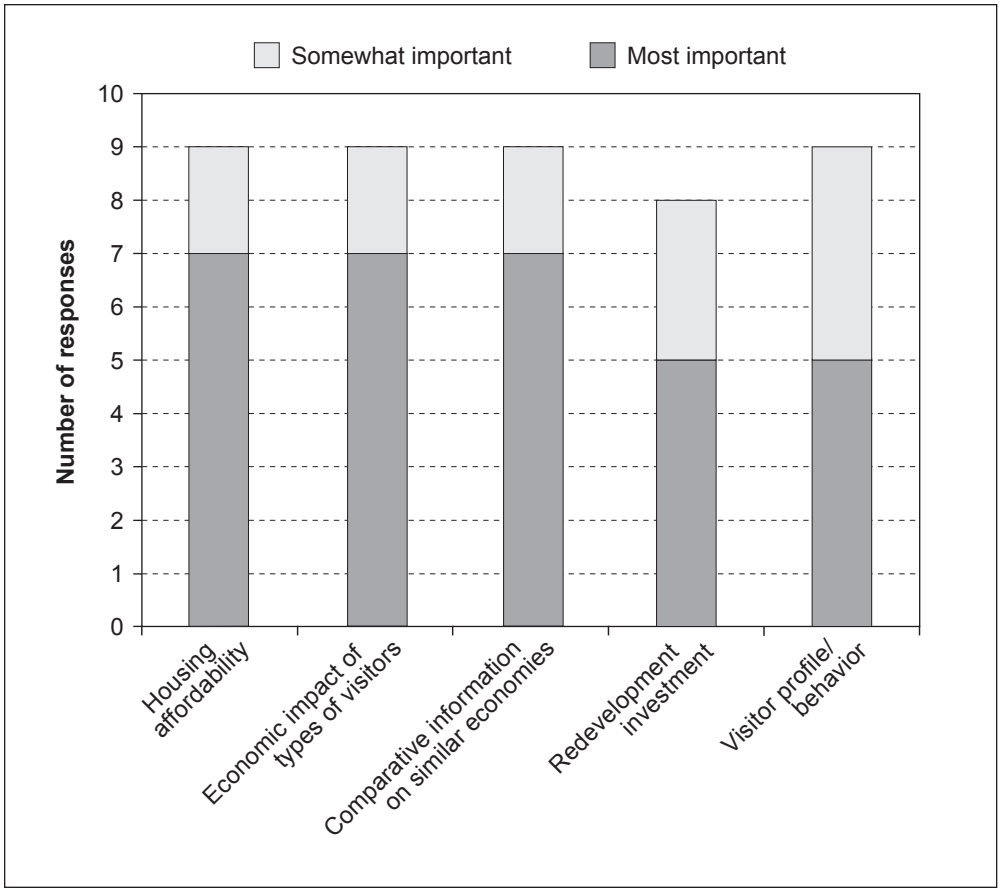

Figure 7.6—Current source of social science information (n = 50). (Source: Kauneckis and Copeland 2008).

The types of information requested differed according to the specific research areas (table 7.4). The most important housing affordability information was on current status and alternative futures (projections of alternative scenarios), followed by general trends. Types of information on the economic impact of visitors included general trends, current status (interpreted as more information about the economic

Table 7.4—Economics Information

	Economic	Housing affordability	Redevelopment investment	Visitor profile/ behavior	Economic impact of visitors	Comparative information
				Number of responses		
Type	Current status	3	3	3	**4**	**4**
	General trends	1	3	**5**	**5**	**5**
	Alternative futures	3	2	2	2	**4**
Spatial	Local political jurisdiction	2	**4**	3	**4**	**4**
	Community level	**4**	**4**	2	3	2
	Tahoe basin	2	1	3	2	**5**
Temporal	Seasonally	2	0	**3**	**3**	**3**
	Annually	4	**3**	3	**4**	**4**
	Every 5 years	0	**3**	0	0	1

Note: Items in bold represent the most frequent responses in each row.

impact of current visitation), and alternative futures. Information types on comparative information on similar resort communities included general trends, and current trends and alternative futures ranked equally.

The spatial extent of data was focused on community level for housing affordability, local political jurisdiction for the economic impact of visitors, and local political jurisdiction and the Tahoe basin for comparative data on other resort communities. The temporal extent was generally annual and seasonal.

Scenic Resources

There are a number of aspects to the management of visual resources and the scenic characteristics of the Tahoe basin. Views of, and from the lake, aspects of the built environment, and forest appearance all contribute to the overall scenic quality. Scenic quality directly impacts property values and underlies the choice of recreational activity within the basin as well as in choosing the basin as an overall travel destination. Important aspects of scenic quality are covered in other parts of this science plan, and are not directly discussed in this chapter. For example the issue of visibility loss because of air pollution is covered in the "Air Quality" chapter; and lake clarity, in the "Water Quality" chapter. It should be noted that the single greatest threat to basin scenic resources is a catastrophic forest fire, a topic considered in several other chapters of this science plan. However, the question of the social acceptance of various treatment options for forest fire fuels is relevant to this section and is discussed below and in the natural hazards metatheme.

Jim Markle

Emerald Bay, Lake Tahoe, in autumn.

Knowledge Gaps

The TRPA currently has indicators for four types of scenic resources: (1) travel route rating, (2) scenic quality rating, (3) public recreation areas and bike trails, and (4) community design. These indicators have numerical scores representing the visual appeal of each spatial unit. Each indicator has a regulatory threshold that the TRPA tries to maintain, and measurements are taken every 5 years. None of these indicators have achieved attainment of threshold values during any of the four previous evaluations (TRPA 2006a). In addition, the USFS conducts scenic class inventories on their lands. A recent document prepared by the USFS as part of preparing its next forest plan addresses changes since the 1988 plan in the scenic conditions as measured by the 1997 Scenery Management System (SMS). It notes that there has been no recent monitoring of existing visual conditions, which means that there are no data sufficient for trend analysis on USFS lands. It calls for more monitoring, a reorganization of TRPA's Scenic Resources threshold system, and an upgraded SMS for scenic inventories (USDA Forest Service 2006b).

In terms of the built environment, there has been a trend toward larger residential structures, which are more visible around the basin and block views of and from the lake. The Place-Based Planning and Forum portions of the Pathway planning process and workshops with the Tahoe Chambers of Commerce all revealed a perception of "urban blight" in portions of the basin, where insufficient investments have been made in redevelopment of commercial properties, rental residential properties, tourist accommodations, public spaces, and infrastructure (Regional Planning Partners 2006). As a result of the Pathway planning process, the TRPA Scenic Resources staff has recently proposed new scenic quality indicators to their governing board. These indicators explicitly recognize issues like community design and the built environment, the importance of improving the scenic quality and integrity rating systems, and even light pollution.

Research Needs

Fifteen areas for potential research were identified for the scenic resource subtheme (see tabulation on page 309). These are discussed in terms of all four categories of research; data collection and consolidation, monitoring for management need, public agency management and collaboration, and program evaluation and policy design. Basic data collection and consolidation needs are focused on determining a better estimate of the public demand for improved visual resource management (S1–S6). Of interest to management agencies is the public perception of the scenic values and appearance of environmental qualities like a healthy forest, lake, or ecosystem (S2). The public's perception of a healthy forest, or the visual impact of

fuels management, do not match that of a professional forester, and this can lead to conflict between staff on the ground and the general public. Issues of light pollution in the Tahoe basin were widely discussed at the science symposium, and it was recommended to develop a sense of how big an issue it actually is, how the public perceives it, and how it might be addressed (S1). The USFS document for updating the forest plan noted a similar demand by residents and visitors for night sky viewing and reductions in light pollution.

There is a broad perception (supported by TRPA Scenic Resource ratings) of increased private investment in larger single-family homes that block views and dominate viewscapes, and a decline in the visual appeal of commercial areas and rental communities owing to low investment in public and commercial areas. Some research into the accuracy of these perceptions is recommended (S3), as would be work on possible regulatory and economic incentives to address them. The draft Pathway report (TRPA 2006d) describes some details of desired future conditions and indicators for scenic qualities, in relatively vague language. The TRPA and other management agencies recommended obtaining more complete public input as a way of refining these goals and there has been increased discussion of more frequent and thorough scenic inventories (S5). One suggested way to do that is through a broader and more detailed public perceptions study or survey (S1, S2, and S3). This would provide systematic knowledge of how people want their communities to look (S6). This can be weighed against the various environmental regulations and other regulations to make policy. To date, limits to land coverage on a developing parcel have been guided almost entirely by ideas about soil capability. However, it is possible that alternatives to soil-based limitations would be useful. A "scenic quality carrying capacity" was proposed as a limiting factor to developments of all types, but particularly directed toward larger single-family residences (S6).

Monitoring for specific management needs was primarily directed toward understanding the link between questions about reinvestment and improving the built environment (S7) and studies of the public value of increased scenic resource protection (S8). Most stakeholders agree that the high scenic beauty of the Lake Tahoe region is a large part of why people live, visit, and recreate in the area, yet the actual value of scenic resources, and the degree to which public spending should be dedicated to preserving and improving them is largely unknown. A study of the value of scenic resources, both in economic and noneconomic terms (S8) was suggested. A combination of contingent valuation, hedonic valuation methods, and travel-cost studies could be conducted to provide some information on these values.

The only question regarding interagency collaboration was that of integrating the TRPA's visual resource management tools and indicators with those of the

USFS (S9). Although the different management mandates of the two agencies may not allow a single system, increased examination of the correspondence of the two systems and coordination with other public and private entities interested in scenic resource management are recommended.

As with the other subthemes, there are numerous questions related to program evaluation and policy design (S10–S15). A simple request in the community workshops was the question of whether it was feasible to put power lines underground as part of the same construction processes that will be undertaken to put in storm drainage systems and sewers as a means of improving scenic quality (S10). Overall, there were broad discussions on examining the means of directing public and private investment to those communities with the greatest visual resource declines (S14). Various participants expressed concern about homogenous residential development being a threat to "local community character." The assertion was that TRPA restrictions on coverage and other regulations have resulted in a more uniform home style: with new homes designed to maximize profit while meeting all the regulations and the outcome leading to the decline in unique visual composition of communities around the lake. Requests were made to understand the extent to which this is true, and, if it is, what might be done to induce more diverse designs (S12). Research was requested on possible regulatory and economic incentives to address various scenic resource issues involving both public and private development (S13); this included possible methods for mitigating the decline of viewscapes owing to private residential development (S15). One issue raised was examining the feasibility of a scenic easement system—analogous to conservation easements—and purchase of scenic development rights or a scenic rights trading system were also recommended as ways to balance the public demand for high-quality scenery with private property rights (S11). Visual resources were not examined in the stakeholder survey.

Noise

The noise subtheme provoked substantially less input than the other social sciences subthemes. However, some research needs were identified. Noise is an issue in the basin largely for human aesthetic reasons, although some instances of noise pollution also may affect wildlife and the quality of their habitats. For example, the northern goshawk (*Accipiter gentilis*), requires quiet and undisturbed nesting sites for breeding and is discussed as a management issue in the ecology and biodiversity chapter. Noise in the Tahoe basin is primarily anthropogenic and includes private vehicle traffic, boats, airplanes, construction, snowmaking, off-highway vehicles, and certain special events.

Knowledge Gaps

The TRPA uses a metric called the Community Noise Equivalent Level (CNEL) to assign and evaluate noise levels based on land use compatibility. The CNEL is a weighted average of all noise in a place within a 24-hour period. The CNEL standards are assigned based on land use categories and transportation corridors. A few examples of existing CNEL standards based on land use are (1) 65 decibel average (dBA) for industrial areas, (2) 60 dBA for hotel and commercial areas, and (3) 55 dBA for high-density residential and urban outdoor recreation areas. The airport CNEL value of 60 dBA applies to approved flight paths. However, TRPA Noise Resource Area staff recently presented a set of modified noise indicators to the TRPA governing board. In addition to somewhat modified decibel levels for CNEL, the proposed indicators include effects on wildlife and single-event noise levels such as low-flying aircraft.

Noise levels are monitored in only a few locations once every 5 years. This creates a temporally and spatially incomplete data set, making it hard to assess trends, adjust for temporary noise sources like construction, capture site-specific noise sources, or test actual traffic noise against the levels predicted by current noise models. In contrast, the Tahoe airport maintains a monitoring system and reports exceedances and complaints monthly (Brown-Buntin Associates, Inc. 2004).

Research Needs

Five areas of research were identified for the noise subtheme, falling into two categories of research: data collection and consolidation, and program evaluation and policy design (see tabulation on page 309). The single largest issue with regard to noise appears to be the need for a monitoring system capable of providing a more spatially and temporally complete and uniform coverage (N1). The current CNEL-driven system does not capture one-time violations and does not provide a good estimate of average noise levels. The proposed single-event and wildlife-related TRPA noise indicators also would need more thorough and effective monitoring systems. A study into the feasibility of remote sensors to monitor noise levels over extended periods could be useful. There also is an issue of the difference between the actual noise levels and the perceived noise levels of private vehicles, off-highway recreation vehicles (like snowmobiles), and other motorized transportation and recreation vehicles. Technological improvements may have reduced the actual noise production of these vehicles, but people may have over the same time become more sensitive and perceive them as incompatible with the Tahoe experience. A number of agency personnel expressed an interest in understanding the real public demand for increased noise regulations (E2).

In terms of policy evaluations, interest was expressed in examining subsidies or other public investment in noise abatement technologies that can reduce noise levels from vehicles while still allowing their current levels of use (N3). Feasibility and effectiveness studies of mitigation opportunities were mentioned as potential topics for study (N4). Studies of enforcement options could be helpful in addressing noise issues and finding resolutions to conflicts about them (N5). Noise was not explicitly addressed in the stakeholder survey.

Metathemes and Emerging Areas of Interest

There were a number of overarching research needs that cut across many of the social science subthemes and even other thematic areas in the natural sciences. Where there were very clear subtheme research questions, they are included in the sections above; however, some issues were raised frequently enough that they warrant separate discussion. This section presents information and research needs for five metathemes: (1) collaborative information management; (2) Tahoe basin community management; (3) program evaluation, policy design, and policy process evaluation; (4) fire and natural hazards; and (5) climate change impacts.

Collaborative Information Management

A conclusion of this research process was the recognition that many types of data and research results would be useful for a variety of different regulatory and management agencies, advocacy groups, private businesses, and community interests. There was a broad consensus that it would be beneficial to the entire Tahoe basin community if there were increased collaboration on funding, collection, dissemination, and storage of social science data, rather than piecemeal data collection for specific organizational needs. There has already been substantial effort made toward the archiving and storage of social science data through the establishment of the Tahoe Integrated Information Management System (TIIMS). The TIIMS was recently established as a data clearinghouse and information hub for Lake Tahoe related data. However, based on the results of the 2008 Social Science Data Needs Assessment for the Lake Tahoe basin (Kauneckis and Copeland 2008), TIIMS appears to be underused as a data clearinghouse (fig. 7.7).

The underuse of TIIMS is likely due to its relatively recent implementation and current redevelopment of its user interface; it is possible that TIIMS will become an important component of the information infrastructure for Tahoe if sustained funding is established. At least some members of the business community have expressed a willingness to join with natural resource management agencies in sharing the cost of gathering, maintaining, and distributing mutually beneficial

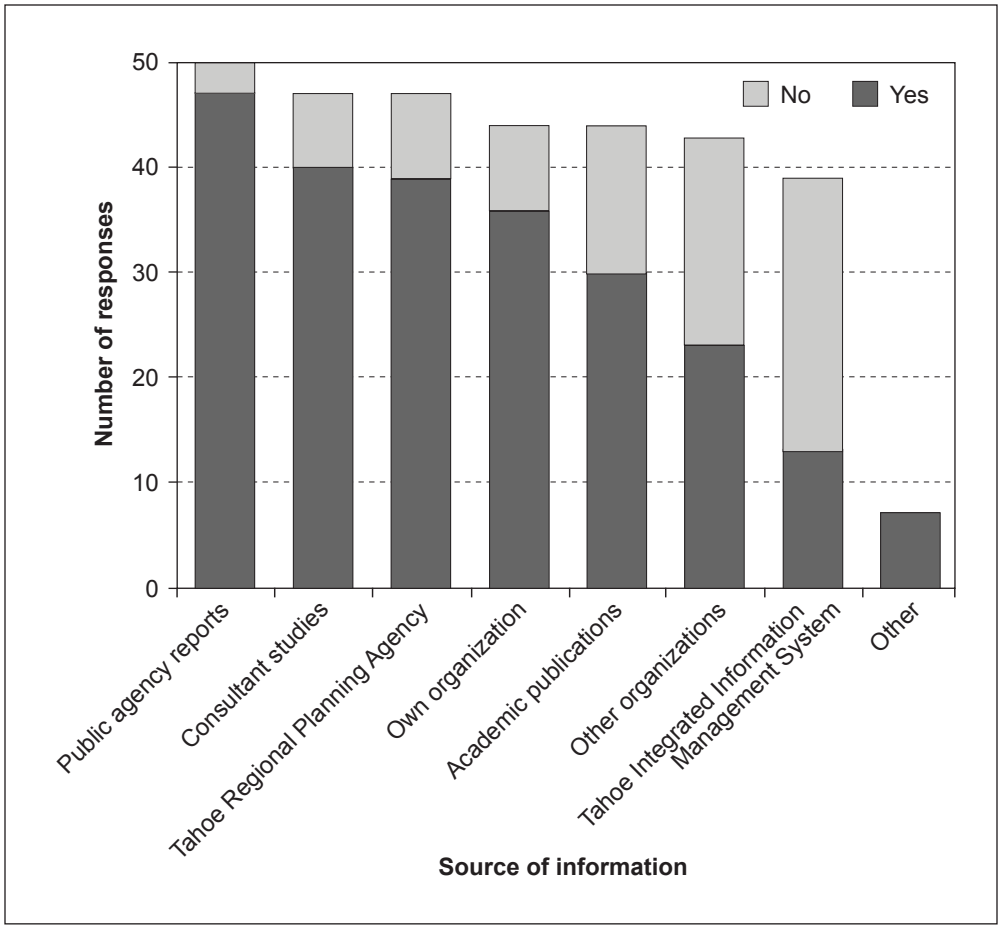

Figure 7.7—Current source of social science information (n= 50). (Source: Kauneckis and Copeland 2008).

scientific information at regular intervals. Numerous regulatory and management agencies and local governments have similarly expressed the potential utility of a clearinghouse where data could be held and distributed for common use. The Tahoe Chambers of Commerce in conjunction with the U.S. Army Corp of Engineers have recently formed a working group of stakeholders to scope the potential for developing a set of community sustainability indicators for the Tahoe basin (see U.S. Army Corps of Engineers 2008). Given the very high level of communication and collaboration already occurring among stakeholders in the basin (Kauneckis and Imperial 2007), focusing this attention on the collection and dissemination of social science information is the next logical step. Although there are challenges to designing a data product useable by such a diverse array of stakeholders, this is a broad-based interest worth pursuing.

Increasing access to the broad array of information on specific management issues adopted in other alpine-tourist-based economies was also a common point of

discussion throughout the science workshop. For example, there was strong interest in the development of a "library" of consumer choice on transportation, vehicle use, and alternative modes (T17). In another example, managers were interested in better understanding how other areas have dealt with recreational conflicts (R12) and with affordable housing in resort communities (E19). Fundamentally, decision-makers feel that they may be "reinventing the wheel" in dealing with many of the challenges at Lake Tahoe and that access to information on policy options created in other areas would facilitate the policymaking process.

Creating such a useable knowledge base is a substantial challenge. However, there are a number of immediate options available. The most common means of learning what has been done elsewhere is through informal professional networks and formal professional associations and publications. This assumes continued engagement with other practitioners and would reallocate attention that otherwise goes toward more immediate tasks. An alternative to Tahoe-based managers going outside the basin is to bring in outside experts and use consultant services to summarize current understanding of a specific topic area. This is a common occurrence at Tahoe and when combined with a focused workshop with resource management agencies can be a very effective means of getting immediate questions answered. However, there are disadvantages to this method of knowledge diffusion. Typically, the input by one person is less useful and reliable than a broader array of opinions. Given the already high level of collaboration at Lake Tahoe, scheduling by top managers tends to be overallocated and unless immediately relevant, attendance to events is often low. Additionally, most managers prefer information available on their own schedule, thus the preferred source of social science information is standard compilations in existing reports (fig. 7.7).

With the advent of Web-based knowledge systems, there are a number of technical options that may be worth exploring. The TIIMS represents an important first step in collecting Tahoe-related research by developing and cataloging reports and data in a searchable format. However, there have been complaints about difficulties in accessing data stored on TIIMS. Information consumers are increasingly demanding immediate usability of the information output and TIIMS structure as a data clearinghouse does have some limitations. Given the specificity of the knowledge needs for particular policy issues, and the underlying complexity of many of the questions public and private stakeholders are interested in addressing, there are no immediate simple technical fixes. Web-based delivery of information would require substantial upfront investment in an information infrastructure and continued resources dedicated to upkeep and management. There are, however, some potential technology-based experiments that could be considered. One of the

most-used sources of Web-based information is open-source discussion groups dedicated to specific topics. If Tahoe-based decisionmakers are having problems finding information on the impact of something like parking fees on recreational experience, it is likely that other transportation and recreation managers have as well. Lake Tahoe is often on the forefront of emerging management issues and this could potentially be leveraged to develop new discussion groups with resource managers facing similar issues. It is recommended that this be done experimentally and in close association and perhaps co-sponsorship with professional associations. This might involve only a subset of alpine lake resource management associations, or even just agency officials within the basin. The challenge is to design a means of leveraging the experience and knowledge of other alpine-resort-based communities. Other options include various forms of information and knowledge architectures. For example, an open discussion and contribution-based Web site such as a "Tahoe-wiki' where general questions could be posted with response options open to other resource managers or the general public. Many Tahoe residents do tend to be highly educated and can bring time and technical expertise to management questions. There are obviously numerous challenges with designing digital knowledge systems that produce useful results; however, Tahoe's unique environmental characteristics, national prominence, and proximity to the epicenter of the digital economy may give it an advantage in being at the forefront of the development of new knowledge systems for managing natural and human-made environments.

Tahoe Basin Community Management

A consistent point of discussion was moving management questions from a central focus on environmental management toward broader issues of basinwide community management (TRPA 2007a, b). This was not directed at weakening environmental regulations, as most stakeholders have come to accept the importance of environmental quality as central to the character of Lake Tahoe, but rather an attempt to bring a similar commitment to social aspects as well. This represents the natural evolution of public management questions in the Tahoe basin as businesses and communities have adapted to the regulatory structure necessary to preserve lake water quality and the broader ecosystem, they increasingly understand the interdependence of the Tahoe basin in terms of a regional economy and a set of interconnected communities.

Examples of immediate areas of research integrated with community decisions included basinwide methods for prioritizing and improving local infrastructure that impact local quality of life. Although the allocation of infrastructure projects is partially discussed in the EIP plan, some stakeholders felt the central focus on

environmental aspects may weaken some community priorities. A related infrastructure issue was that of the lack of DSL or other high-speed Internet access basinwide. This may be an important business diversity issue for likely a large percentage of Tahoe-based professionals who work out of home offices. Discussions of the lack of a basin- or regionwide communication infrastructure that would help emergency response in the aftermath of a natural disaster, extreme weather event, or other emergency situation were an additional concern. Coordination of the various local government units could improve the response, but there is little direction or infrastructure to support it. It is recommended that alternative energy and environmentally sustainable design be considered part of the ongoing Tahoe basin management, and yet they do not fit into any thematic category. There has been some local interest in the development of regional forest biomass conversion facilities for renewable energy. Additionally, participants in workshops held by the chambers of commerce expressed the need to further develop public gathering places, community and nonoutdoor recreation centers, increase the level of arts and culture, town centers, and other community-related amenities. Information on the return to public investment as well as how to better target the type of public space infrastructure investments was a shared concern by both local planners and regulatory agencies, and private businesses.

A number of recent activities suggest there is a substantial movement toward redirecting and coordinating management decisions at the community level. The Pathway process involved a number of direct engagements between the regulatory agencies and communities. The Community Enhancement Program produced a set of community visions (from which many of the questions examined in the survey and discussed in this chapter were drawn). The recent effort toward the development of a set of sustainability indicators (U.S. Army Corps of Engineers 2008) suggests substantial room for collaborative work between the public and private sectors.

The discussion above presents the primary issues brought forth during meetings and workshops, yet additional insight is revealed in the stakeholder survey results. Based on a review of the literature and discussion with local stakeholders, the survey was designed to specifically capture other community-based research issues not directly addressed in the subthemes above. Community well-being consistently ranked high among issues addressed in the survey (fig. 7.4). In terms of specific community well-being issues, school quality ranked as most import, followed by fire vulnerability, the population living below the poverty line, housing affordability, and public space (fig. 7.8).

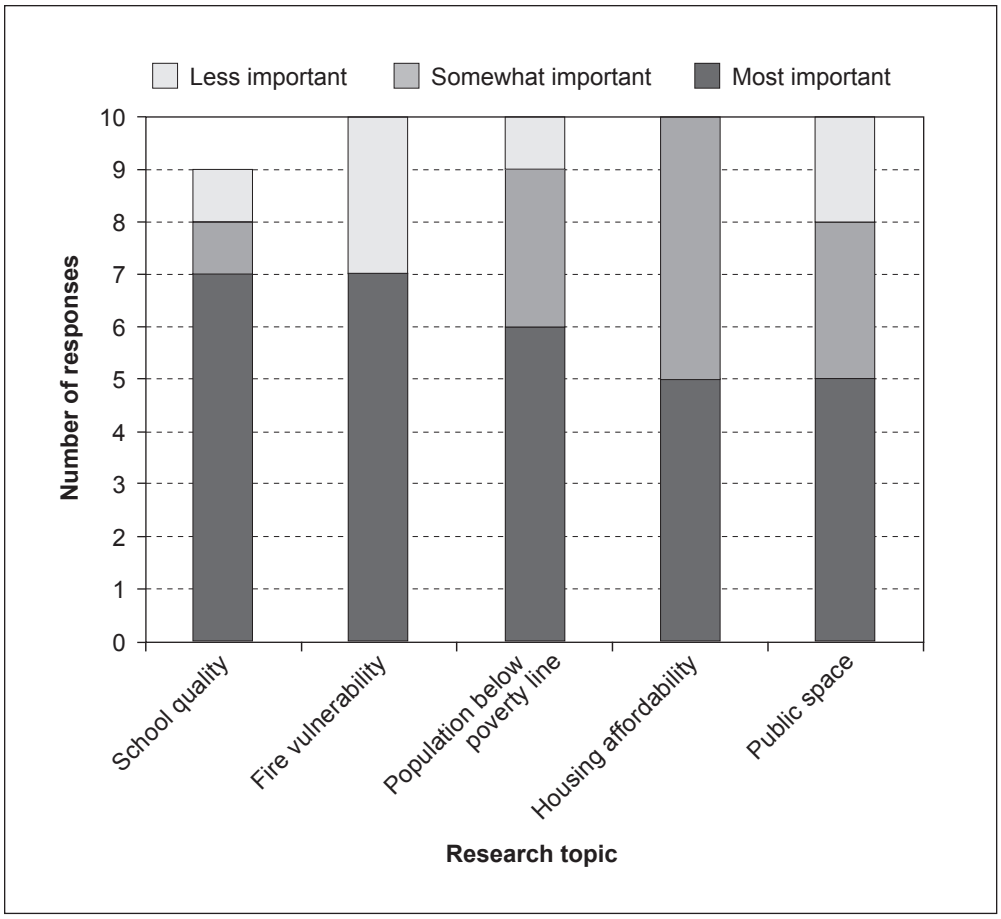

Figure 7.8—Ranked importance of community well-being issues (n = 10). (Source: Kauneckis and Copeland 2008).

An examination of the type of data needed for each of the above (table 7.5) reveals that the most important need is for information on current status, followed by future projections and general trends. The spatial extent of the data varies according to the specific issue (table 7.5). School quality data were both important at the basin and local political jurisdiction level. Fire vulnerability was included in the survey under community management, and interestingly the spatial extent of the necessary data was at the individual level, likely a recognition of the importance of establishing defensible space on private parcels. Fire risk was also considered important at all other spatial extents. In terms of the temporal extent of data, the results were predictable, with school quality and the population below the poverty line important annually, fire vulnerability and public space seasonally, and housing affordability biannually and seasonally, probably recognizing the unique nature of the seasonal employment flows to Tahoe.

Table 7.5—Community management

	Community	School quality	Fire vulnerability	Population below poverty line	Housing affordability	Public space
				Number of responses		
Type	Current status	5	**6**	**6**	**6**	4
	Future projections	2	5	**6**	5	4
	General trends	3	3	2	**4**	3
Spatial	Local political jurisdiction	**5**	4	**5**	**5**	3
	Community level	3	**4**	**4**	2	3
	Tahoe basin	**4**	3	3	2	3
Temporal	Seasonally	1	**4**	2	2	3
	Annually	2	1	**3**	1	1
	Biannually	1	0	0	**2**	0

Note: Items in bold represent the most frequent responses in each row.

Program Evaluation, Policy Design, and Policy Process Evaluation

Many participants in the various workshops and meetings, from the public, private, and nonprofit sector expressed interest in a variety of public policy evaluation issues. These are grouped here into three overlapping areas of policy research: (1) program evaluation, (2) policy design, and (3) policy process evaluation. Program evaluation involves research questions on the efficacy, efficiency, and equity of current public programs and regulatory policies implemented in the basin. Policy design addresses questions of the specific components of existing and new programs and how these can be adjusted to improve desired outcomes. Policy process evaluation includes research and methods for improving the decisionmaking and collaborative process itself. Typically this includes such issues as coordinating policy implementation across different agencies, public management, managing program implementation in networked environments, developing conflict resolution mechanisms, and increasing public participation.

In terms of program evaluation needs, a number of participants, including management agencies and representatives of the Tahoe Chambers of Commerce, expressed interest in identifying conflicts between various regulatory policies. One example discussed was installation of a flashing light to warn motorists of a crosswalk, which was proposed and planned but could not be implemented owing to its direct violation of TRPA scenic regulations. Another is the perceived incompatibility of vegetation management for fuel reduction and habitat enhancement versus the impacts these actions can have on soil and water quality. These interventions produce positive public outcomes, but they present challenges for reconciling local

and regional goals and clearly communicating actions to the public. Developing an explicit means for the systematic investigation of these types of clashes was also discussed. The fact that the request was not to resolve specific conflicts, but rather for a process to frame future discussions, suggest various methods of policy process evaluation could be useful. This incompatibility is further discussed in the recent emergency fire management report (California-Nevada Tahoe Basin Fire Commission 2008).

The social science data needs survey was designed explicitly to address various aspects of the policy environment at Lake Tahoe and included questions about a variety of public agency management issues (fig. 7.9). The highest ranked items of interest were the relationship between government agencies and the public, followed by improving interagency cooperation, evaluation of the effectiveness of current policies, cost-effectiveness, and conflict reduction tools.

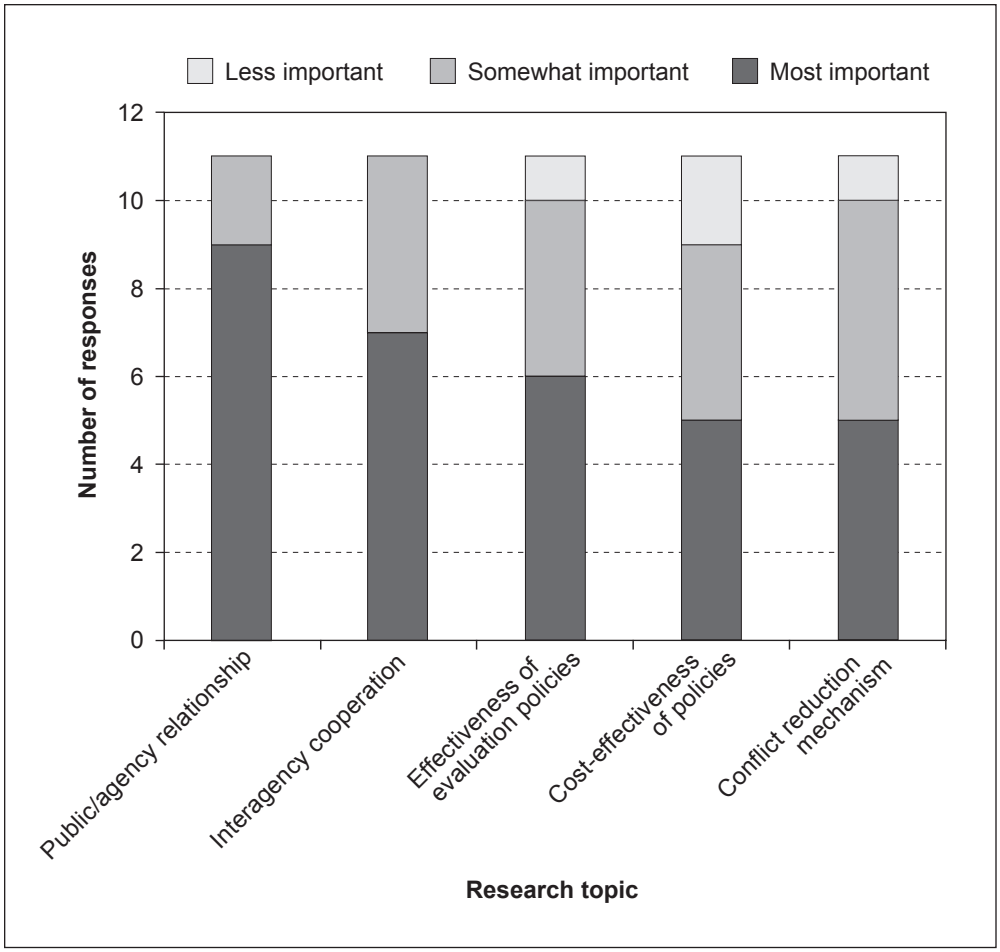

Figure 7.9—Ranked importance of public agency management issues (n = 11). (Source: Kauneckis and Copeland 2008).

With regard to the types of data, current status was highest in importance in the areas of public/government relations, interagency cooperation, and conflict reduction (table 7.6). Evaluation of program effectiveness was directed toward future projections suggesting an emphasis on improving the participation and compliance with existing policy programs. Across all issue areas, the spatial extent of interest was the Tahoe basin, with some attention to administrative jurisdiction for effectiveness evaluation of policy and cost-effectiveness. The temporal extent was generally focused on annual or biannual evaluations (table 7.6).

Table 7.6—Public agency management and collaboration

	Agency	Public/ agency relationship	Interagency cooperation	Effectiveness of evaluation policies	Cost effectiveness of policies	Conflict reduction mechanisms
				Number of responses		
Type	Current status	**5**	4	1	2	4
	General trends	2	2	2	**6**	2
	Efficiency improvements	1	1	2	**3**	**3**
Spatial	Local political jurisdiction	2	1	0	0	**3**
	Administrative jurisdiction	0	1	3	**4**	2
	Tahoe basin	**8**	7	5	5	6
Temporal	Monthly	2	2	1	1	**3**
	Annually	3	2	**4**	3	1
	Biannually	1	0	1	1	**3**

Note: Items in bold represent the most frequent responses.

A related issue discussed by some public agency representatives was the extent to which the public understood the environmental quality issues at Lake Tahoe and the impact of the various policies. Although some research has been conducted on public attitudes and perceptions of the TRPA and its regulatory policies (Kauneckis 2008, TRPA 2005a, Weible 2007), very little work has been done pertaining to the role of public education in helping organizations and agencies in the basin promote collaboratively defined desired conditions (for an exception see Ward et al. 2003). This includes understanding the impact of current public information and interpretive programs, as well as how these can be designed to be more effective.

One of the best examples of the crosscutting nature of policy evaluation is the current program of private and commercial property BMPs. In the Lake Tahoe basin, BMPs are structural and landscape design components intended to reduce soil erosion and polluted runoff from private parcels. Best management practices include building infiltration systems for stormwater runoff from impervious

surfaces such as driveway and rooftops, mulching and revegetating bare or disturbed soils, stabilizing steep slopes and loose soils, and paving dirt driveways and roads. Best Management Practices were required on new construction and remodeling projects beginning in the 1980s. The TRPA instituted BMP requirements as part of its basinwide ordinances in 1992 and in 2002 created the BMP Retrofit Program targeting existing structures as well as new constructions. As of 2003, TRPA ordinance requires BMPs on all private residential, commercial, and industrial parcels. Implementation of BMPs on existing private parcels was prioritized into three watershed groups, and deadlines have been set for compliance and certification. The deadlines for compliance in priority 1 and 2 areas passed in 2000 and 2006, respectively, and are set for 2008 for priority 3 areas. Despite active public outreach via TRPA, university cooperative extension programs, resource conservation districts, and the Natural Resources Conservation Service, average rates of compliance for the BMP retrofit program are at 16 percent for California and 25 percent for the basin as a whole (TRPA 2009: 25). So far there has been little attempt at enforcing BMP retrofit requirements on existing structures and few actual sanctions imposed. Compliance has occurred on a voluntary basis and is likely linked to home renovations (Kauneckis 2008).

The environmental aspect of BMPs is the primary management strategy for dealing with water quality and soil management issues in the Tahoe basin. Their environmental aspects are discussed in the "Water Quality" and "Soil Conservation" chapters. Although relatively limited, some work has evaluated the water quality benefits of private and commercial BMPs (see Schuster and Grismer 2004). However, BMPs also are important to understand as a component of the social sciences, as the primary questions raised by stakeholders involved increasing implementation on private parcels, the efficiency and cost-effectiveness of current designs and location selection, and means of coordination and prioritizing public investment in community-scale BMPs for targeting the most effective projects.

The most salient contemporary program design issue is that of modifying regulations that work at cross purposes for protecting environmental quality and reducing excess forest fuels following the Angora Fire (California-Nevada Tahoe Basin Fire Commission 2008). This included clarifying the private homeowner's responsibility to clear vegetation and pine needle debris to create defensible space and requirements to maintain native vegetation and ground cover to minimize erosion and polluted runoff. This issue also extends into undeveloped areas such as fuel management of areas in stream environment zones, and balancing forest thinning practices and biomass management with water quality and erosion control functions.

Social science applications for improving environmental management include aspects of the management organizations as well as those of the public. Issues of engaging public participation, compliance, information, education, and general relationships between public agencies and private citizens also were addressed explicitly in the stakeholder survey. Public willingness to participate in programs was ranked as the most important, followed by public understanding of environmental issues at Lake Tahoe, public perceptions and understanding the effectiveness of current policies, access to information on BMPs, and general knowledge of public policies (fig. 7.10). In terms of the types of information needed, the majority of social science research needs were around items of current status, with some attention to future projects (participation and perceptions of policy effectiveness), and efficiency improvements (table 7.7). The spatial extent of the data requirements were almost universally at the basin level, with some interest in community level.

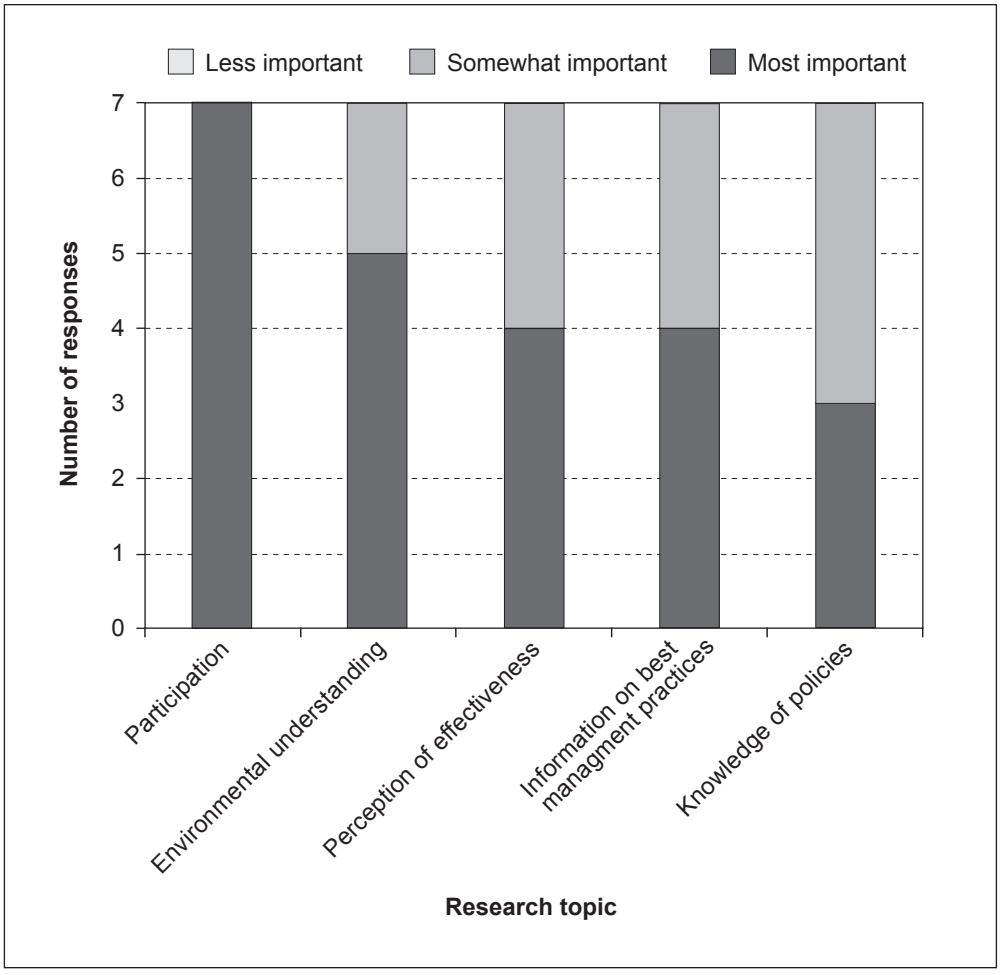

Figure 7.10—Ranked importance of public information issues (n = 7). (Source: Kauneckis and Copeland 2008).

Table 7.7—Public information and outreach

	Public	Participation	Environmental understanding	Perception of effectiveness	Information on Best Management Practices	Knowledge of policies
			Number of responses			
Type	Current status	3	2	3	3	**6**
	Future predictions	**3**	1	**3**	2	2
	Efficiency improvements	**2**	0	**2**	**2**	**2**
Spatial	Community level	2	0	0	1	**3**
	Administrative jurisdiction	0	1	1	1	**2**
	Tahoe basin	4	3	**5**	3	4
Temporal	Seasonally	**3**	2	**3**	0	2
	Annually	0	0	0	**3**	1
	Every 5 years	**2**	1	**2**	**2**	1

Note: Items in bold represent the most frequent responses in each row.

Although the expected relationship was that this information would be most useful on an annual basis, respondents indicated that seasonal was more important. This is tied to the winter/summer recreational seasons and likely the need to understand the new dynamic of second-home ownership.

With much of the policy focus at Tahoe on issues of private land management, such as BMP implementation and fuels management, the role of public participation is becoming increasingly important. However, the growth of second-home ownership presents challenges to maintaining public involvement in community and basinwide issues. Yet there are a broad array of methods for informing and engaging the public in policy decisionmaking including traditional forms of public engagement through community workshops, consensus visioning, public education, and interpretation. There also are a number of methods for more explicitly addressing the role of the public. Community-based mapping, using Web-based geographic information systems or other visualization techniques were discussed in various meetings. The TIIMS is currently developing an online map service to show the location and relevant information about EIP projects, and progress on defensible space on a parcel-by-parcel basis. Commercial and other open-source data visualization programs also are available for better presenting information to the general public. Other technology-based methods include such approaches as alternative futures and consensus modeling. Alternative-futures modeling presents various possible scenarios in land, water, and natural resource management and permits stakeholder discussion around the state they would prefer for their community. Alternative-futures modeling has been useful in a number of environmental

management applications (Baker et al. 2004, Van Sickle et al. 2004). Consensus and alternative-futures modeling involves simulations of different scenarios in order to engage both stakeholders and the broader public in terms of the consequences of their actions (or inaction). This typically presents visual output that is easily interpreted by the public and allows various parameters over which decisions can be made to examine outcomes (Costanza 1998, Van Den Belt 2004).

Although the history of the creation of the current regulatory structure at Tahoe accompanied a high degree of contention, today it may offer a competitive advantage for marketing Lake Tahoe as a center of businesses and community sustainability. There are numerous areas of potential collaboration between the public and private sectors for not only data collection that serves a common interest, but also creative partnerships that move beyond regulatory policy and toward forms of voluntary and market-based policy instruments. There has already been some success with relatively creative programs such as transferable development rights and the BMP programs (Kauneckis and Reid 2006, Reid and Kauneckis 2008). Other areas worth exploring might include formal recognition of environmentally friendly activities by Tahoe-based businesses through green business certification programs. There are a number of well-established industry-specific, regional and international environmental management and certification systems (ISO 14001 and Europe's Green Dot are the best known). There is good reason to consider creating something like a "Tahoe Blue Dot" system that can simultaneously engage and reward the business community and allow the marketing of regulatory compliance as an asset and sustainable business practices. Other nonregulatory approaches can include various forms of "social marketing." Social marketing programs represent a method of communicating public goals, targeting programs to citizens, and focusing the distribution of information to specific population subsectors. Rather than regulatory policy and negative sanctions serving as the principal tools to increase participation in public programs, it relies on information and positive psychological rewards using methods from the private sector to gain brand loyalty and understand market niches. Successful applications of social marketing toward public goals have been noted in public health and human services delivery (Goldberg et al. 1997, McKenzie-Mohr and Smith 1999).

Managing Fire and Natural Hazards

The effects of wildfire and fuels management were crosscutting themes in many of the discussions. Following the 2007 Angora Fire, fuels management became particularly salient to the public and government agencies. Additionally, the presence of faultlines in the basin has also alerted stakeholders to the possible threat

of seismic events. Both hazards generate important social science needs as well. A major forest fire in or near the Tahoe basin would have broad effects on all of the theme areas considered in this science plan, including most of the social science subthemes. Fire impairs both the quality and quantity of recreation and scenic resources, and a major fire could do so for an extended period. This would have broad implications for the regional economy, both in terms of direct and indirect costs. The more immediate economic concerns have to do with paying for fuels management on public, private, and state lands, and prioritizing fuel reduction projects. Other concerns discussed in stakeholder meetings include the social acceptance of various treatment options for forest fuels.

Transportation issues are directly linked to community safety questions and most discussions regarding public agency management and natural disaster management were directed at creating a basinwide communications network for public officials. The Tahoe basin is a seismically active area with potential for large-scale events including earthquakes, landslides, and earthquake-triggered seiche waves in the lake that would act like a tsunami and flood major portions of the near-shore areas (Ichinose et al. 2000). Assessment of the vulnerability and resilience of transportation networks, recreation areas, and communities to these natural hazards is recommended, so that mitigation strategies can be developed and their likely effectiveness understood. This will certainly aid management agencies and local governments in long-term planning goals.

Climate Change Impacts

Finally, global climate change represents a relatively new research area that deserves some discussion. Because the projected changes are so broad-based, there are impacts on all the subthemes discussed in this chapter. The most immediate effect would be in terms of the interactions between recreation, scenic resources, and the local economy.

If changes occur as projected by most climate models, the Sierra Nevada is likely to experience substantial reductions in the amount of snowfall, and the snowpack that does exist is expected to melt off earlier in the year (Cayan et al. 2006). Both of these effects will lead to a reduced areal extent and season length for ski resorts and backcountry snow-based recreation while simultaneously increasing the season of some forest-based recreation such as hiking and mountain-biking, all of which are important parts of the recreation experience at Tahoe. Changes in precipitation and temperature will likely affect vegetation and pest dynamics and increase the threat of major forest fires (Ibañez et al. 2006, Westerling et al. 2006). The short- and long-term economic responses to, for example, a ski season shortened

by the reduced snowpack expected from climate change or summer recreational opportunities impacted by increased wildfires are important to assess now so that mitigation and response plans can be developed. Reduction in snowfall, the risk of wildfire, and resulting impact on water quality and scenic resources related to forest cover all suggest major changes for the regional economy, which could be examined through alternative futures modeling.

Near-Term Social Science Research Priorities

The most consistently discussed topics related to issues of transportation, economics, recreation, and the quality of the built landscape. Common metathemes were the development of a collaborative information management infrastructure, increasing the evaluation and effectiveness of current policy, a refocusing of management decisions toward the community level, and management of fire hazards and climate change impacts. Table 7.1 illustrates items identified as the highest priority.

The selection of this subset of priorities was based on a number of criteria. First, a social science research issue area had to reappear across the multiple information collection methods used here: literature review, stakeholder meetings and workshops, focused discussions with key public and private representatives, and the stakeholder survey. Second, there was an estimation of the complexity of the research issues and the likelihood that resources dedicated to a specific topic would lead to immediate improvements in environmental management decisions. This was balanced against a movement toward more complex tasks and laying out the necessary information infrastructure for improving long-term decisionmaking as discussed in more detail below. Finally, emphasis was placed on research issues that served the broadest array of stakeholders. Those that were requested by a mix of private, public, and community interests were considered more important than those of a smaller set of agency representatives. The specific justification for the selection of priority research items are indicated in table 7.1. The conceptual model in fig. 7.5 illustrates the relationship between the highest priority social science research needs and the causal driver and linkages to specific management components.

In the opinion of the authors, the crosscutting metatheme of collaborative information management is the highest overall priority. This is based on three rationales. First, this was the most common request across all the subthemes and by that fact alone can be ranked as the highest priority. Second, in terms of practically advancing the goals of this document, strategically allocating resources toward data collection will allow a common focal point for stakeholder input by

creating a platform for distribution of results from other research areas. Third, there has already been substantial activity by stakeholders in this direction. Input from the chambers of commerce has enthusiastically expressed support for joint data collection and a subset of priorities for data inventory and consolidation has recently been released (U.S. Army Corps of Engineers 2008). Taking advantage of the current level of interest and the resources that have already been dedicated should move this to the top priority. Creating a platform for a small subset of common topics of interest will make data collection and consolidation in each of the individual subthemes easier. There are exceptional opportunities for creative public-private cooperation.

There also has been interest expressed toward the creation of a Tahoe basin decision-support system. Decision-support systems (DSS) use a common computer platform that brings together multiple data sources on management issues to better inform decisionmakers about the relative tradeoffs of various policy options. These have most commonly been used for natural resource management agencies making decisions for multiple-use areas; however, there is considerable potential for using DSS for integrating the social sciences with environmental goals. The advantage of a DSS is that it creates a library of integrated data sets, models, and methods. It can act as a focal point of discussion for research across different disciplines and stakeholders. Additionally many are scalable and present data in a useable visual output that implicitly incorporates uncertainty and highlights missing and needed data (Reynolds et al. 2000). The concurrent discussions on the implementation of DSS and community indicators by very different stakeholders presents an opportunity for better integrating the social sciences with management decisions.

It is worth repeating a couple of final comments and caveats. The process outlined here for scoping the need and form of various types of social science data was intended to develop a framework for further discussion, not the priorities of data collection needs. These priorities are best determined by specific stakeholders and focused on direct policy needs. This is particularly true in collaborative situations involving multiple organizations as much of the academic literature stresses that collaboration works best when there are substantive outcomes that each participant recognizes as useful (Kauneckis and Imperial 2007, Lubell 2004, Singleton 1998, Wondolleck and Yaffee 2000). This document outlines a broad array of social science data needs and perceptions of the relative utility of various forms of data in terms of the type and spatial and temporal scales. However, it does not measure the costs of obtaining the data in its most useful form, nor the willingness by stakeholders to commit resources toward the collection, management, and distribution of useful information products.

There may be opportunities to advance the research needs discussed here by establishing closer ties with one or more of the regional campuses. The University of California, Davis and the Desert Research Institute already have close research connections with resource managers in terms of the natural sciences. A similar effort can be made in the social sciences. University of California, Davis has numerous departments—particularly the Department of Environmental Policy—that can bring expertise and student resources to many of the research issues discussed in this chapter. The University of Nevada, Reno (UNR) likewise has seen recent activity in expanding its research capacity in the social sciences. New research centers and programs established in the past 5 years include the UNR Academy for the Environment, the School of Journalism's Interactive Environmental Journalism program, in addition to well-established programs in cooperative extension and other departments. Graduate programs on both campuses include business and economics, resource economics, land use planning, public administration, and policy analysis. Much of the research discussed here involves relatively straightforward data collection, consolidation, and statistical analysis, all of which are amendable to graduate student research.

Finally, it is worth returning to the concepts discussed earlier about the distinction between the collection and consolidation of data, making that data relevant and contextualized for informing policy, and turning that information into knowledge about the social dynamic of Lake Tahoe. Although the feasibility of data collection and research on the various topics of interest listed here has not been explicitly measured, few of the issues are beyond the scope of contemporary social science research methods. However, some of these studies would require substantial costs and are best addressed in terms of the relative benefits to informing policy decisions. Although the majority of input from stakeholders was on data collection, most of the subsequent discussion was about its priority as useful information and bringing the relevant knowledge to bear on policy decisions. Because of the high costs of primary data collection and continued monitoring, it is recommended that the starting point of prioritizing research efforts be on the direct application of the information for a specific management need, rather than only a generalized unspecified perception of the importance of more information on a topic. Stakeholder meetings often included interest in having information on an issue of concern without the necessary followup discussion of how that information can be put to direct use. Focusing on the management use of prior data collection efforts will help focus the priority of even basic data collection and consolidation, as well as assist in honing it down to those pieces of information that will best inform the broadest array of decisions and serve the most stakeholders.

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