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Research Note

Longitudinal Social Science Research in Natural Resource Communities: Lessons and Considerations

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The majority of social science research is cross-sectional in nature, with data collected at a single point in time. However, social systems are dynamic and many of the variables of interest to social scientists may change over time. Longitudinal research methods enable data collection at two or more points in time among a population of interest to examine change in measured variables and influencing factors. Despite the opportunities it affords, longitudinal research is relatively uncommon in natural-resource-based social science research as compared to other fields (e.g.,

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medical, criminal, education). We feel that the field of natural resource social science is ripe for a proliferation of longitudinal studies, now that a substantial body of cross-sectional data has been built. In the spirit of encouraging more of this type of research, we draw on our collective experiences in longitudinal studies to share lessons learned in research design, sampling, and data management.

Keywords lessons learned, longitudinal research, natural resource social science

As the work published in this journal demonstrates, social science research may draw on theory from a variety of disciplines, employ a diverse range of methodological approaches, and address a multitude of research contexts. In most cases, cross-sectional data (collected at a single point in time) are used to investigate constructs that are likely to change over time. Although careful analysis of cross-sectional data can provide insight into dynamic social constructs, it ultimately has a limited ability to understand ongoing processes. Babbie (1995, 95) describes such an approach as attempting to “determine the speed of a moving object on the basis of a high-speed, still photograph.”

Longitudinal research addresses this weakness by collecting data over two or more points in time, enabling a more direct analysis of change within a population. We have utilized longitudinal research designs to measure change in attitudes, behaviors, and citizen–agency relationships as related to wildfire social science and forest health in eight different panel studies. In this research note, we draw on this experience to describe longitudinal panel research and identify key points to consider when designing and implementing such studies.

Brief Background on Longitudinal Research

Much of the early natural resource longitudinal research in the social sciences was conducted in a recreation management context (e.g., Kuentzel and Heberlein 1992; Shelby et al. 1988). As federal programs like the Recreation Opportunity Spectrum and the Limits of Acceptable Change systems were being introduced, resource professionals began looking for ways to gauge changing conditions on the landscape and among users—particularly the displacement of recreation visitors. Outside of recreation trends, fewer longitudinal studies have been performed; however they have spanned a variety of topic areas. McCool and Stankey (1986) studied changes in perceptions of prescribed burning by visitors to the Selway–Bitterroot Wilderness in Montana over a 10-year period; Brown and Harris (2000) examined shifts in attitudes toward management strategies within the USDA Forest Service between 1990 and 1996; and Carroll et al. (2000) sought to understand the changing adaptation strategies for laid-off forest products workers in Idaho over a 1-year period. As these examples illustrate, there is potential for use of longitudinal methods in a variety of natural resource social science applications.

Longitudinal research is not defined by a singular method, but rather describes a variety of research approaches that repeatedly sample a population, process, or system over time (Bauer 2004). Menard (2002) has identified three characteristics of a longitudinal data set: (1) Data are collected in two or more distinct time periods; (2) participants or cases are the same (panel) or comparable (cohort) in each data collection period; and (3) analysis compares data collected in each time period. Panel studies, with data collection among the same individuals at two or more points in

time, may be the most familiar of the longitudinal approaches. Repeated cross sections (sometimes termed trend studies) are another common approach; in these studies the survey instrument is repeated in a population of interest using an entirely new sample of individuals (Bauer 2004; Menard 2002).

Bauer (2004) describes several advantages of longitudinal data:

- Longitudinal data allow for measuring changes at the individual level in populations of interest. This method provides the ability to track and monitor participants' changes in beliefs, attitudes, behaviors, or other variables of interest over time.
- Compared to cross-sectional approaches that ask participants to describe potential change over time, longitudinal methods decrease recall error by soliciting current responses at different points in time.
- Longitudinal data provide flexibility and adaptability by allowing for the inclusion of additional variables in later data collection periods to probe particular areas of interest, include measures excluded from prior rounds, or examine the influence of current events to examine potential causes of observed change.

Despite these advantages, there are also several potential disadvantages to using longitudinal methods:

- They can be costly and difficult to implement.
- For panel studies, it can be difficult to locate past participants.
- Drop-out of participants over time.
- Participant familiarity with survey instrument may influence responses.
- Ensuring comparability of results across time.

The goal of this article is to share some of our lessons learned to inform the efforts of others who are interested in applying longitudinal approaches.

Learning from Experience

Over the years we have collectively implemented a variety of longitudinal panel studies; some were designed as longitudinal studies from their inception, while others were more opportunistic as we encountered an unforeseen opportunity to resurvey a sample from a previous project. Along the way we have encountered a number of challenges unique to both planned and unplanned studies. From our combined experiences we offer the following recommendations regarding project design and management. While our experiences are specific to panel designs, many of these recommendations are applicable to other longitudinal designs as well.

Selecting a Panel Sample

- *Oversample*: It is generally not possible to resample everyone from the first round of data collection, due to emigration, aging, and other life changes. Oversampling at the beginning of the project helps ensure that enough people are available for subsequent data collection.
- *Be consistent*: If it is important that the same individual (rather than same household) takes the survey both times, this should be highlighted in the cover letter or initial contact in subsequent phases. Asking demographic questions in all phases of research can help provide a check on consistency.

- *Take site selection into account:* When conducting on-site interviews it may require multiple site visits to complete data collection, particularly after the first round when the sample is fixed. While interview sites do need to meet the criteria of interest for the particular study, locations that are easy to access for the research team can greatly facilitate data collection.

Designing Question Format

Particular attention should be paid to how the data will be compared during instrument design. Some questions will likely be repeated in all data collection phases, but others may only be asked once. Additionally, questions may be added to take advantage of advances in theoretical or practical knowledge within the broader field of study or new circumstances within the research population.

- *Use identical wording:* Any information that is intended to be compared should be worded exactly the same way—slight changes in wording of questions or measurement scales can seem inconsequential during instrument development or data collection, but become a problem during data analysis.
- *Ask about extenuating events:* Circumstances change over time and it is helpful to know if a particular event or situation led to a change in someone's response. Include a few questions asking about changing circumstances. Both closed- and open-ended questions are useful.
- *Number survey items consistently:* Where practical, keep the question number for identical questions the same in subsequent survey formats, to reduce data entry and analysis errors.

Data Management

- *Maintain a consistent research team:* Although principle investigators may not change, in a longitudinal project those collecting and managing the data may change. Whenever possible, project design should try to maintain consistent personnel throughout the entire project. This provides particular benefits to data management (facilitates quality control) and recontacting interview participants (builds on positive rapport previously established).
- *Diligently maintain detailed metadata and procedural notes:* Record the what, how, and why on everything, from project design to sampling frame to data analysis. This is particularly important if research team members change over time or are not all in the same physical location. The following practices make it easier to transition between phases of research, even when key personnel have changed:
 - Maintain a project log that documents decisions and activities. Include names of all existing documents, file names, date of most recent update, and storage locations. Save the project log in a location accessible to all team members.
 - Maintain a detailed data entry journal (e.g., protocols for handling questions with two responses to a question), attach code manuals to all databases, and include the current date in filenames.
- *Keep the attrition rate as low as possible:* Maintaining the same participants across time is one of the greatest challenges to longitudinal panel research. While mortality and respondent relocation are unavoidable, there are numerous strategies to encourage respondents' continued participation.

- Respondents may volunteer updates to their own contact information, but in most cases, the research team will benefit from exploring public records and postal services to locate respondents when necessary.
- Once contact is made, persistence is vital to ensure an adequate response rate in sequential data collection periods. For example, if repeated mailings gain no response, switching to alternative methods such as telephone calls may be necessary. Appealing to the irreplaceability of participants' responses, appealing to their previous interest, and making clear how the results will be used can all be useful strategies in motivating responses. Dillman (2009) described other methods of increasing response rates.

Conclusion

Our experience with longitudinal approaches has demonstrated both the promise and the challenge of using this research design. Collecting data at two or more points in time provides the opportunity to examine dynamic social phenomena, something that is limited with most conventional cross-sectional studies. Resulting findings provide a valuable contribution to the study of society and natural resources—even more so given the relatively limited nature of longitudinal studies. While there are several challenges to completing longitudinal work, attention to planning and detail can prevent some of the common pitfalls, improving the validity and usefulness of the research.

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