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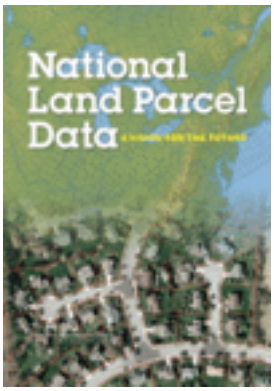

National Land Parcel Data: A Vision for the Future

Committee on Land Parcel Databases: A National Vision, Mapping Science Committee, National Research Council

ISBN: 978-0-309-11026-6, 172 pages, 6 x 9, (2007)

Land parcel data (also known as cadastral data) provides geographically-referenced information about the rights, interests, and ownership of land and are an important part of the financial, legal and real estate systems of society. The data are used by governments to make decisions about land development, business activities, regulatory compliance, emergency response, and law enforcement. In 1980, a National Research Council report called for nationally-integrated land parcel data, but despite major progress in development of land parcel databases in many local jurisdictions, little progress has been made towards a national system. Therefore, this National Research Council report was sponsored by the Bureau of Land Management, the Census Bureau, the Federal Geographic Data Committee, the Department of Homeland Security, and Environmental Systems Research Institute, to look at the current status of land parcel data in the United States. This report concludes that nationally-integrated land parcel data is necessary, feasible, and affordable, and provides recommendations for establishing a practical framework for sustained intergovernmental coordination and funding required to overcome the remaining challenges and move forward.

Summary

Private ownership of land is a foundation of the financial, legal, and real estate systems of our society. Furthermore, open access to information about ownership and use of land has always been a cornerstone of our democracy and free enterprise system. In a modern land information system, land parcel databases describe a combination of the rights, interests, ownership, and value of property. Parcel data (also known as cadastral data) constitute the most appropriate level of geographic detail for a host of decisions and actions relating to the development of land, business activities, regulatory compliance, emergency response, law enforcement, and logistical support. Parcel data are also critical to the analysis of natural hazard risk, transportation needs, and even environmental issues. With this understanding, about a third of the counties in the United States have embraced digital parcel data as the core of their state-of-the-art information systems. At the same time, commercial firms in the United States are capitalizing on the public's interest in parcel data. For example, it is estimated that more than 2 million people a month access Zillow.com to anonymously obtain detailed property values and characteristics for more than 70 million properties. Many other private companies in the utility, insurance, or location-based services industries also maintain their own parcel databases. However, a nationally consistent set of parcel data does not exist in the United States. Other countries have acknowledged the benefits of such a national data set; for example, Australia has a unified system of parcel data for the entire country that even serves as the basis for automated address location through Google Maps.

In 1980, a National Research Council (NRC) study, *Need for a Multipurpose Cadastre* (NRC, 1980), asserted that parcel data should be the fundamental building block for a nationally integrated system of land information. Two other reports, *Modernization of the Public Land Survey System* (NRC, 1982) and *Procedures and Standards for a Multipurpose Cadastre* (NRC, 1983), built upon and added to the original report. However, despite major progress in the development of digital land parcel databases in many local jurisdictions, some directed and coordinated by state programs, little progress has been made toward the development of nationally integrated land parcel data since that time. Therefore, the current study, which was sponsored by the Bureau of Land Management (BLM), the Census Bureau, the Federal Geographic Data Committee (FGDC), the Department of Homeland Security (DHS), and Environmental Systems Research Institute (ESRI), was initiated to

assess the current status of a national land parcel data set and the challenges to developing it. The study included the following specific tasks:

- Identify the benefits of accurate parcel databases for all stakeholders (public and private);
- Describe the current status of parcel databases across the nation at all levels of government;
- Document what has been shown to be possible at a local, regional, and state level, using examples of successful systems; and
- Provide a vision of what could be possible nationwide, and identify a strategy to achieve the vision, including the role of the federal agencies, and accounting for challenges that must be overcome.

The committee concluded that complete national land parcel data are necessary, timely, technically feasible, and affordable. Although the benefits and needs for nationally consistent parcel data are much more clear and urgent than in 1980, there has been little progress toward the recommendations of the 1980 report. While a great deal of parcel data has been digitized at the local level, 30 percent of individual parcels still need to be converted, and there has been little progress toward an integrated national set. Many of the technical barriers have been overcome, so the remaining challenges are primarily organizational. The committee makes nine recommendations for overcoming these remaining barriers.

PROGRESS AND NEEDS

In reviewing the events of the past 27 years, there is ample evidence that the federal government has attempted to better coordinate its geospatial activities. Recent policy directives mandate that the federal government coordinate the development of important national geospatial data sets, including land parcel data. By including cadastral data as a framework layer of the National Spatial Data Infrastructure (NSDI) the federal government has acknowledged their importance. BLM has been assigned important responsibilities to serve as a coordinator for parcel data for lands managed by the federal government and the coordination of parcel data produced by all levels of government that are needed to meet federal programmatic needs. Therefore, progress has been made in enacting policies that enable the creation of a national land parcel data set.

Although much has changed over the past quarter of a century, the list of benefits of a national land parcel data system outlined by the early reports remains relevant for all levels of government, the private sector, and individual citizens. While only a few of the largest and most progressive counties had functioning parcel-based information systems in the early 1980s, now about a third of the counties are operating such systems. For many of them, parcel maintenance is the essential core of their information system. Nevertheless, even though the value of parcel data is better accepted, the benefits of nationally integrated parcel data are not as widely acknowledged. Stakeholder feedback to the committee highlighted that federal- and state-level employees who produce parcel data believe that nationally integrated parcel data are necessary, but many local governments create data for their own applications and do not see how a national effort would benefit their own local use. This becomes a challenge now that the need for complete national land parcel data has become even more urgent for one application in particular—emergency response. When Hurricane Katrina hit the Gulf Coast, critical parcel information that was urgently needed by emergency responders, public officials, and insurance companies was not readily available and, in many cases, was nonexistent.

CURRENT STATUS OF PARCEL DATA

An important part of this study was to assess the current status of parcel data in the United States. The committee found that a significant digital parcel data divide exists between various counties. In many parts of the United States, parcel data exist only as lines on paper maps stored in a local courthouse. While about 70 percent of the tax parcels in the United States now exist in digital form, the remaining 30 percent are located in the roughly 2,000 most rural counties. Although these counties have fewer total parcels, they also do not have adequate financial resources to convert their data to digital form. On the other side of the divide, many urban areas are covered by two or three versions of parcel data, and often anyone with a simple web browser can anonymously retrieve information about the ownership, taxes, and value of any parcel by owner name or street address. Many communities routinely align parcel boundaries using digital aerial photographs that precisely display fences, driveways, sidewalks, hedges, and other features that align with property boundaries. In fact, there are parcel data programs that reflect real-time changes in real estate transactions or new street addresses through field-based global positioning system enabled hand-held computers.

As mentioned earlier, there has been a fair amount of federal policy supporting a comprehensive approach to parcel data. However, while the FGDC has designated BLM as the steward for federal land parcel data and the coordinator of cadastral data, a coordinated approach to parcel data, even for federally managed property, does not exist. The most tangible and successful effect of federal efforts has been the FGDC Subcommittee for Cadastral Data, which has made significant progress in the development of standards and coordination with stakeholders. As for federal agency programs to develop parcel data, the National Integrated Land System is the closest thing to a coordinated program, but it remains much more of a set of technologies than a source of parcel data. Meanwhile, there is evidence that federal agencies are acknowledging their need for parcel data to fulfill their missions. For example, the Department of Agriculture's common land unit program is generating subparcel data to monitor fraudulent crop insurance claims, and DHS has included a detailed specification for parcel data in its geographic data model. This is a tangible recognition of the essential role parcel data can play in improving the level of service from federal agencies. The development of parcel data for Indian lands is also very inconsistent across the nation, due in part to the many additional difficulties that must be addressed when dealing with Indian trust lands.

CHALLENGES

The committee assessed the challenges, issues, and barriers to the development of a national land parcel data set and found these to be technological or data-related, financial, legal, organizational, and political, as well as problems unique to Indian lands. Although most of the technological barriers have been overcome, issues related to the accuracy and currency of the data still must be addressed. Appropriate funding mechanisms for a national land parcel data set are needed. However, the committee believes that the financial and technical issues are minor compared to the organizational and political ones. With thousands of counties or other government entities as potential producers of parcel data, the organizational issues are complex. It is not a simple task to assemble parcel data that span several counties or states. Overcoming the organizational barriers even among federal agencies has been difficult, as evidenced by the fact that there is no single inventory of federal lands. The lack of nationally integrated land parcel data has led to massive duplication of effort among various levels of government and between the public and private sectors. For example, in the absence of a coordinated public sector approach to parcel data, private firms have acquired local data and teamed with aerial photography companies and commercial digital map providers to develop their own versions of parcel data.

Many legal and political issues related to parcel data have arisen. Even when parcel data do exist in digital format they are often encumbered by restrictive local government licensing policies. Other issues arise related to data sharing, such as the Census Bureau's legal inability to share address data. There are many issues related to what data should be in the public domain and what should be considered confidential to protect privacy. Local governments have few incentives to adopt a consistent data content standard for parcel data or even to share the information beyond their borders. Local governments are also suspicious that development of a national land parcel data set may become another "unfunded mandate," under which they are required to provide their data for little or no compensation or benefit to them.

COMMITTEE'S VISION

The committee's vision for nationally integrated land parcel data is a distributed system of land parcel data housed with the appropriate data stewards but accessible through a central web-based interface. It would have a minimum set of attributes, and the development and integration of the national data set would be overseen by a national coordinator, working with coordinators for federal lands, Indian lands, and each state. These data would serve as the cadastral data layer of the NSDI. This vision is based on existing federal policies for national geospatial data and thus the data would be in the public domain, but in order to address issues relating to privacy and confidentiality, no information will be provided about private ownership, use, or value. This national system would be built on already existing parcel data systems at the state and local levels.

The envisioned system would link a series of distributed servers maintained by local and state governments. In a virtual environment the system could seamlessly assemble accurate and timely parcel information for any part of the nation. This would be analogous to "just-in-time manufacturing" in which parts required for assembly are obtained when they are needed, rather than having a large warehouse filled with inventory. For this to happen the national vision would require that each parcel be treated as a unique entity. The information about each parcel would be maintained by local government officials. These local parcel data stewards would share only geographic coordinates that define the geometry of each parcel and a minimal set of attributes including street address, unique identification number, a generalized category of ownership, and metadata. Since this system is not intended to replace the legal property record system, the geometry of each property could initially be represented as a single point while digital boundary data are developed. State coordinators would ensure consistency and work with the Census Bureau to use the parcel data to create accurate boundaries for governmental land units.

At the federal level there would be a federal land parcel coordinator who would focus on the development of parcel data for federal lands. There would also be a national land parcel coordinator who would be responsible for coordinating the development of complete and integrated nationwide coverage of parcel data from all levels of government. This national coordinator would build relationships with state and local governments to establish unfettered access to a comprehensive set of parcel data linked to a unique identification system. While this level of intergovernmental coordination may seem to be a daunting task it is exactly what is proposed by current initiatives at both the state and the national levels, such as the Fifty States Initiative developed by the National States Geographic Information Council (NSGIC) in cooperation with the FGDC to improve statewide coordination of geospatial information technologies and the Office of Management and Budget's (OMB's) Geospatial Line of Business (GLoB) to improve geospatial data coordination across the federal government. The national coordinator could also support the geospatial community in understanding the proper role of parcel data with respect to other NSDI data themes relating to land ownership, housing, buildings, and government boundaries.

Immediate and sustained funding for the program should be a shared responsibility among all stakeholders. The federal government would bear the incremental cost to integrate parcel data across county and state boundaries. New initiatives such as the proposed NSGIC Imagery for the Nation would help fund data acquisition needed for parcel data development. Cost sharing between federal and state and local governments would follow the successful model used by the U.S. Geological Survey to create the national mapping program. The private sector and local governments are already making substantial investments in parcel data. Therefore, they are critical stakeholders in the national vision for parcel data and would realize substantial benefits from a coordinated approach. Additional sources of funding would be required to establish new parcel programs in areas where they do not currently exist. Local governments with existing programs could retain their current licensing programs and receive new funding to cover the cost of data sharing.

In order to achieve this vision and overcome the challenges and barriers, the committee makes nine recommendations. A discussion of these recommendations follows.

RECOMMENDATIONS

The committee believes, first and foremost, that there is an urgent need to clarify and enforce federal agency responsibilities for land parcel-related geospatial data under OMB Circular A-16. In order to accomplish this, the committee recommends the following:

RECOMMENDATION 1. In order to achieve nationally integrated land parcel data, there should be both a federal land parcel coordinator and a national land parcel coordinator. A panel should be established to determine whether BLM has the necessary and sufficient authority and capacity to serve as the federal and/or national land parcel coordinator, and if not, either it should be given the authority and resources, or some other agency should be named. The panel should conduct a review of BLM's existing stewardship responsibilities for cadastral and federal land ownership status under OMB Circular A-16, as well as its current legislative authorities and budget priorities.

Next, the committee believes that there needs to be a better understanding of the interrelationships between land parcel data and the following OMB A-16 mandated data themes: Buildings and Facilities, Cultural Resources, Governmental Units, and Housing. This would provide for better integration of the data themes and avoid unnecessary duplication of effort.

RECOMMENDATION 2. As part of the Geospatial Line of Business process, the FGDC should identify the role of parcel data in the collection and maintenance of the following data themes: Buildings and Facilities, Cultural Resources, Governmental Units, and Housing.

Since the federal government is the largest land management agency, complete parcel data for federal lands are needed for a national data set. Therefore, it is necessary for the federal government to develop and maintain an inventory of its own property, which would be implemented through the following recommendation.

RECOMMENDATION 3. The Federal Land Parcel Coordinator should coordinate the development and maintenance of a single, comprehensive, and authoritative geographi-

cally referenced database for land parcels managed by the federal government, including public lands. This database should include the ownership, area, and use of all federally managed lands.

To create trust among the stakeholders and address the technical and legal issues identified in this report, a national program for parcel data must have a comprehensive and accountable business plan. Proven benchmarks and metrics for assessing progress have already been developed by the FGDC Subcommittee for Cadastral Data.

RECOMMENDATION 4. The National Land Parcel Coordinator should develop and oversee a land parcel data business plan for the nation. This plan should serve as the basis for evaluation of the program and as a model for state and local governments. Metrics should be based on the FGDC Parcel Management Program Business Plan Template.

There is a need for the federal government to maintain an inventory of tribal trust land; however, there are unique issues and requirements associated with tribal trust parcels.

RECOMMENDATION 5. The Office of the Special Trustee for Tribal Lands should establish an Indian Lands Parcel Coordinator who would manage a program to coordinate and fund the development and maintenance of a geographically referenced database for Indian trust parcels. The data should then be made available to the National Land Parcel Coordinator to be integrated with national land parcel data.

The Census Bureau is currently modernizing the Topologically Integrated Geographic Encoding and Referencing (TIGER) system of digital street data for the 2010 Census. It has worked to align TIGER streets and blocks to the same data used by local governments. It is also creating a point-level representation of properties with associated street addresses. Several commercial companies are doing exactly the same thing. While these companies will lease their data, the Census Bureau is prohibited by Title 13 of the United States Code from sharing these data with other federal agencies or with the local governments that provided much of the information. Since addresses and their location are publicly available information, the ability of the Census Bureau to release just building address point locations could serve a multitude of uses and would have major economic benefits while not revealing confidential information about individuals. The availability of address points could dramatically improve emergency 911 systems across the nation and provide a starting point for parcel data in rural parts of the country.

RECOMMENDATION 6. Congress and the Bureau of the Census should explore potential policy options, including modifications to Title 13, that would allow its digital data on building addresses and their geographical coordinates to be placed in the public domain while also maintaining important privacy protections. If publicly available, these street addresses and coordinates could be used to assist in the development of parcel data in areas where parcel data sets do not exist.

Coordination at the state level is a necessary element of nationally integrated land parcel data and could logically be a part of the NSGIC/FGDC Fifty States Initiative.

RECOMMENDATION 7. The National Land Parcel Coordinator should embrace the Fifty States Initiative and require that every state formally establish a state parcel coordinator. State coordinators should develop a parcel data business plan and manage the relationships among all levels of government involved in parcel production. The plan and program should achieve comprehensive border-to-border parcel coverage for all public and privately owned property within the state. The state parcel coordinator should either work with the state office responsible for the Census Bureau's Boundary and Annexation program or with local government offices if a statewide program does not exist.

There are many different sources of funding that could be used to complete the development of digital parcel data nationwide, including intergovernmental cooperation, shared funding, and various incentives. The federal government can play a major role in orchestrating a better use of these funds. Therefore, a major responsibility of the national land parcel coordinator is to develop a "top-down" funding model to support a "bottom-up" production process. The coordinator will also need to obtain funding for integrating the data and developing the system to make them available.

RECOMMENDATION 8. The National Land Parcel Coordinator should develop a plan for a sustainable and equitable intergovernmental funding program for the development and maintenance of parcel data. The plan must provide financial incentives to local governments that will produce and maintain the majority of the parcel data. Many of the funds for this program should come from existing federal programs that require parcel data; however, new funding will be required to establish an initial baseline, integrate the data, and make them available through a web interface.

Many of the property fraud cases associated with the hurricanes of 2005 are the direct result of poor or nonexistent parcel data. The federal government, in concert with local and state agencies, should aggressively correct this information void. The committee believes that a series of incentives and requirements could jump-start this program. Tying grant eligibility for federal funds related to property or participation in federal data sharing programs to the existence of digital parcel data would help promote parcel data development. Since many local governments have already developed digital land parcel data for their own internal purposes, this should not be an excessive burden for them. For others that do not yet have digital land parcel data, incentives and support will be needed to promote their development.

RECOMMENDATION 9. To participate in federal geospatial programs such as federal collection and dissemination of orthoimagery, a local or state government should be required to make the parcel geometry and limited set of attributes needed for the national land parcel data system available in the public domain. Further, in order to be eligible to receive federal funds that are directly associated with property, such as disaster relief or community development assistance, digital land parcel data necessary to effectively administer the program should be made available by local and state governments.

This study argues that nationally integrated land parcel data are necessary, timely, technically feasible, and affordable. The 1980 NRC study of land parcels was visionary when it laid out a multilevel intergovernmental partnership that would provide parcel data across the country. At the

same time, the report was overly optimistic about the ability of 1980 vintage technology to deal with millions of parcels. Today, with our current infrastructure of geospatial technologies and standards, along with web-based technologies, it actually is technically and economically feasible to implement such a vision. Establishment of the NSDI and associated geospatial data policies suggests that the question does not appear to be whether the federal government has the need, resources, or authority to implement a national parcel data program, but rather whether it has the motivation and incentives to confront difficult institutional and financial obstacles. This report has laid out a set of recommendations to establish the framework necessary for intergovernmental coordination and funding. The committee hopes that establishing this framework will be the first step in moving forward with a national land parcel data program.

National Land Parcel Data

A VISION FOR THE FUTURE

Committee on Land Parcel Databases: A National Vision

Mapping Science Committee

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Washington, D.C.
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This study was supported by the Department of Commerce / U.S. Census Bureau Award No. YA123-05-SE-0220, Department of Homeland Security Award No. HSHQDC-06-P-00051, Department of Interior / Bureau of Land Management Award No. PAA-03-7087, Environmental Systems Research Institute, and U.S. Geological Survey / Federal Geographic Data Committee Award No. 04HQAG0127. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the organizations or agencies that provided support for the project.

International Standard Book Number-13 978-0-309-11030-3 (Book)
International Standard Book Number-10 0-309-11030-0 (Book)
International Standard Book Number-13 978-0-309-11031-0 (PDF)
International Standard Book Number-10 0-309-11031-9 (PDF)
Library of Congress Control Number 2007937818

Additional copies of this report are available from the National Academies Press, 500 Fifth Street, N.W., Lockbox 285, Washington, DC 20055; (800) 624-6242 or (202) 334-3313 (in the Washington metropolitan area); Internet, http://www.nap.edu.

C*over:* Lower half of the cover shows aerial imagery overlain with parcel boundaries provided courtesy of Delaware County, Ohio. Cover design by Michael Dudzik.

Printed in the United States of America

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Acknowledgments

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Research Council's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their participation in the review of this report:

Richard R. Almy, Almy, Gloudemans, Jacobs and Denne, La Grange Highlands, Illinois
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Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations nor did they see the final draft of the report before its release. The review of this report was overseen by Michael F. Goodchild, University of California, Santa Barbara. Appointed by the National Research Council, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

Preface

Land ownership has been critical to the economic and philosophical development of the United States. Land parcel databases, which are also known as cadastres, describe the rights, interests, and value of property. These databases represent the distribution of the real property assets of a community and its ownership, form the basis for all land use and zoning decisions, and represent the location of residences, businesses, and public lands. In other words, almost every aspect of government and business can be associated with a land parcel.

In 1980, the National Research Council (NRC) issued a report titled *Need for a Multipurpose Cadastre*, which became, and still is, a guidebook for land parcel data systems throughout the world. The report advocated the development of a nationally integrated set of land parcel data and recommended a vision for achieving it. However, 27 years later, despite technological advances to make it more feasible and policy directives that support the development of national land parcel data, the United States has still not achieved this vision. Therefore, the NRC was requested by five organizations (the Bureau of Land Management, the Federal Geographic Data Committee, the Department of Homeland Security, the Census Bureau, and the Environmental Systems Research Institute) to reassess the 1980 vision for land parcel data and determine why it has yet to be achieved.

During the conduct of this study, the importance, complexity, and passion that surround a concept such as a national perspective on land parcel data became much more evident. It also became obvious that the study committee faced a huge challenge in trying to improve upon *Need for a Multipurpose Cadastre,* since much of what is recommended in that report is as relevant today as it was in 1980. The task therefore became to determine why its vision was not achieved, and how the technological and organizational changes of the last quarter century have influenced the vision and the potential for reaching it.

Fortunately, the committee consisted of an outstanding group of individuals who were up to the task. Committee members came from local and tribal governments that depend on parcel data to improve the delivery of services to taxpayers, and from state governments that are struggling to develop workable partnerships with local governments to acquire parcel data. The committee also included members from the private sector who know how to create parcel data and whose businesses depend on this. Finally, it included members of academia who are dedicated to improving the use

of geospatial data and technologies in public policy. The committee received invaluable input from a diverse group of participants from federal agencies, the private sector, and professional organizations at meetings held in the spring of 2006, including an information-gathering workshop called a Land Parcel Summit. The pulse of the producers and users of parcel data across the nation was measured through a web-based feedback system. This was an innovative approach that gained the perspective of 400 individuals who are working "in the trenches" with parcel data. The thousands of written comments provided by this diverse set of stakeholders helped the committee better understand the issues and formulate its recommendations. The input of all of these individuals has made this a much better report. Finally, the entire committee benefited from the guidance and tireless work of Ann Frazier from the NRC who helped us stay on course. The entire team appreciates the support of the sponsors who wanted us to objectively assess a complex situation and provide a vision for the future.

Finally, a unique aspect of this study has been the opportunity to revisit an issue that was first addressed in 1980. It is an obvious understatement to say that the world is a much different place in 2007. In 1980, personal computers were rare and few could have even described the capabilities that are now available to us over the World Wide Web. In 1980 no one had experienced the events of September 11, 2001, or Hurricane Katrina. Institutionally we did not have a Department of Homeland Security or a Federal Geographic Data Committee. The current framework of Spatial Data Infrastructure standards for data, technology, and discovery did not exist. Now, geospatial technology and related services are ubiquitous. These events and technological advances have changed the way we do business. In light of these factors the committee can only hope that that this report will be as highly regarded as the one written in 1980, but at the same time, we also hope that it will have a greater impact in terms of changing the way all levels of government create and use land parcel data. It is intended for those organizations that create and use land parcel data, and in particular those U.S. government agencies that play a role in coordinating and funding national land parcel data and other related themes of the National Spatial Data Infrastructure. The challenge is exactly the same one that faced the original NRC committee 27 years ago—how do we create workable partnerships to better serve our citizens?

David Cowen
Chair

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