



February 2015

GEOSPATIAL DATA

Progress Needed on Identifying Expenditures, Building and Utilizing a Data Infrastructure, and Reducing Duplicative Efforts

On March 18, 2015, this report was reissued to (a) clarify that GSA responded that it did not have comments on a draft of our report, and (b) ensure consistency in reporting that the Department of Transportation has begun to implement procedures for using the Geospatial Platform's Marketplace. These changes had no impact on the conclusions of our report.

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Why GAO Did This Study

The federal government collects, maintains, and uses geospatial information—data linked to specific geographic locations—to help support varied missions, including national security and natural resources conservation. To coordinate geospatial activities, in 1994 the President issued an executive order to develop a National Spatial Data Infrastructure—a framework for coordination that includes standards, data themes, and a clearinghouse. GAO was asked to review federal and state coordination of geospatial data.

GAO's objectives were to (1) describe the geospatial data that selected federal agencies and states use and how much is spent on geospatial data; (2) assess progress in establishing the National Spatial Data Infrastructure; and (3) determine whether selected federal agencies and states invest in duplicative geospatial data. To do so, GAO identified federal and state uses of geospatial data; evaluated available cost data from 2013 to 2015; assessed FGDC's and selected agencies' efforts to establish the infrastructure; and analyzed federal and state datasets to identify duplication.

What GAO Recommends

GAO suggests that Congress consider assessing statutory limitations on address data to foster progress toward a national address database. GAO also recommends that OMB improve its oversight of FGDC and federal agency initiatives, and that FGDC and selected agencies fully implement initiatives. The agencies generally agreed with the recommendations and identified plans to implement them.

View [GAO-15-193](#). For more information, contact David A. Powner at (202) 512-9286 or pownerd@gao.gov.

What GAO Found

Federal agencies and state governments use a variety of geospatial datasets to support their missions. For example, after Hurricane Sandy in 2012, the Federal Emergency Management Agency used geospatial data to identify 44,000 households that were damaged and inaccessible and reported that, as a result, it was able to provide expedited assistance to area residents. Federal agencies report spending billions of dollars on geospatial investments; however, the estimates are understated because agencies do not always track geospatial investments. For example, these estimates do not include billions of dollars spent on earth-observing satellites that produce volumes of geospatial data. The Federal Geographic Data Committee (FGDC) and the Office of Management and Budget (OMB) have started an initiative to have agencies identify and report annually on geospatial-related investments as part of the fiscal year 2017 budget process.

FGDC and selected federal agencies have made progress in implementing their responsibilities for the National Spatial Data Infrastructure as outlined in OMB guidance; however, critical items remain incomplete. For example, the committee established a clearinghouse for records on geospatial data, but the clearinghouse lacks an effective search capability and performance monitoring. FGDC also initiated plans and activities for coordinating with state governments on the collection of geospatial data; however, state officials GAO contacted are generally not satisfied with the committee's efforts to coordinate with them. Among other reasons, they feel that the committee is focused on a federal perspective rather than a national one, and that state recommendations are often ignored. In addition, selected agencies have made limited progress in their own strategic planning efforts and in using the clearinghouse to register their data to ensure they do not invest in duplicative data. For example, 8 of the committee's 32 member agencies have begun to register their data on the clearinghouse, and they have registered 59 percent of the geospatial data they deemed critical. Part of the reason that agencies are not fulfilling their responsibilities is that OMB has not made it a priority to oversee these efforts. Until OMB ensures that FGDC and federal agencies fully implement their responsibilities, the vision of improving the coordination of geospatial information and reducing duplicative investments will not be fully realized.

OMB guidance calls for agencies to eliminate duplication, avoid redundant expenditures, and improve the efficiency and effectiveness of the sharing and dissemination of geospatial data. However, some data are collected multiple times by federal, state, and local entities, resulting in duplication in effort and resources. A new initiative to create a national address database could potentially result in significant savings for federal, state, and local governments. However, agencies face challenges in effectively coordinating address data collection efforts, including statutory restrictions on sharing certain federal address data. Until there is effective coordination across the National Spatial Data Infrastructure, there will continue to be duplicative efforts to obtain and maintain these data at every level of government.

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Abbreviations

BLM	Bureau of Land Management
Census	U.S. Census Bureau
Commerce	Department of Commerce
DHS	Department of Homeland Security
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FSA	Farm Service Agency
GIS	geographic information system
Interior	Department of the Interior
IT	information technology
LIDAR	light detection and ranging
NGAC	National Geospatial Advisory Committee
NGDA	National Geospatial Data Asset
NOAA	National Oceanic and Atmospheric Administration
NSDI	National Spatial Data Infrastructure
NSGIC	National States Geographic Information Council
OMB	Office of Management and Budget
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USPS	United States Postal Service

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U.S. GOVERNMENT ACCOUNTABILITY OFFICE

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February 12, 2015

The Honorable Thomas R. Carper
Ranking Member
Committee on Homeland Security and Governmental Affairs
United States Senate

The Honorable Orrin G. Hatch
United States Senate

The Honorable James E. Risch
United States Senate

The Honorable Mark R. Warner
United States Senate

The federal government collects, maintains, and uses geospatial data—information linked to specific geographic locations—to help in decision making and to support many functions, including national security, law enforcement, health care, environmental protection, and natural resources conservation. Among the many activities that can depend on critical analysis of geospatial data are maintaining roads and other critical transportation infrastructures and quickly responding to natural disasters, such as floods, hurricanes, and fires.

Multiple federal agencies provide services at the same geographic locations and may independently collect similar geospatial data about those locations, thus raising the question of how well the nation's investments in geospatial data are coordinated. In an attempt to coordinate geospatial activities and discourage duplication, in 1994, the President issued an executive order to develop a National Spatial Data Infrastructure (NSDI). Consisting of data themes, standards, metadata, a clearinghouse, and partnerships, NSDI was expected to facilitate the efficient collection, sharing, and dissemination of geospatial data among all levels of government, the private sector, and the public.

However, the initiation of the NSDI did not halt duplicative investments in geospatial data. In August 2012, the Department of the Interior (Interior) estimated that the federal government invested billions of dollars in

geospatial data annually, and reported that duplication among investments was common.¹ Additionally, in November 2012, we reported that federal efforts to acquire geospatial data were uncoordinated and that the government was acquiring duplicative data.² We made several recommendations to improve coordination among federal agencies, and the status of those recommendations is discussed later in this report.

Given your interest in reducing duplicative investments, you asked us to review federal and state efforts to improve coordination in acquiring geospatial data. Our objectives were to (1) describe the geospatial data that selected federal agencies and states are using to support their missions, and identify how much is spent on geospatial data; (2) assess progress in establishing the NSDI; and (3) determine whether selected federal agencies and states invest in duplicative geospatial data.

To address our objectives, we selected two key data types, seven federal agencies, and five states. We selected the two key data types—addresses and imagery resulting from aerial photography—based on (1) the need to appropriately scope our review due to the large amounts of geospatial data, (2) the importance of these types of data to the work of the federal and state governments, and (3) the potential for duplication within these data types, as noted by prior federal reports.

We selected agencies based on several factors, including agencies whose missions were closely tied to the selected data types (addresses and aerial photography), as well as including a mix of agencies who participate in the Office of Management and Budget's (OMB) required geospatial clearinghouse³ and those who do not. In addition, we sought to include some agencies that were not the subject of our prior geospatial report.⁴ The federal agencies we selected because of their reliance on

¹Department of the Interior, *Geospatial Line of Business Capital Asset Summary* (Aug. 14, 2012).

²GAO, *Geospatial Information: OMB and Agencies Need to Make Coordination a Priority to Reduce Duplication*, GAO-13-94 (Washington, D.C.: Nov. 26, 2012).

³The geospatial clearinghouse is one feature of the National Spatial Data Infrastructure. It is intended to be a centralized geospatial metadata repository that contains geospatial metadata records from federal agencies, state and local governments, and academic and private sector organizations that can be searched to determine whether needed geospatial data exist and can be shared.

⁴GAO-13-94.

address data are the Department of Commerce's (Commerce) U.S. Census Bureau (Census), the Department of Homeland Security's (DHS) Federal Emergency Management Agency (FEMA), and the United States Postal Service (USPS).⁵ The federal agencies we selected because of their reliance on aerial photography are the U.S. Department of Agriculture's (USDA) Farm Service Agency (FSA), Commerce's National Oceanic and Atmospheric Administration (NOAA), the Department of the Interior's (Interior) Bureau of Land Management (BLM), and Interior's U.S. Geological Survey (USGS).

We selected the states in our review based on whether they had state imagery and address data programs and whether the state hosted federal imagery programs. In addition, we sought states that would provide regional diversity within the United States. The selected states are Maryland, Montana, Ohio, South Carolina, and Washington.

To describe the geospatial data that the selected federal agencies and states use to support their missions, we reviewed agency and state documentation and responses to structured questions, and conducted interviews with agency and state officials. To assess progress in establishing the NSDI, we compared agencies' activities against guidance found in OMB documentation and an executive order regarding geospatial activities.⁶ We also interviewed relevant agency officials about ongoing and planned initiatives. To determine whether the selected federal agencies and states invest in duplicative data, we compared OMB and GAO guidance on reducing duplication to practices in place on the geospatial platform as well as agency and state repositories.⁷ Specifically, we analyzed federal and state collections of two types of geospatial

⁵USPS is an establishment of the federal executive branch. For purposes of our report, we are referring to it as a federal agency.

⁶OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities* (Aug. 19, 2002); *Issuance of OMB Circular A-16 Supplemental Guidance*, M-11-03 (Nov. 10, 2010); and Executive Order No. 12906, *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*, 59 Fed. Reg. 17,671 (Apr. 11, 1994).

⁷GAO, *2013 Annual Report: Actions Needed to Reduce Fragmentation, Overlap and Duplication, and Achieve Other Financial Benefits*, [GAO-13-279SP](#) (Washington, D.C.: Apr. 9, 2013) and OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities* (Aug. 19, 2002); *Issuance of OMB Circular A-16 Supplemental Guidance*, M-11-03 (Nov. 10, 2010).

data—addresses and aerial photography—to identify datasets that appeared to overlap. We then interviewed relevant federal and state officials to determine if these potential overlaps were examples of duplication.

We conducted this performance audit from January 2014 to February 2015 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. Details of our objectives, scope, and methodology are contained in appendix I.

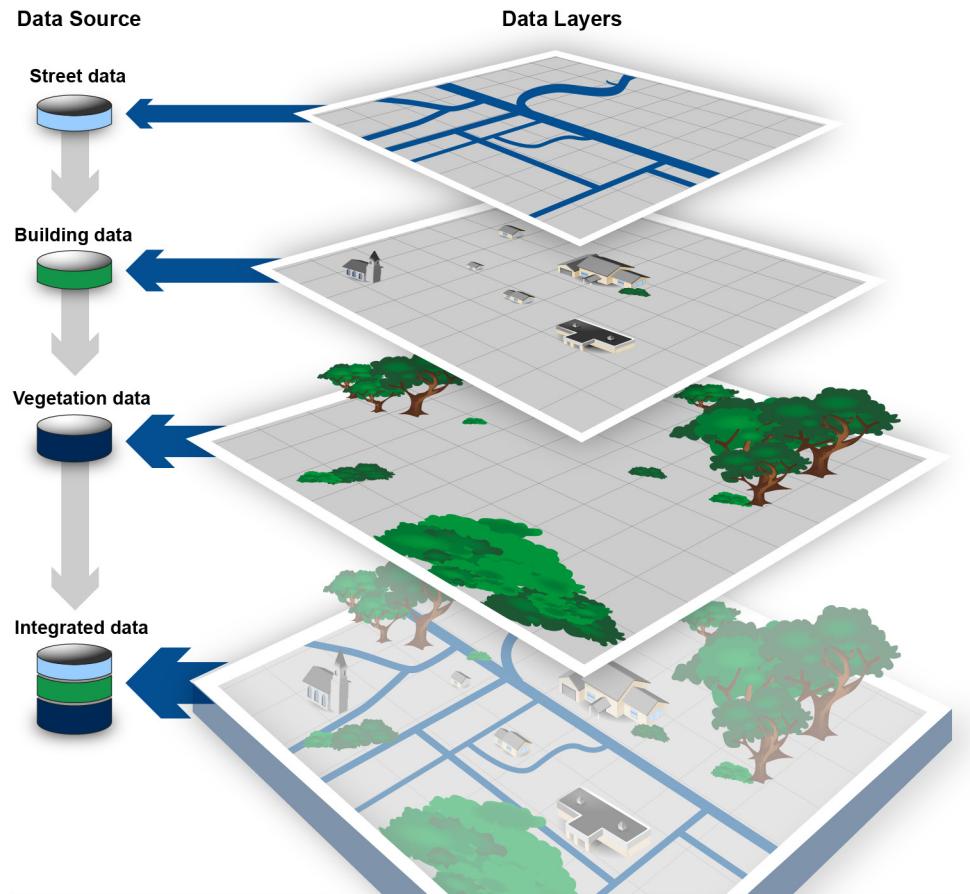
Background

Geospatial data describe features or phenomena that can be referenced to specific locations relative to the earth's surface. For example, features such as buildings, rivers, road intersections, power plants, and national parks can all be identified by their locations. In addition, phenomena such as wildfires, the spread of an enterovirus, and the thinning of trees due to acid rain can also be tracked by their geographic locations.

Individuals can analyze geospatial data in geographic information systems (GIS)—systems of computer software, hardware, and data used to capture, store, manipulate, analyze, and graphically present a potentially wide array of geospatial data. The primary function of a GIS is to link multiple sets of geospatial data and display the combined information as maps with different layers of information. Assuming that all of the information is at the same scale and has been formatted according to the same geospatial standards, users can potentially overlay geospatial data about any number of specific topics to examine how the data in the various layers interrelate.

Each layer of a GIS map typically represents a single theme made up of one or more sets of data, each of which could be derived from a source completely different from the others. For example, one theme could represent all of the streets in a specific area. Another theme could correspond to all of the buildings in the same area, and others could show vegetation and water resources. Analyzing this layered information as an integrated whole can significantly aid decision makers in considering complex choices, such as where to locate a fire station building to best serve the greatest number of citizens. Figure 1 portrays the concept of data themes in a GIS.

Figure 1: Visual Representation of Data Themes in a Geographic Information System



Source: GAO. | GAO-15-193

Coordination of Geospatial Data in the Federal Government

For many years, the federal government has taken steps to coordinate geospatial activities both within and outside the federal government to discourage the duplication of data and the inefficient use of resources. In 1953, the Bureau of the Budget⁸ first issued Circular A-16, encouraging

⁸The Bureau of the Budget became OMB in 1970. Executive Order No. 11541, *Prescribing the Duties of the Office of Management and Budget and the Domestic Council in the Executive Offices of the President*, 35 Fed. Reg. 10737 (July 1, 1970).

expeditious surveying and mapping activities across all levels of government and avoidance of duplicative efforts. In 1990, OMB revised Circular A-16 to, among other things, establish the Federal Geographic Data Committee (FGDC) as an interagency coordinating body to promote the coordinated use, sharing, and dissemination of geospatial data nationwide. FGDC is chaired by the Secretary of the Interior and supported by a program office within USGS.

To strengthen that guidance, in 1994 the President issued Executive Order 12906 to address wasteful duplication and incompatibility of geospatial data, and assigned FGDC the responsibility to coordinate the development of the National Spatial Data Infrastructure (NSDI). In 2002, OMB again revised Circular A-16 to further describe the components of NSDI; clearly define agency responsibilities for acquiring, maintaining, distributing, using, and preserving geospatial data; and reaffirm FGDC's role as the interagency coordinating body for NSDI-related activities. The circular established the following five components of NSDI and described how these components were to be implemented.

- **Data themes.** Data themes are topics of national significance, such as cadastre, which includes rights and interests in real property and surveys, and land use-land cover, which includes land surface features and use. OMB Circular A-16 identified 34 data themes and identifies the lead agency or agencies for each theme. Each data theme is to consist of one or more electronic data records, known as datasets.
- **Standards.** Geospatial standards provide common and repeatable rules or guidelines for the development, documentation, and exchange of geospatial datasets.
- **Metadata.** Metadata are information about datasets, such as content, source, accuracy, method of collection, and point-of-contact. Metadata are used to facilitate the search of and access to datasets within a data library or clearinghouse, and enable potential users to determine the data's applicability for their use.
- **National Spatial Data Clearinghouse.** The clearinghouse is intended to be a centralized repository that contains geospatial metadata records from federal agencies, state and local governments, and academic and private sector organizations. Executive Order 12906 and OMB guidance require federal agencies to identify their existing and planned geospatial investments in the clearinghouse, and to

search the clearinghouse for cost-saving opportunities before acquiring new geospatial data. In 2003, FGDC created the Geospatial One-Stop as the clearinghouse in order to provide “one-stop” access to geospatial metadata from a centralized database and search function. In October 2011, the Geospatial One-Stop was retired, and FGDC initiated the Geospatial Platform.⁹ As of September 2014, there were approximately 88,000 geospatial metadata records registered on the Geospatial Platform, of which about 42,000 were from federal sources. Individuals can search the metadata repository and access the data through two different portals: the Geospatial Platform¹⁰ and Data.gov.¹¹

- **Partnerships.** Partnerships are efforts aimed at involving all stakeholders (e.g., federal, tribal, state, and local government, as well as academic institutions) in the development of the NSDI. Some of these partnerships include the National Geospatial Advisory Committee (NGAC),¹² the National Digital Orthoimagery Program,¹³ and the National Digital Elevation Program.¹⁴

In 2010, OMB provided supplemental guidance that further defined and clarified Circular A-16 and focused on managing geospatial data as a capital asset. The guidance established the concept of National Geospatial Data Assets (NGDA), which are the most significant data themes and datasets. It also encouraged agencies to adopt and

⁹In addition to providing a clearinghouse, the Geospatial Platform is also envisioned to provide shared and trusted geospatial services and applications for use by government agencies, their partners, and the public.

¹⁰<http://www.geoplatform.gov>.

¹¹Data.gov is a website designed to increase the ability of the public to easily find, download, and use datasets that are generated and held by the federal government. The Geospatial Platform and Data.gov use the same data catalog.

¹²NGAC includes members from federal, state, local, and tribal governments, the private sector, and academia who provide FGDC with advice and recommendations related to the management of federal and national geospatial programs.

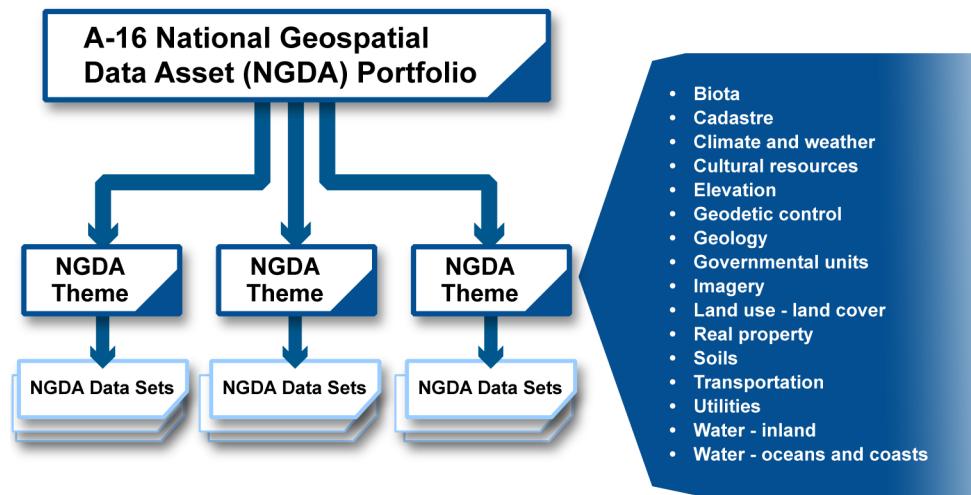
¹³Orthoimagery are images of the earth’s surface collected by aerial photography or satellites that have been corrected for distortions or viewing angles. The National Digital Orthoimagery Program is a consortium of federal and state agencies committed to providing national orthoimagery coverage by coordinating requirements and combining funding resources.

¹⁴The National Digital Elevation Program brings federal and state agencies together to acquire high-quality elevation data for the United States and its territories.

implement a portfolio management approach for their investments in geospatial data. By moving to a portfolio management approach in individual agencies, the guidance sought to create a government-wide NGDA portfolio.

As of August 2014, FGDC reported that there were 16 NGDA themes and 188 NGDA datasets. Figure 2 provides an overview of the NGDA portfolio and lists the 16 NGDA data themes. (See app. II for descriptions of the 16 NGDA data themes.)

Figure 2: Overview of the National Geospatial Data Asset Portfolio



Source: GAO analysis of Federal Geographic Data Committee data. | GAO-15-193

To fulfill its responsibilities, FGDC is governed by a steering committee—an interagency decision-making body that provides leadership and policy direction in support of the development of the NSDI. The Secretary of the Interior chairs the committee, and the Deputy Director for Management of OMB is the Vice-Chair of the committee. All departments or agencies that are responsible for geospatial data themes or have activities in geographic information or geospatial data collection or uses are required by OMB to be members of FGDC. Thirty-two agencies are currently members of the steering committee and are represented by their senior

agency officials for geospatial data.¹⁵ These senior agency officials are responsible for overseeing, coordinating, and facilitating their respective agency's implementation of geospatial requirements, policies, and activities. FGDC is supported by an Office of the Secretariat that consists of about 10 people located in USGS who do the day-to-day work of supporting, managing, and coordinating the activities of FGDC.

In December 2007, the Secretary of the Interior created the NGAC¹⁶ to provide the department and FGDC with advice and recommendations related to the management of federal and national geospatial programs, development of the NSDI, and the implementation of related federal guidance. Members of the committee include approximately 30 officials from federal, state, local, and tribal governments, the private sector, and academia. The advisory committee meets every 3 to 4 months, and provides a forum to convey views representative of non-federal stakeholders in the geospatial community.

OMB's Roles, Responsibilities, and Oversight

OMB has specific responsibilities for federal information technology (IT) systems and acquisition activities—including GIS—to help ensure their efficient and effective use. The three key laws that outline these responsibilities are the Paperwork Reduction Act of 1995, Clinger-Cohen Act of 1996, and E-Government Act of 2002.

- The Paperwork Reduction Act of 1995 specified OMB and agency responsibilities for managing information resources, including the management of IT. Among its provisions, this law established agency responsibility for assessing and managing the risks of major

¹⁵The 32 agency members of the Steering Committee are: Interior, OMB, the Departments of Agriculture, Commerce, Defense, Education, Energy, Health and Human Services, Homeland Security, Housing and Urban Development, Justice, Labor, State, Transportation, the Treasury, and Veterans Affairs; Environmental Protection Agency; Federal Communications Commission (non-voting member); General Services Administration; Library of Congress; National Aeronautics and Space Administration; National Archives and Records Administration; National Capital Planning Commission (non-voting member); National Science Foundation; Office of Personnel Management; Small Business Administration; Smithsonian Institution; Social Security Administration; Tennessee Valley Authority; U.S. Agency for International Development; U.S. Army Corps of Engineers (non-voting member); and U.S. Nuclear Regulatory Commission.

¹⁶NGAC was created by the Secretary of the Interior in December 2007 under the Federal Advisory Committee Act.

information systems initiatives. It also required that OMB develop and oversee policies, principles, standards, and guidelines for federal agency IT functions, including periodic evaluations of major information systems.

- The Clinger-Cohen Act of 1996 requires OMB to establish processes to analyze, track, and evaluate the risks and results of major capital investments in information systems made by federal agencies and report to Congress on the net program performance benefits achieved as a result of these investments.
- The E-Government Act of 2002 establishes e-government initiatives, which encourage the use of web-based Internet applications to enhance the access to and delivery of government information and service to citizens, business partners, and employees, and among all levels of government. The act also requires OMB to report annually to certain congressional committees on the status of the e-government initiatives. In these reports, OMB is to describe the administration's use of e-government principles to improve government performance and the delivery of information and services to the public.

OMB subsequently began to fulfill the requirements established by these laws:

- In February 2002, OMB established the Federal Enterprise Architecture, which is intended to facilitate government-wide improvement through cross-agency analysis and identification of duplicative investments, gaps, and opportunities for collaboration, interoperability, and integration within and across agency programs. The Federal Enterprise Architecture is composed of five "reference models" describing the federal government's (1) business (or mission) processes and functions, independent of the agencies that perform them; (2) performance goals and outcome measures; (3) means of service delivery; (4) information and data definitions; and (5) technology standards.
- In March 2004, OMB established multiple "Line of Business" initiatives to consolidate redundant IT investments and business processes across the federal government. Later, in March 2006, OMB established the Geospatial Line of Business. Each Line of Business initiative is led by an individual agency and supported by other relevant agencies. Interior is the managing partner for the Geospatial Line of Business and the FGDC Secretariat provides project management support.

In carrying out its responsibilities, OMB uses several data collection mechanisms to oversee federal IT spending during the annual budget formulation process. Specifically, OMB requires federal departments and agencies to provide information on their IT-related investments (called exhibit 53s) and capital asset plans and business cases (called exhibit 300s).

- Exhibit 53. The purpose of the exhibit 53 is to identify all IT investments—both major and non-major—and their associated costs within a federal organization.¹⁷ Information included in agency exhibit 53s is designed, in part, to help OMB better understand agencies' spending on IT investments. OMB guidance on formulating budgets for fiscal years 2013 and 2014 instructed agencies to identify their geospatial investments in the exhibit 53 using Federal Enterprise Architecture codes for specific functions (e.g., geospatial services, financial management, and acquisition management).
- Exhibit 300. The purpose of the exhibit 300 is to provide a business case for each major IT investment and to allow OMB to monitor IT investments once they are funded. Agencies are required to provide information on each major investment's cost, schedule, and performance.

Coordination of Geospatial Data in the State Governments

State governments rely on geospatial data to implement a wide range of responsibilities, including emergency management, taxation, wildlife management, and maintaining and managing state roads and bridges, among others. In order to support the NSDI, the National States Geographic Information Council (NSGIC) promotes geospatial coordination activities in all states. The council also advocates for states in national geospatial policy and initiatives. Members of NSGIC include state geographic information system managers, representatives from federal agencies, local government, the private sector, academia, and other professional organizations. NSGIC conducts semi-annual conferences to bring together its diverse membership. In addition, through its committees and work groups, NSGIC also develops proposals and

¹⁷A major IT investment is a system or an acquisition requiring special management attention because it has significant importance to the mission or function of the government; significant program or policy implications; high executive visibility; high development, operating, or maintenance costs; an unusual funding mechanism; or is defined as major by the agency's capital planning and investment control process.

recommendations through its advocacy efforts, including proposing a national address database and improved elevation data coordination.

NSGIC is also member of the Coalition of Geospatial Organizations, which provides a forum for organizations concerned with national geospatial issues in order to improve communications, provide educational information on relevant issues, align and strengthen policy agendas, and facilitate development of strategies to address national issues.

In addition to state-sponsored organizations, state governments typically have representation on many of the federal coordination groups, such as the National Digital Orthoimagery Program and the National Digital Elevation Program (both through NSGIC). In addition, representatives from state and local governments are members of NGAC—the committee that advises FGDC. Non-federal organizations, including stakeholders from organizations that represent state and local governments, may also serve as collaborating partners with the FGDC. These organizations include the Association of American Geographers,¹⁸ NSGIC, the National Association of State Chief Information Officers,¹⁹ the National Association

¹⁸The Association of American Geographers is a nonprofit scientific and educational society. Its members share interests in the theory, methods, and practice of geography, which they cultivate through annual meetings and scholarly journals, among other practices. More information can be found at <http://www.aag.org>.

¹⁹The National Association of State Chief Information Officers represents state chief information officers and information technology executives and managers from state governments across the United States. Its mission is to foster government excellence through quality business practices, information management, and technology policy. More information can be found at <http://www.nascio.org/>.

of Counties,²⁰ the Western Governors' Association,²¹ and the National League of Cities.²²

Overview of Two Key Data Types: Addresses and Aerial Imagery

While federal, state, and other entities regularly utilize a wide range of geospatial data, two key types of data are addresses and aerial photography. Addresses are the location identifiers most widely used by state and local government and the public. In most cases, local or county address authorities create new addresses. From there, addresses are aggregated by several types of entities. For example, some states aggregate local addresses in order to create a statewide database to help the state carry out its mission. In addition, USPS works with local address authorities to update their address databases on an ongoing basis. USPS produces a separate address file, which is provided to others for a fee. Private sector vendors typically use this address file to create their own address data products that they sell to their customers, which include federal agencies, state and local governments, and other private sector companies. Census uses several sources to update the address file it uses to conduct its various censuses. These sources include addresses from USPS, state and local government, and other federal agencies.

To increase their usefulness, address data are often linked to the exact geographical coordinates of a specific location through a process called geocoding or geo-referencing. Geocoded addresses provide a much greater level of accuracy than can be derived from using street centerlines and address ranges. Organizations may have different requirements for what location should be geocoded. For example, emergency officials need the geocode of the home or housing structure,

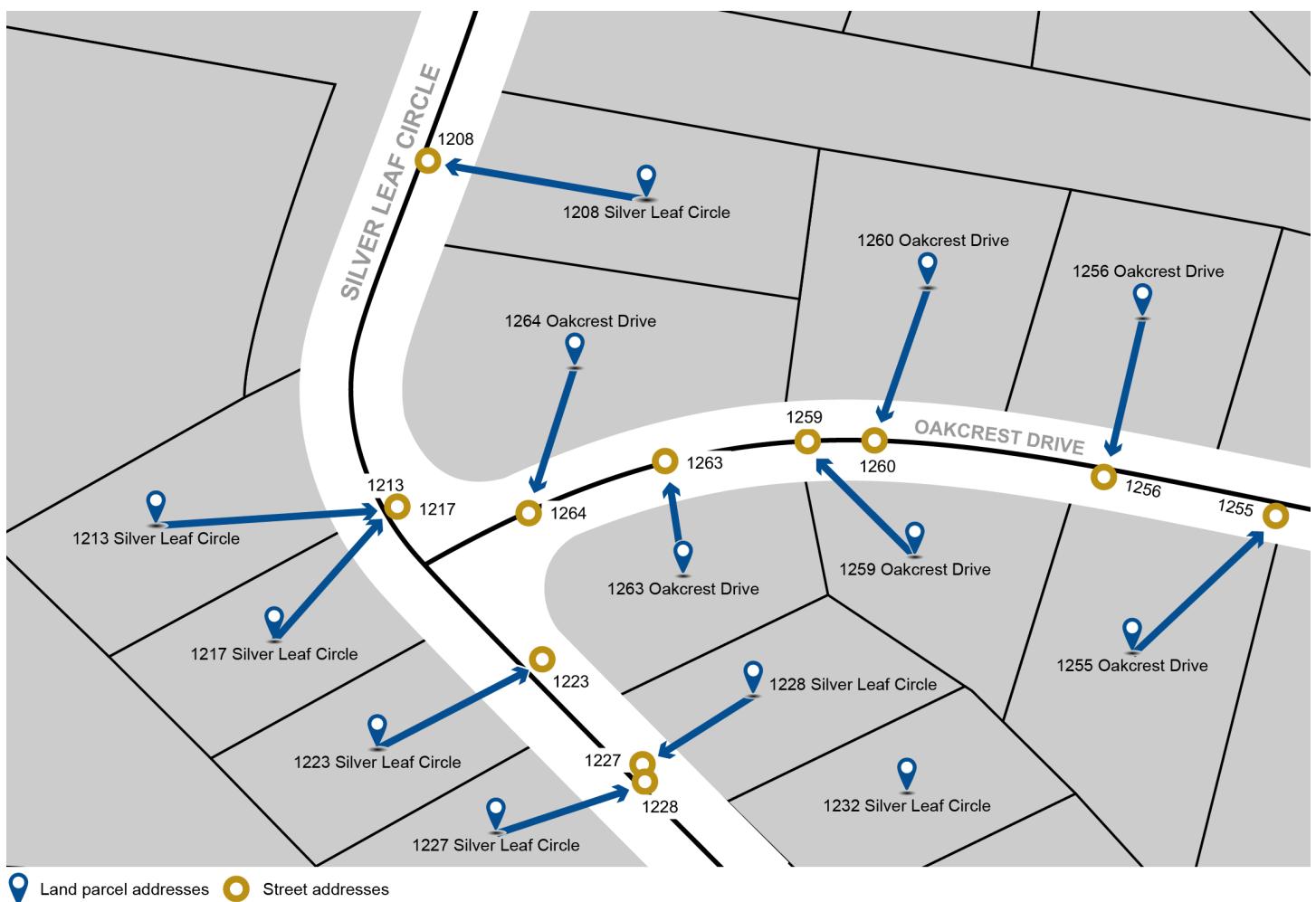
²⁰The National Association of Counties is a national organization that represents county governments in the United States. Its mission is to promote sound public policies, foster county solutions and innovation, promote intergovernmental and public-private collaboration and provide value-added services to save counties and taxpayers money. More information can be found at <http://www.naco.org/Pages/default.aspx>.

²¹The Western Governors' Association represents the governors of 19 western states and 3 U.S.-flag islands. The association is an instrument of the governors for bipartisan policy development, information exchange, and collective action on issues of critical importance to the Western United States. More information can be found at <http://www.westgov.org/about>.

²²The National League of Cities represents municipalities from across the country. Its goal is to help city leaders make better communities. More information can be found at <http://www.nlc.org/about-nlc>.

whereas USPS is more interested in the location of the mailbox. Figure 3 shows the difference from address points that are based on the center of the land parcels and address points that are based on the street centerline.

Figure 3: Difference between Address Points Based on Land Parcels and Street Centerlines



addition, addresses are the most commonly used way to communicate the location of an emergency; lives and property may be lost if first responders cannot quickly obtain an address to accurately locate an emergency event. For example, in the wake of Hurricane Katrina, the lack of address information slowed and frustrated rescue and recovery operations.²³

In addition to addresses, aerial photography is a key data type used by many levels of the government.²⁴ Aerial photography, which is part of the imagery data theme, records the ever-changing natural and man-made features on the earth's surface using aircraft (including planes, helicopters, and unmanned aerial systems) that are equipped with mapping cameras. When aerial photography began, imagery was acquired using film cameras. With recent advances in technology, more acquisition is being done with digital sensors. Digital sensors also offer capabilities that allow for the enhancement of the images to compensate for adverse conditions, such as shadows. This allows data collection in areas that might be obscured on film. Regardless of whether the images are collected using film or digitally, the resulting images are inspected using automated and visual methods to ensure accuracy. Orthoimagery, which are images of the earth's surface that have been corrected to resolve the displacement of features in the photo due to camera angles and terrain relief, can also be used as maps.

Most aerial photography is acquired through private sector vendors and contractors. Aerial photography can be purchased from vendors that maintain libraries of existing images, or contracted for specifically according to a customer's need for a particular product. When contracting for aerial photography collections, many elements need to be considered, including the size of the area to be photographed, the terrain (urban or non-urban, mountains or plains), vegetation cover (agricultural or forest, leaf-on or leaf-off²⁵), sunlight (time of day or time of year) and angle

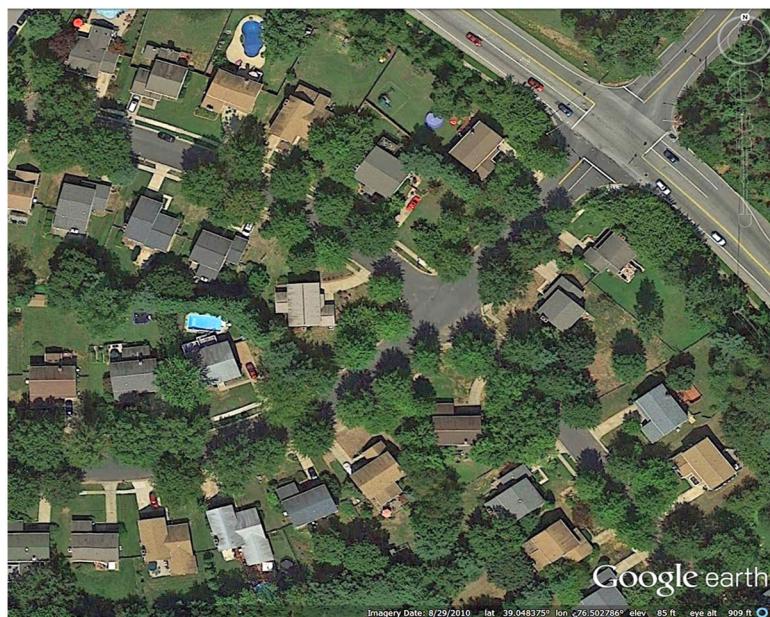
²³See NGAC, *The Need for a National Address Database, A Report Submitted by the National Geospatial Advisory Committee* (December 2012).

²⁴FGDC considers aerial photography a subset of the imagery data theme. The other subset is satellite photography.

²⁵Leaf-on photography refers to images acquired when there is foliage on certain tree and shrub species. Leaf-off photography refers to images acquired when there is no foliage or a reduced amount of foliage on certain tree and shrub species.

(straight down—known as vertical, or an at angle—known as oblique). Most imagery is acquired as a four-band product, which can be viewed as either a natural color or color infrared image. See figures 4 and 5 below for a comparison of leaf-on and leaf-off imagery.

Figure 4: Leaf-on Aerial Photography



Source: Google, Inc. | GAO-15-193

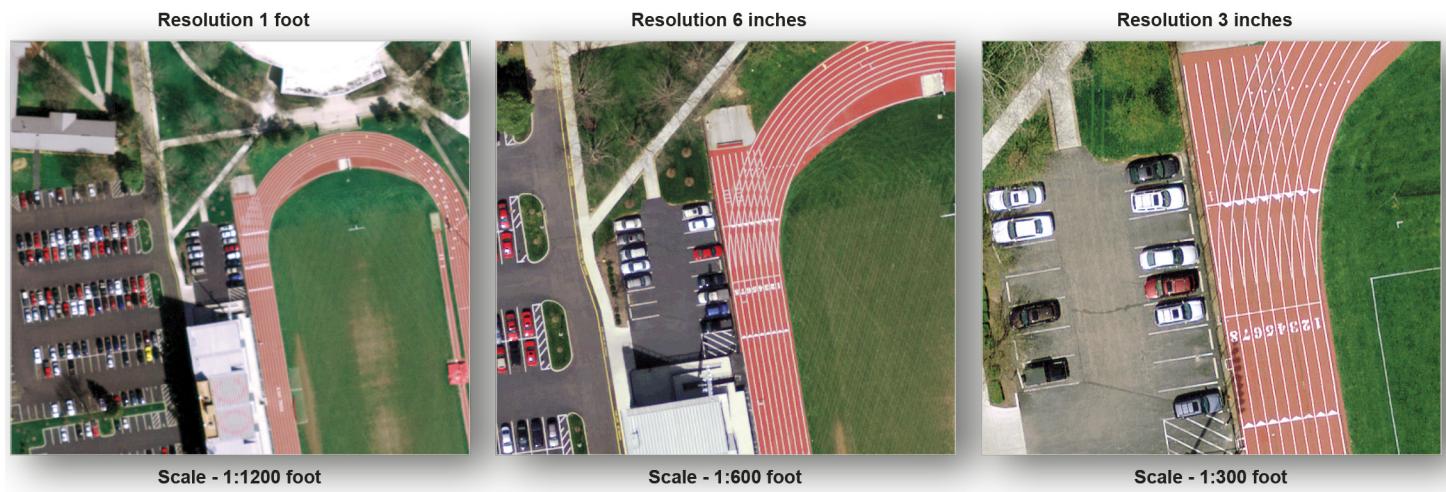
Figure 5: Leaf-off Aerial Photography



Source: Maryland Department of Information Technology. | GAO-15-193

One important consideration in using an image is determining the level of detail necessary. Typically, the greater the level of detail required, the higher the resolution of photography necessary. Digital aerial photography resolution is generally expressed as the amount of area covered by one pixel. For example, imagery with a 1-foot resolution will cover 1 foot of ground in each pixel; this is considered relatively high resolution. Imagery with a 1-meter resolution will cover 1 meter of ground in each pixel; this is considered relatively lower resolution. See figure 6 for examples of different aerial photography resolutions.

Figure 6: Example of Aerial Photography at Different Resolutions



Source: Ohio Statewide Imagery Program. | GAO-15-193

GAO Has Previously Reported on Geospatial Data

In November 2012, we reported that while the President and OMB had established policies and procedures for coordinating investments in geospatial data, government-wide committees and selected federal departments and agencies had not effectively implemented them.²⁶ We made recommendations aimed at improving coordination and reducing duplication, including recommendations that

- FGDC develop a national strategy for coordinating geospatial investments;
- selected federal agencies (Commerce, Interior, and Transportation) follow federal guidance for managing geospatial investments; and
- OMB develop a mechanism to identify and report on geospatial investments.

Commerce and Interior agreed with our recommendations; Transportation neither agreed nor disagreed. OMB concurred with the need for improved collection of geospatial-related investments, but stated that it should only

²⁶ GAO-13-94.

be achieved through improvements to broader reporting mechanisms for IT investments and data assets, and not by developing new and separate mechanisms specifically for geospatial-related assets. We discuss agencies' progress on implementing key recommendations later in this report. For further information on the status of our prior recommendations, see appendix III.

In addition to our work on geospatial data management, over the last 4 years, we have issued a series of reports that have identified federal programs and functional areas where unnecessary duplication, overlap, or fragmentation exists;²⁷ the actions needed to address such conditions; and the potential financial and other benefits of doing so.²⁸ In particular, we identified opportunities to reduce duplication and the cost of government operations in several critical IT areas. In our 2013 annual report on duplication, we reported that better coordination among federal agencies that collect, maintain, and use geospatial data could help reduce duplication of geospatial investments and provide the opportunity for potential savings of millions of dollars. In that report, we reiterated the need for action among several federal agencies, FGDC, and OMB.

²⁷Fragmentation refers to those circumstances in which more than one federal agency (or more than one organization within an agency) is involved in the same broad area of national need and opportunities exist to improve service delivery. Overlap occurs when multiple agencies or programs have similar goals, engage in similar activities or strategies to achieve them, or target similar beneficiaries. Duplication occurs when two or more agencies or programs are engaged in the same activities or provide the same services to the same beneficiaries.

²⁸GAO, *2014 Annual Report: Additional Opportunities to Reduce Fragmentation, Overlap, and Duplication and Achieve Other Financial Benefits*, GAO-14-343SP (Washington, D.C.: Apr. 8, 2014); *2013 Annual Report: Actions Needed to Reduce Fragmentation, Overlap and Duplication and Achieve Other Financial Benefits*, GAO-13-279SP (Washington, D.C.: Apr. 9, 2013); *2012 Annual Report: Opportunities to Reduce Duplication, Overlap and Fragmentation, Achieve Savings, and Enhance Revenue*, GAO-12-342SP (Washington, D.C.: Feb. 28, 2012); and *Opportunities to Reduce Potential Duplication in Government Programs, Save Tax Dollars, and Enhance Revenue*, GAO-11-318SP (Washington, D.C.: Mar. 1, 2011).

Federal Agencies and States Use a Wide Variety of Geospatial Data to Support Their Missions, but the Reported Costs Are Understated

Federal agencies and state governments use multiple geospatial datasets to support their varying missions and provide vital services to their constituents. Federal sources have estimated that over 80 percent of the data federal agencies produce has a geospatial component. Each of the states and agencies we reviewed uses some or all of the 16 NGDA data themes as well as address data. Further, many of the geospatial data products used by agencies and the federal government use a combination of different datasets from different themes to derive products to support their mission needs. For a list of data themes used by selected federal agencies and states, see appendix IV.

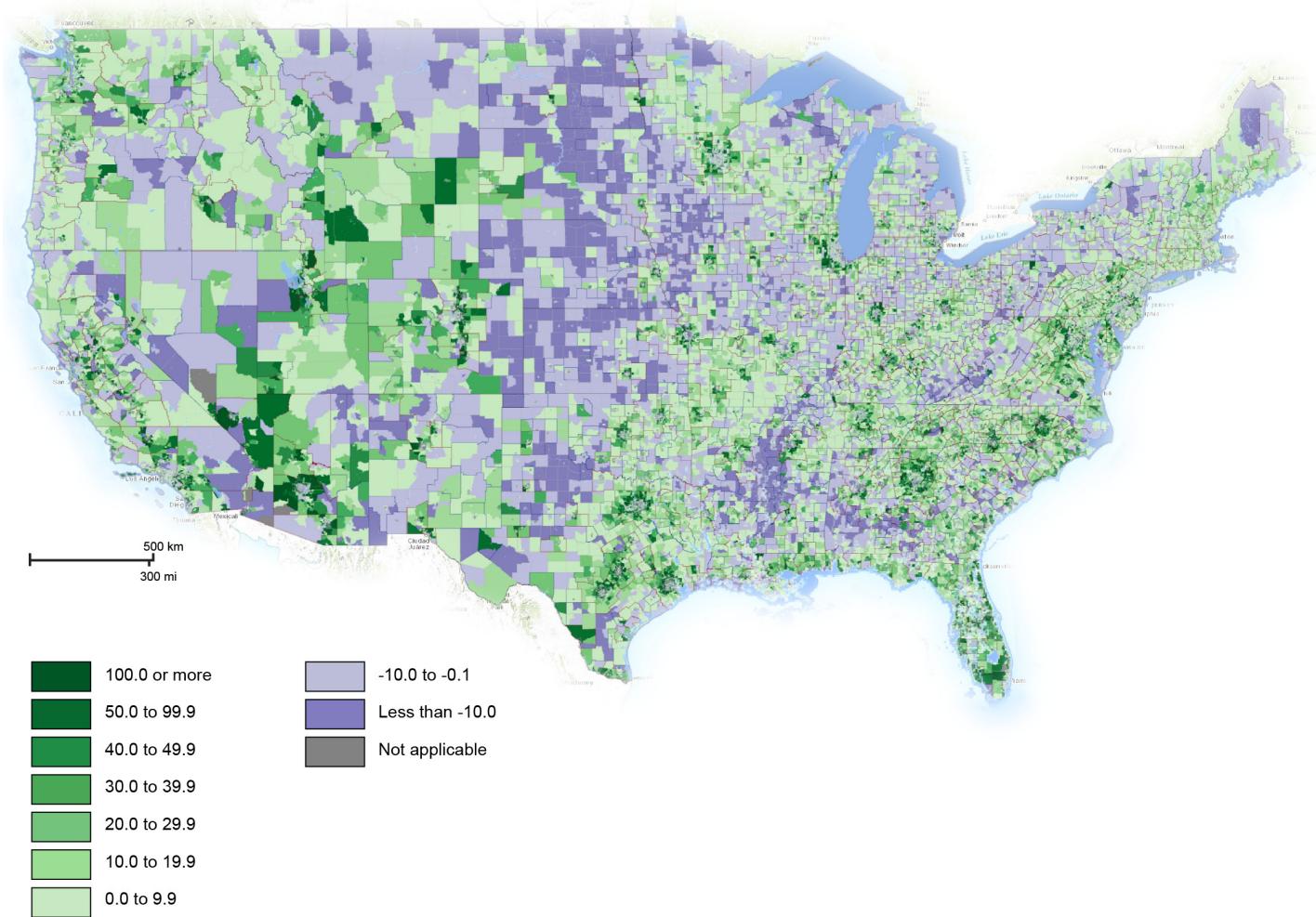
Although federal agencies and states often use geospatial data, the costs reported for procuring, updating, and using the data are understated. To address this issue, FGDC and OMB started an initiative to have federal agencies identify and report annually on geospatial-related investments as part of the fiscal year 2017 budget process.

Federal Agencies Use a Wide Range of Geospatial Data to Support Their Missions

Federal agencies reported using many of the 16 NGDA data themes, as well as address data, to support various parts of their missions. The uses of the data range from statistical assessments of the nation, to ensuring public safety, to providing accurate elevation data for national maps, to assessing agricultural health and farm land boundaries. For example, Census is responsible for conducting various statistical censuses and surveys of the American people as part of its mission. Census uses vast amounts of geospatial data, including addresses, cadastre, governmental units, and related information (such as in the transportation and water themes). Figure 7 illustrates one of Census's products, a comparison of nationwide population change from 2000 to 2010 by census tract.²⁹

²⁹Census tracts are small, relatively permanent statistical subdivisions of a county or equivalent entity. The primary purpose of census tracts is to provide a stable set of geographic units for the presentation of statistical data. Census tracts generally have a population size between 1,200 and 8,000 people, with an optimum size of 4,000 people. Census tract boundaries are delineated with the intention of being maintained over a long time so that statistical comparisons can be made from census to census.

Figure 7: Percent Change in Population by Census Tract from 2000 to 2010

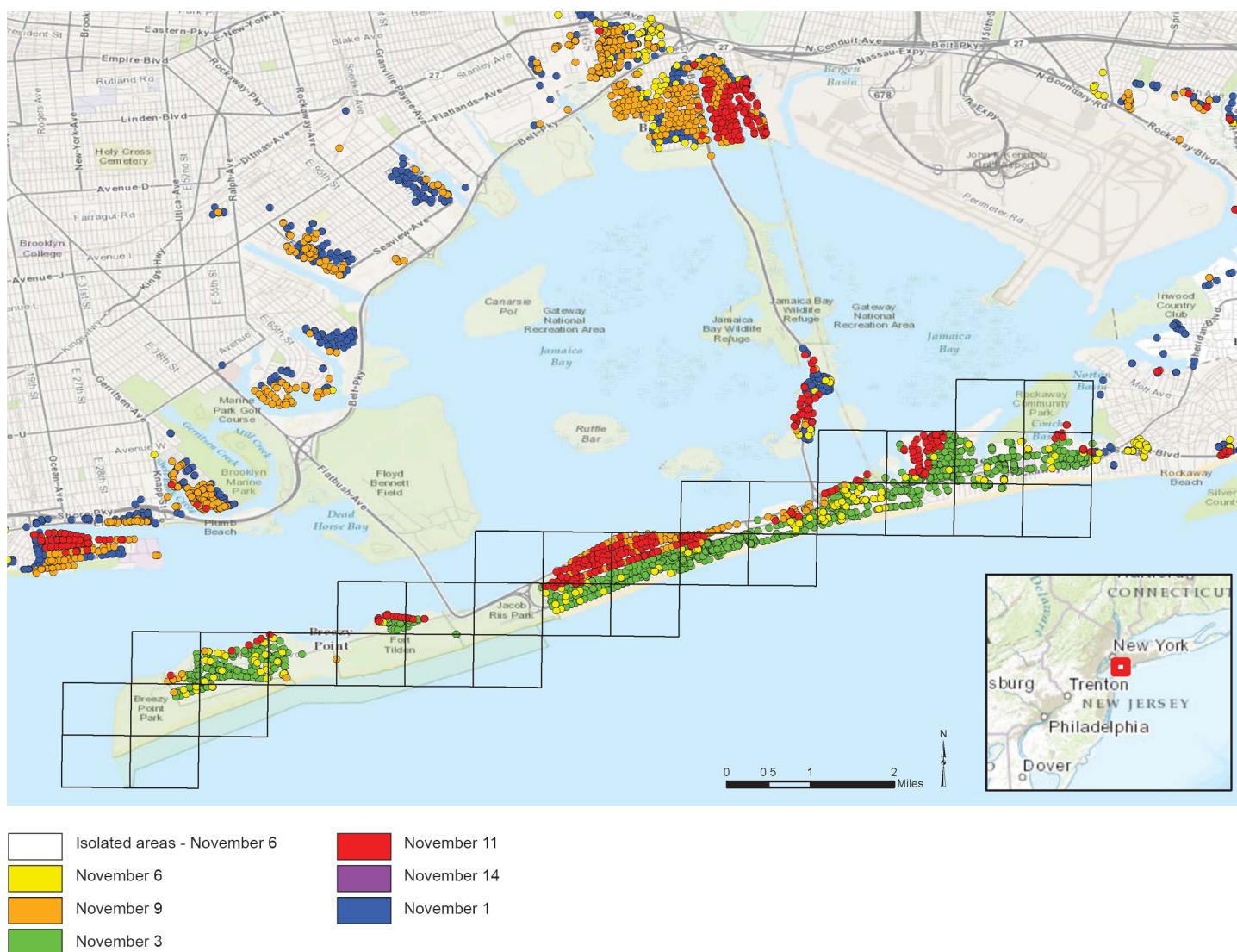


Source: Census.gov | GAO-15-193

In addition, FEMA uses a broad range of geospatial data, including addresses, cadastre, climate and weather, imagery, and land use-land cover data to support its mission to lead Americans to prepare for, prevent, respond to, and recover from disasters. For example, during and after Hurricane Sandy in 2012, FEMA's modeling task force conducted analysis of the storm's impact on communities. Based on storm modeling data combined with real-time data coming from USGS stream and high-water markers, NOAA weather analysis and aerial imagery, and other sources, the task force was able to quickly identify 44,000 households that were both damaged and inaccessible, and as a result, FEMA

reported that it was able to provide over \$130 million in expedited assistance to area residents. Figure 8 illustrates houses that the task force was able to review to make determinations about their livability—even though the houses were inaccessible.

Figure 8: Inaccessible Locations in Jamaica Bay Region, New York (by ZIP Code + 4)

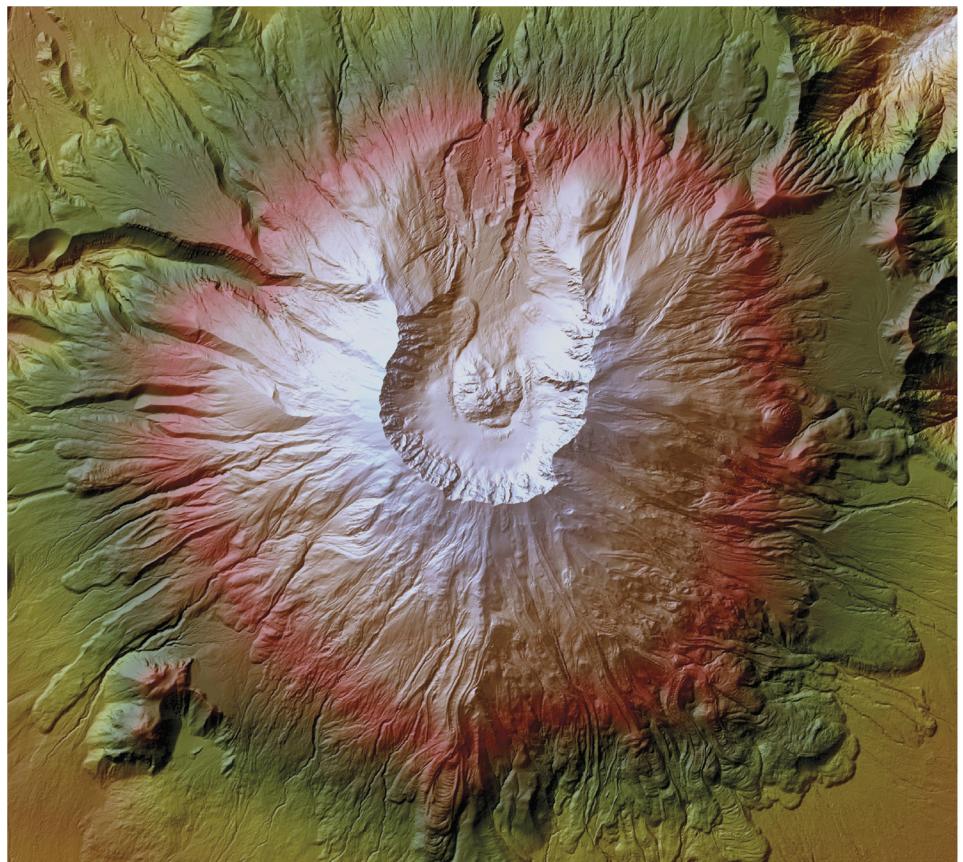


Source: Federal Emergency Management Agency. | GAO-15-193

Further, one of USGS's geospatial programs is the National Elevation Dataset, which collects publicly available elevation data into a central location. The dataset serves as the elevation layer of The National Map.³⁰ Elevation data are used for a wide variety of purposes, including—just within USGS—natural resources management, water quality mapping, coastal zone studies, flood risk management, and determining geologic hazards. One of the ways that elevation information is collected is through the use of LIDAR (or light detection and ranging), conducted using airplane flyovers. Figure 9 shows a digital rendering of the elevation of Mount St. Helens in Washington State.

³⁰The National Map is a collaborative effort among USGS, other federal agencies, states, and local governments that provides core geospatial data about the United States and its territories, similar to the data traditionally found on paper topographic maps. USGS reported that it is currently transitioning to its 3D Elevation Program as the next generation elevation layer. The program was designed based on the 2012 National Enhanced Elevation Assessment, which identified more than 600 requirements for 3D elevation data to address the mission-critical uses of federal agencies, states, local, and tribal governments, and private industries. The legacy products of the National Elevation Dataset are now a part of the 3D Elevation Program data holdings.

Figure 9: Mount St. Helens, Washington



Source: U.S. Geological Survey. | GAO-15-193

In addition, the USDA's Farm Service Agency manages the National Agriculture Imagery Program. The program acquires 1-meter resolution aerial imagery of the continental United States during the agricultural growing season. The program's current goal is to acquire imagery of the entire contiguous United States on an annual basis; however, agency officials noted that current funding levels only allow them to collect for the entire country on a 2-year cycle. This leaf-on imagery is used by a wide range of people to improve their understanding of land cover and land use nationwide. The program's imagery serves as the base layer of many GIS programs and helps maintain FSA crop boundaries, as well as administer farm records, commodity, conservation, disaster, and lending programs. Figure 10 provides an example of the imagery collected.

Figure 10: Image of Madelia, Minnesota, and Surrounding Farms during 2013 Growing Season

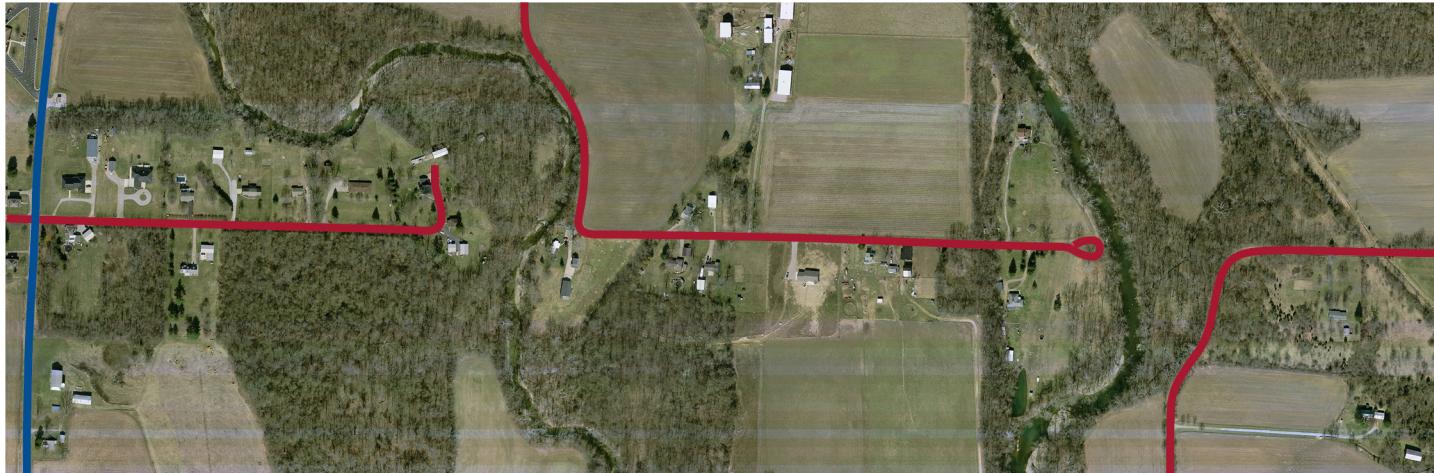


Source: National Agriculture Imagery Program. | GAO-15-193

States Use a Wide Variety of Geospatial Data to Support Their Missions

Selected states reported using many—and in numerous cases, all—of the 16 NGDA data themes, as well as address data, to support various parts of their missions. These uses include emergency management, focusing public health initiatives, and managing tax rates and revenues. For example, one of the ways in which Ohio uses extensive geospatial data is a site-specific state address database that uses data aggregated from local governments to assist emergency personnel, among other uses. An Ohio official noted that the response system has already saved lives because the range of addresses associated with a stretch of land is not always well coordinated with the way the roads work. Figure 11 depicts an example where address ranges that appeared to be contiguous were not contiguous because the road abruptly ended before all of the addresses were reached. With data in the improved response system, state officials noted that emergency responders could avoid a 4-mile trip around neighboring roadways, leading to a 4-minute-faster response time.

Figure 11: Example of Street Discontinuity, Preble County, Ohio



Source: State of Ohio, Preble County. | GAO-15-193

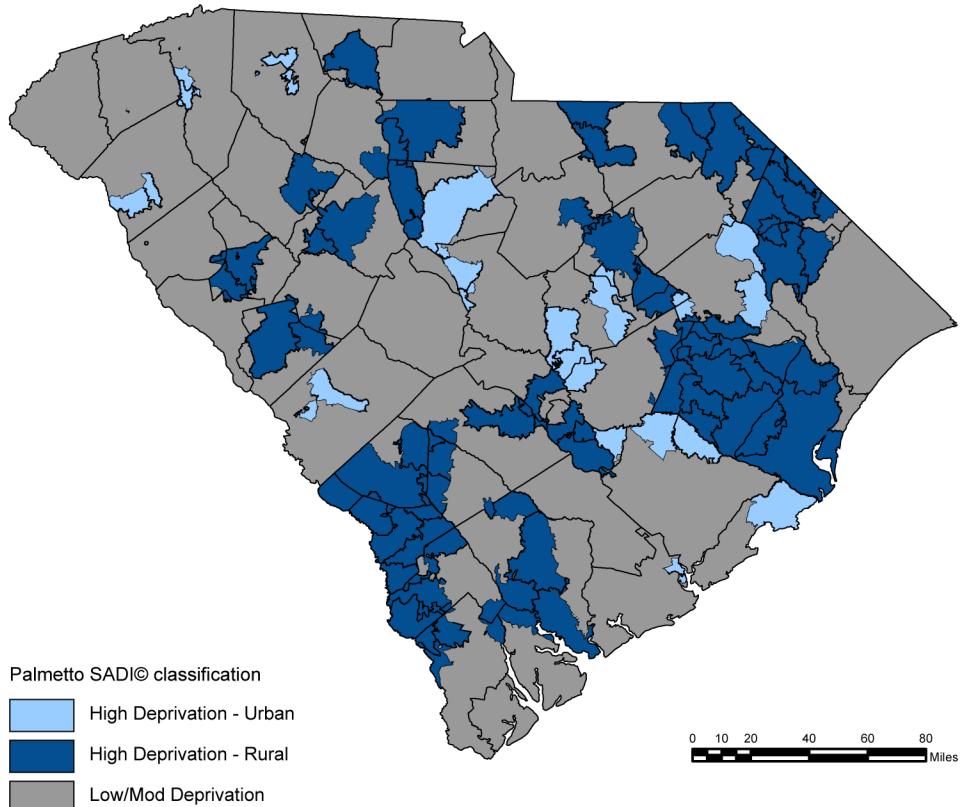
Additionally, in South Carolina, a university-sponsored Medicaid policy research group³¹ works with the state to use geospatial data to improve

³¹This research group is the Division of Medicaid Policy and Research within the University of South Carolina's Institute for Families in Society.

delivery of medical services to Medicaid-eligible populations. Because of a documented connection between higher rates of infectious and chronic diseases in socioeconomically deprived areas of the state, the research group developed an index that measures three key components (the percentage of persons without a high school diploma, the percentage of persons living below the poverty level, and the percentage of households with no vehicle), along with urban and rural populations measures, and layers this information on a map of the state. The derived product, pictured in figure 12 below, allows state officials to target resources in certain high-need geographic areas. According to the policy group, such tools may be especially valuable in targeting the state's limited resources to prevent, diagnose, and manage chronic conditions among Medicaid recipients.

Figure 12: A Map of Palmetto Small Area Deprivation Index, as of October 2014

Palmetto SADI© high deprivation areas in South Carolina^a



Source: University of South Carolina, Institute for Families in Society, Division of Policy and Research on Medicaid and Medicare. | GAO-15-193

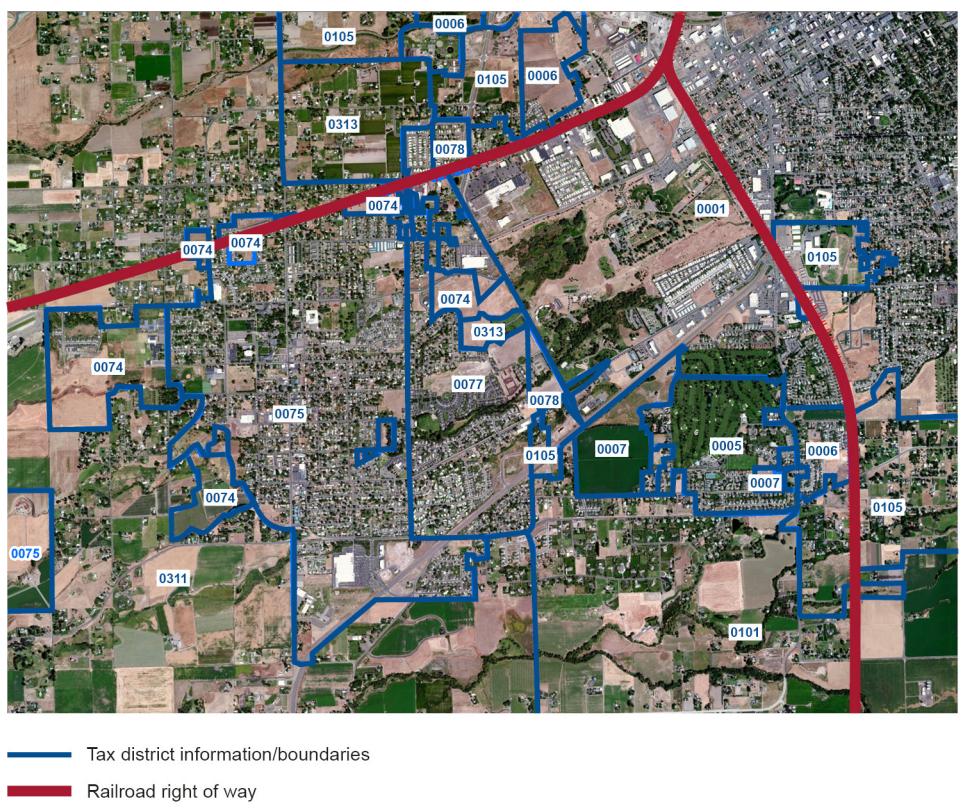
Note:

^aHigh deprivation areas are defined as the top quartile of ZIP Code tabulation areas identified using the Palmetto Small Area Deprivation Index© (SADI) scores, 2013. ZIP Code tabulation areas are Census's generalized representations of U.S. Postal Service ZIP Codes, created by aggregating census blocks. The Palmetto SADI scores measure three components (the percentage of persons without a high school diploma, the percentage of persons living below the poverty level, and the percentage of households without a vehicle). Palmetto SADI© 2014, University of South Carolina. All rights reserved. Used by permission.

Further, Washington State's Department of Revenue uses geospatial data to assist in determining the correct tax rates and payees for utilities taxes. Specifically, in Washington, utilities are taxed based on the localities they pass through—and there are over 3,200 tax code areas in the state. As a result, the analysis of where the utilities go—and which tax districts collect the revenue—can be highly complex and very sensitive. Recently, the department conducted an exercise to improve its

understanding of these data. Figure 13 shows one example of this exercise. It overlays tax district information (blue) and a local railroad right of way (red) on top of satellite imagery to more accurately determine the tax districts the railroad passes through.

Figure 13: Tax Jurisdictions in Walla Walla, Washington, and Railroad Right of Way



Source: Washington State Department of Revenue. | GAO-15-193

Note: Map image is the intellectual property of Esri and its licensors.

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Federal Agencies and States Reported Significant Spending on Geospatial Data and Systems, but the Amount Is Understated Because Not All Costs Are Tracked

Federal agencies and states reported spending significant funds on geospatial data and supporting systems, but the total amount spent is understated because not all costs are tracked. Identifying the cost of geospatial data has been an ongoing problem for the federal government. OMB and Interior have tried to estimate the amount spent on geospatial data and systems, but the estimates are either old or not comprehensive. In 2006 and 2007, OMB made two data calls directly to federal agencies to determine their spending on geospatial investments. However, according to OMB, neither of these data calls was complete or reliable—largely because agencies either provided incomplete information or did not respond at all. Although OMB’s data collection was not complete, the agencies reported that they had planned to spend about \$1.89 billion in geospatial data and services from fiscal year 2007 through 2009, of which about \$1.53 billion, or 81 percent, was to be on geospatial data. Further, in 2012, Interior estimated, as part of its budget documentation, that the federal government was investing billions of dollars on geospatial data annually.³² However, the department did not provide a comprehensive breakdown of that estimate.

OMB and agencies currently employ multiple mechanisms for collecting cost information that provide insights into the billions of dollars spent on geospatial data and systems. Current mechanisms for collecting data on geospatial data investments include (1) information on agency IT investments, capital asset plans, and business cases that were provided to OMB as part of the budget process; (2) data on USASpending.gov—a website that includes data on federal contract, grant, and assistance awards; and (3) individual agency and state estimates.

However, these estimates are understated because agencies do not always categorize geospatial investments in ways that allow them to be tracked. Further, we previously found that USASpending.gov award data were significantly underreported and where data were reported, they were not usually consistent with the information in agency records.³³ Each of

³²Department of the Interior, *Geospatial Line of Business Capital Asset Summary* (Aug. 14, 2012).

³³GAO, *Data Transparency: Oversight Needed to Address Underreporting and Inconsistencies on Federal Award Website*, GAO-14-476 (Washington, D.C.: June 30, 2014).

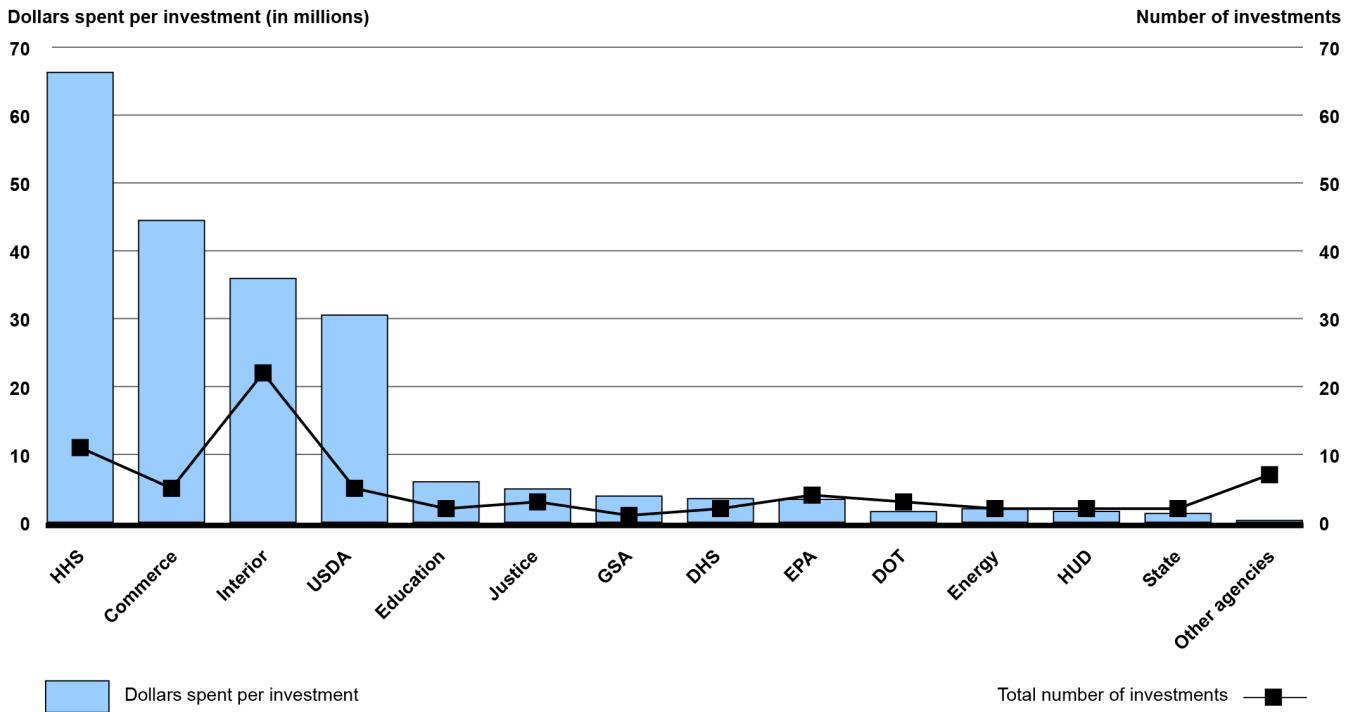
OMB Budget Data Show Billions Spent on Geospatial Investments but Do Not Capture All Costs

the three mechanisms for collecting cost information, and its limitations, are discussed in more detail in the following sections.

During the annual budget formation process, federal agencies provide OMB with information related to their IT investments (called exhibit 53s) and capital asset plans and business cases (called exhibit 300s). As part of these processes, agencies are to identify the investment using codes for specific functions (e.g., mapping or geospatial, accounting, or customer services) and provide cost information.

In their annual submissions of budget documentation, agencies categorize some, but not all, applicable investments as geospatial investments. Specifically, budget documents show that 19 agencies categorized 71 IT investments as being geospatial in nature, spending an average of \$205.4 million per year for the fiscal years 2013 to 2015. Figure 14 shows which agencies reported spending the most on geospatial investments.

Figure 14: Government-Wide Average Spending on Geospatial Information Technology Investments from Fiscal Year 2013 to 2015



Acronyms and abbreviations:

HHS (U.S. Department of Health and Human Services), Commerce (U.S. Department of Commerce), Interior (U.S. Department of the Interior), USDA (U.S. Department of Agriculture), Education (U.S. Department of Education), Justice (U.S. Department of Justice), GSA (General Services Administration), DHS (U.S. Department of Homeland Security), EPA (U.S. Environmental Protection Agency), DOT (U.S. Department of Transportation), Energy (U.S. Department of Energy), HUD (U.S. Department of Housing and Urban Development), State (U.S. Department of State)

Source: GAO analysis of exhibit 53 data, as of August 2014. | GAO-15-193

Note: Other agencies include the Departments of Labor and the Treasury, National Science Foundation, Small Business Administration, Social Security Administration, and the U.S. Army Corps of Engineers.

However, many agencies did not categorize geospatial investments as such. Specifically, 60 additional investments that were not categorized as “geospatial” are described using this term in their exhibits 53 and 300 budget documents. For example, USDA reported an IT investment called the Enterprise Spatial Mapping Service, which is described as an enterprise level, cloud-based geospatial service that supports data and GIS provisioning and consumption in a rapidly deployed portal framework. However, the investment was not reported as a geospatial investment. Further, the Department of Defense accounts for 35 of the unreported geospatial investments. These additional investments account for, on average, another \$180.3 million spent yearly or planned to be spent from

fiscal year 2013 to 2015 government-wide. OMB officials explained that these systems may not be categorized as geospatial because it gives agencies significant leeway in deciding which categories they select as relevant. Table 1 provides the number and anticipated cost of investments that were described as being geospatial in nature, but not specifically categorized as geospatial investments.

Table 1: Number and Cost of Investments Associated with Geospatial Data That Are Not Categorized as Geospatial, Fiscal Years 2013 to 2015

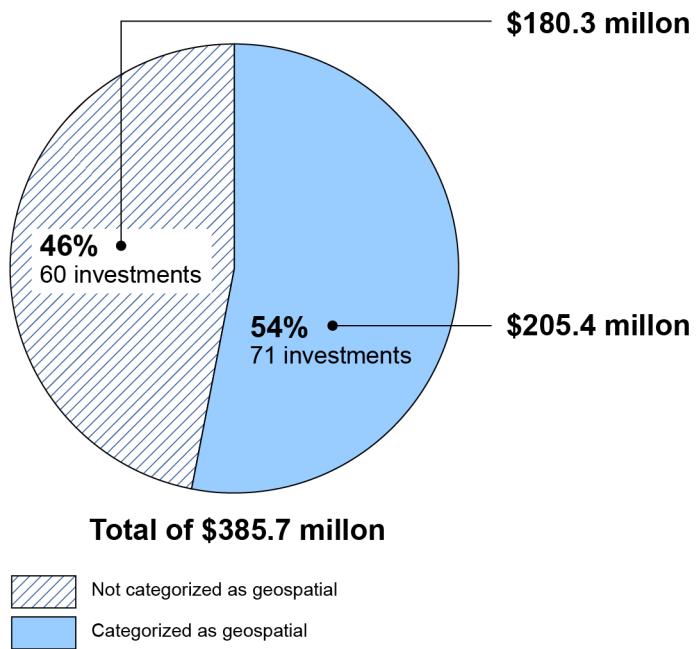
Agency	Geospatial investments not categorized as geospatial	Average amount spent or planned from fiscal years 2013 to 2015 (in millions)
Department of Agriculture	5	\$2.8
Department of Commerce	3	\$34.3
Department of Defense	35	\$32.3
Department of Energy	1	\$0.05
Department of Health and Human Services	1	\$13.0
Department of Homeland Security	6	\$87.0
Department of the Interior	1	\$3.1
Department of Transportation	5	\$5.6
General Services Administration	1	\$0.05
National Aeronautics and Space Administration	1	\$0.1
U.S. Army Corps of Engineers	1	\$2.0
Total	60	\$180.3

Source: GAO analysis of exhibit 53 and 300 data, as of August 2014. | GAO-15-193

Note: The IT Dashboard does not collect or display any classified or national security-sensitive information, and thus the totals listed in the table do not reflect any classified or national security-sensitive geospatial investments. In addition, the items in the table do not add up to the total listed due to rounding.

With the addition of the investments that were not categorized as geospatial, there are a total of 131 geospatial investments with an average of \$385.7 million spent on these investments annually for the period from fiscal year 2013 through fiscal year 2015. The geospatial investments not categorized as geospatial account for just under half of all of the geospatial investments. Figure 15 provides more details on the government-wide geospatial investments.

Figure 15: Government-Wide Investments Associated with Geospatial Data, Fiscal Years 2013-2015



Source: GAO analysis of exhibit 53 and 300 data, as of August 2014. | GAO 15-193

In addition to annual budget figures, OMB collects total estimated cost information on the largest and most critical IT investments. In documents prepared for the 2015 budget, 12 IT investments were described using the word “geospatial” in their exhibit 300s. As of August 2014, the federal government had spent an estimated \$1.3 billion on these investments alone. See table 2 for details on the investments.

However, similar to other OMB data collection activities, this list is not comprehensive due to limitations in what data are collected. For example, NOAA has two major weather satellite programs totaling over \$22 billion in expected life-cycle costs (with over \$9 billion spent to date) that are to provide critical geo-located weather and climate data well into the next decade. Because the satellites are not identified as IT investments, they were not captured in the \$1.3 billion estimate. Similar to other agencies,

NOAA does not identify its space systems as IT investments because OMB does not enforce this requirement.³⁴

Table 2: Costs of 12 Major Investments Associated with Geospatial Data, from Investment Start to August 2014

Agency	Investment	Cost in millions
Department of Commerce	Census's Geographic Support Systems	\$362.5
	NOAA's Comprehensive Large Array-data Stewardship System	\$243.8
	National Telecommunications and Information Administration's Federal Spectrum Management System	\$46.4
Department of Defense	Air Force's Integrated Strategic Planning and Analysis Network	\$75.4
Department of Health and Human Services	Food and Drug Administration Office of Regulatory Affairs Regulatory Business Information Services	\$107.5
Department of Homeland Security	Customs and Border Protection's Integrated Fixed Towers	\$261.0
	Immigration and Customs Enforcement's Enforcement Information Sharing	\$77.1
Department of the Interior	BLM's IT Support for Resources and Mineral Land Use Planning	\$34.8
	USGS's Geospatial Platform and Shared Services	\$7.6
	USGS's The National Map Reengineering Project	\$98.4
Department of Transportation	Federal Highway Administration's Fiscal Management Information System 5.0	\$6.7
	Pipeline and Hazardous Materials Safety Administration's National Pipeline Information Exchange	\$5.8
Total		\$1,327.0

Source: GAO analysis of exhibit 300 data, as of August 2014. | GAO-15-193

USASpending.gov Shows That Federal Agencies Spend Hundreds of Millions Each Year on Contracts for Geospatial Data and Services, but the Website Does Not Capture All Costs

In addition to reporting on individual IT investments to OMB, federal agencies are required by law³⁵ to report specific information on contract and assistance awards to USASpending.gov, a website designed to provide transparency into where the government is spending money.

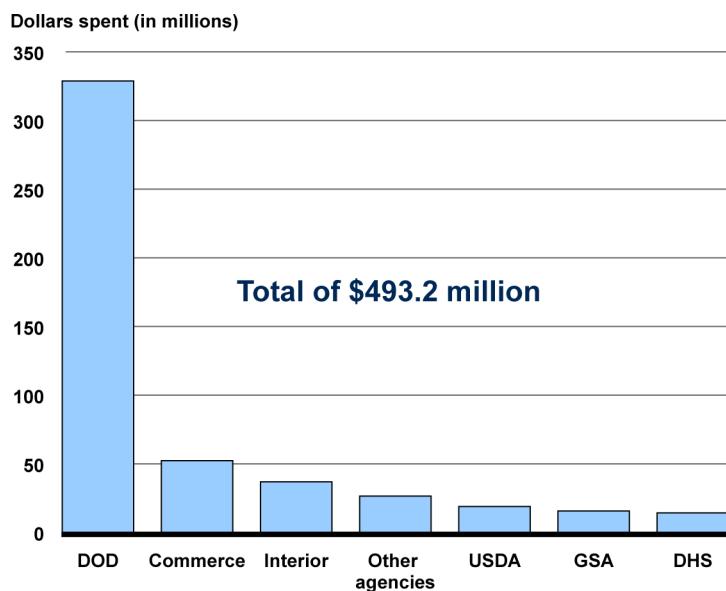
While agencies used a variety of categories and descriptions, as of September 2014, federal agencies reported \$493.2 million in contracting costs for geospatial data in fiscal year 2013. The Department of Defense

³⁴GAO, *Information Technology: OMB Needs to Improve Its Guidance on IT Investments*, GAO-11-826 (Washington, D.C.: Sept. 29, 2011).

³⁵Federal Funding Accountability and Transparency Act. Pub. L. No. 109-282, §§ 1 to 4 (Sept. 26, 2006). This act was amended by the Government Funding Transparency Act of 2008, § 6202(a), Title VI, Ch. 2, Supplemental Appropriations Act, 2008, Pub. L. No. 110-252 (June 30, 2008); 31 U.S.C. § 6101 Note.

reported spending the most on geospatial-related contract awards, with a total of \$328.8 million spent. Figure 16 shows contracting costs on geospatial investments in fiscal year 2013.

Figure 16: Contracting Costs for Geospatial Investments in Fiscal Year 2013



Acronyms:

DOD (U.S. Department of Defense), Commerce (U.S. Department of Commerce), Interior (U.S. Department of the Interior), USDA (U.S. Department of Agriculture), GSA (U.S. General Services Administration), DHS (U.S. Department of Homeland Security)

Source: GAO analysis of USASpending.gov data, as of September 2014. | GAO-15-193

Note: Other agencies include the Departments of Health and Human Services, Housing and Urban Development, Energy, Justice, State, the Treasury, Transportation, Veterans Affairs, the Environmental Protection Agency, Federal Communications Commission, Federal Energy Regulatory Commission, National Aeronautics and Space Administration, Small Business Administration, Smithsonian Institution, and U.S. Agency for International Development.

However, we recently found that USASpending.gov award data were significantly underreported and there was little consistency between the website and agency records.³⁶ Further, USASpending.gov data do not give a complete picture of the cost of geospatial data because there is not a definitive way to categorize the contracts as being geospatial in nature.

³⁶ GAO-14-476.

Agencies and States Had Difficulty Providing Comprehensive Cost Data

Selected agencies and states had difficulty providing consistent and complete cost data for their investments in geospatial data. Of seven selected agencies, one agency (FSA) was able to provide a comprehensive accounting of the cost of its geospatial data, while five (BLM, Census, FEMA, USGS, and USPS) provided estimates for selected categories of geospatial data, and one (NOAA) was unable to provide cost data even though the vast majority of its mission involves geospatial data. Agency estimates ranged from no spending on geospatial data (for data that are provided to the agency at no cost) to \$26.9 million in fiscal year 2014 for the operation and maintenance of an address system. Table 3 provides agency estimates for spending on geospatial data.

However, the estimates provided often vary widely from what is reported in other data collection initiatives. For example, even though Census officials could not provide an estimate for over half of its geospatial data costs, Commerce's Office of the Inspector General previously reported that Census spent nearly \$1.4 billion over a 10-year period to produce and verify address data it used in the 2010 Census.³⁷ The office also reported that the bureau is spending \$674 million on the Geographic Support System Initiative—a multiyear effort to, among other things, improve address data quality.³⁸ Further, while NOAA officials could not provide an estimate of its geospatial data costs, we recently found that NOAA has spent an average of about \$430 million on the operation and management of its observing systems that collect data on specific environmental conditions, such as sea surface temperature or wave height.³⁹

³⁷U.S. Department of Commerce, U.S. Census Bureau: *High-Quality Maps and Accurate Addresses Are Needed to Achieve Census 2020 Cost-Saving Goals*, OIG-12-024-1 (May 10, 2012).

³⁸U.S. Department of Commerce, U.S. Census Bureau: *2020 Census Planning: Research Delays and Program Management Challenges Threaten Design Innovation*, OIG-14-003-A (Dec. 3, 2013).

³⁹GAO, *NOAA's Observing Systems: Additional Steps Needed to Achieve an Integrated, Cost-Effective Portfolio*, GAO-15-96 (Washington, D.C.: Nov. 17, 2014).

Table 3: Selected Agencies' Estimated Expenditures for Geospatial Data

Data category	BLM	Census	FEMA	FSA	NOAA	USGS	USPS
Addresses ^a	○	○	\$722,607	n/a	n/a	n/a	\$6.6 million \$26.3 million ^b and \$26.9 million ^c on operations and maintenance of address system
Biota	○	n/a	n/a	n/a	○	\$157,000 ^d for management of three datasets	n/a
Cadastre	\$1 million ^b \$900,000 ^c	\$0	\$1.2 million	\$0	n/a	○	n/a
Climate and Weather	\$0	n/a	\$0	n/a	○	○	n/a
Cultural Resources	\$200,000 ^b \$201,000 ^c	○	n/a	n/a	n/a	○	n/a
Elevation	\$0	n/a	\$689,976 ^b \$4,636 ^{c,d}	\$0	○	\$13.9 million ^{c,e} \$1.1 million for Hurricane Sandy ^c	n/a
Geodetic Control	n/a	n/a	○	n/a	○	○	n/a
Geology	\$0	n/a	○	n/a	n/a	\$1 million/yr for geologic map data	n/a
Governmental Units, and Administrative and Statistical Boundaries	○	○	\$0	\$0	○	○	n/a
Imagery	\$406,000 for National Agriculture Imagery Program ^{b,c} \$1.3 million for other projects ^b	○	\$287,536 ^b \$10.1 million ^c	\$9.6 million ^b \$957,000/yr for National Agriculture Imagery Program	○	\$5.1 million ^b \$4 million ^c	○
Land Use-Land Cover	\$600,000/yr \$2.5 million/yr	\$0	\$606,000	n/a	○	○	n/a
Real Property	○	n/a	\$0	n/a	n/a	n/a	n/a
Soils	\$0	n/a	n/a	\$0	n/a	○	n/a
Transportation	○	○	\$0	n/a	○	\$84,621 ^c	○
Utilities	\$25,000/yr (approx.)	n/a	\$0	n/a	n/a	n/a	n/a
Waters-Inland	\$400,000/yr	\$0	○	n/a	○	\$5.7 million ^{c,f}	n/a
Water-Oceans and Coasts	\$0	\$0	\$0	n/a	○	n/a	n/a

Key: ○ = Agency could not provide a cost estimate, despite reporting that it uses geospatial data from this data theme.

. n/a = Agency reported that it did not use geospatial data from this data theme.

Source: GAO analysis of agency reported data and documentation. | GAO-15-193

Notes:

^a Addresses are not currently an NGDA data theme.

^b Expenditure is from fiscal year 2013.

^c Expenditure is from fiscal year 2014.

^d Expenditure is partial, as fiscal year was not complete when estimate was provided.

^e Funds contributed by other agencies to USGS for this theme equaled \$23.5 million in 2014.

^f Funds contributed by other agencies to USGS for this theme equaled \$1.4 million in 2014.

Acronyms and abbreviations: BLM = Bureau of Land Management; Census = U.S. Census Bureau; FEMA = Federal Emergency Management Agency; FSA = Farm Service Agency; NOAA = National Oceanic and Atmospheric Administration; USGS = U.S. Geological Survey; USPS = United States Postal Service.

All five selected states were able to provide estimates on some of the costs of geospatial data. These ranged from one state purchasing imagery for \$130 in 2013 to another state that spends about \$34 million yearly on real property data. While most states reported using nearly all the categories of geospatial data, most states were not able to provide comprehensive estimates on the cost of those data. For example, while officials from Washington estimated that the state spent approximately \$3.1 million on geospatial software in 2013, they could not provide an estimate of how much was spent on other individual data categories, such as addresses or transportation. A state official attributed this to the state's decentralized governance model. Similarly, an official from Ohio was able to provide estimates for its cost of address and imagery data, but reported that the costs for the other data categories were unknown. See table 4 for more information.

Table 4: Selected States' Estimated Expenditures for Geospatial Data for Fiscal Years 2013 and 2014

Data category	Maryland	Montana	Ohio	South Carolina	Washington
Addresses ^a	\$75,000 ^{b,c}	\$80,000/yr	\$450,000 ^{b,c}	○	○
Biota	\$0 ^d	○	○	○	○
Cadastre	\$700,000 ^{b,c}	\$800,000/yr (approx.)	○	○	○
Climate and Weather	\$0 ^d	\$200,000/yr	○	○	○
Cultural Resources	\$0 ^d	○	○	○	○
Elevation	\$120,000 ^b \$655,200 ^c	○	○	○	○
Geodetic Control	\$0 ^d	\$100,000/yr	○	○	○
Geology	\$0 ^d	○	○	○	○
Government Units, and Administrative and Statistical Boundaries	\$0 ^d	\$80,000/yr	○	○	○
Imagery	\$810,000 ^c	\$130 ^b \$452,000 ^b \$418,000 ^c		\$1.8 million	○
Land Use-Land Cover	\$0 ^d	\$200,000/yr (approx.)	○	○	○
Real Property	\$34.5 million ^b \$35 million ^c \$700,000/yr for georeferencing	○	○	○	○
Soils	\$0 ^d	○	○	○	○
Transportation	\$2.3 million ^{b,c}	\$35,000	○	○	○
Utilities	\$0 ^d	○	○	○	○
Water-Inland	\$0 ^d	\$120,000	○	○	○
Water-Oceans and Coasts	\$0 ^d	n/a	○	○	○
Geospatial Software Costs	n/a	n/a	n/a	n/a	\$3.1 million

Key: ○ = State could not provide a cost estimate, despite reporting that it uses this data theme.

n/a = State reported that it did not use geospatial data from this data theme.

Source: GAO analysis of state documentation. | GAO-15-193

Note:

^a Addresses are not currently an NGDA data theme.

^b Expenditure is from fiscal year 2013.

^c Expenditure is from fiscal year 2014.

^d Expenditure was from a year prior to fiscal years 2013 and 2014.

We previously reported on the lack of consistent and comprehensive information about how much is spent on geospatial data, and OMB and FGDC have made plans to improve cost tracking. In November 2012, we found that OMB lacked the necessary information to accurately quantify

the amount of federal dollars spent on geospatial data.⁴⁰ We recommended that OMB develop the ability to identify and report annually on all geospatial-related investments in order to improve its oversight and minimize duplication. OMB officials generally concurred with the recommendation and, according to OMB officials, this recommendation is being addressed through FGDC's *National Geospatial Data Asset (NGDA) Management Plan*,⁴¹ which was issued in March 2014. The plan acknowledges that it is difficult to make a determination of the total costs for federal geospatial data due to the ubiquitous nature of geospatial data (that the investment may be reflected across multiple budget codes) and the inconsistency in the use of budget codes across the government. The plan also notes that different definitions of a geospatial investment are being used by OMB, the FGDC community, and individual agencies.

Accordingly, one of the objectives of the plan is to develop and apply a standard definition of a geospatial investment in order to facilitate reporting on budgeted geospatial data investments. The plan contains two supporting actions for this objective. The first action, to have FGDC and OMB establish a standard definition of a geospatial investment for use in the budgeting process, is planned to be completed by September 2015. The second action is for federal departments and agencies to apply this definition in their respective budgeting processes. Since the fiscal year 2016 budget process is already well under way, the soonest agencies could implement the new guidance is in their fiscal year 2017 budgeting process.

A recently passed law can provide OMB with another opportunity to improve information about federal spending on geospatial data and investments. Specifically, on May 9, 2014, the President signed into law the Digital Accountability and Transparency Act of 2014,⁴² which among other things, requires (1) the establishment of government-wide data standards by May 2015, (2) disclosure of direct federal spending with certain exceptions, (3) agencies to comply with the new data standards, and (4) inspectors general audits of the quality of the data made available to the public. The Comptroller General recently testified that effective

⁴⁰GAO-13-94.

⁴¹This is FGDC's portfolio management plan for NGDA assets as called for in OMB's *Issuance of OMB Circular A-16 Supplemental Guidance* (Nov. 10, 2010).

⁴²Pub. L. No. 113-101, also known as the DATA Act.

Progress Has Been Made in Establishing the National Spatial Data Infrastructure, but Shortfalls Remain

implementation of the act would help promote transparency to the public and address ongoing government management challenges by expanding the quality and availability of federal spending data.⁴³ Until OMB and the departments have complete and reliable information on the scope, cost, and nature of investments in geospatial data, the possibility remains that the government is investing in duplicative or wasteful geospatial investments.

FGDC and selected federal departments and agencies have made progress in implementing their responsibilities for establishing the NSDI, but a number of shortfalls remain. OMB guidance and an executive order call for both FGDC and agencies to fulfill certain responsibilities in order to further the development of the NSDI and its components (data themes, standards, metadata, clearinghouse, and partnerships).⁴⁴ Specifically, FGDC is to establish a strategic plan to improve all five components, a portfolio management plan to facilitate management of data themes, a clearinghouse for coordinating investments, and partnerships for coordinating with stakeholders. Similarly, agencies are to establish their policies and procedures that address the use of the clearinghouse, strategic plans, and partnerships with states to collect and disseminate geospatial data.⁴⁵ In addition, we previously made recommendations, based on best practices in program implementation, to improve the

⁴³GAO, *Federal Data Transparency: Effective Implementation of the DATA Act Would Help Address Government-wide Management Challenges and Improve Oversight*, GAO-15-241T (Dec. 3, 2014).

⁴⁴OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities* (Aug. 19, 2002); *Policies for Federal Agency Public Websites*, M-05-04 (Dec. 17, 2004); *Designation of a Senior Agency Official for Geospatial Information*, M-06-07 (Mar. 3, 2006); *Issuance of OMB Circular A-16 Supplemental Guidance*, M-11-03 (Nov. 10, 2010); *Digital Government: Building a 21st Century Platform to Better Serve the American People* (Washington, D.C.: May 23, 2012); and Executive Order No. 12906, *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*, 59 Fed. Reg. 17,671 (Apr. 11, 1994).

⁴⁵OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities* (Aug. 19, 2002); *Policies for Federal Agency Public Websites*, M-05-04 (Dec. 17, 2004); *Designation of a Senior Agency Official for Geospatial Information*, M-06-07 (Mar. 3, 2006); *Issuance of OMB Circular A-16 Supplemental Guidance*, M-11-03, (Nov. 10, 2010); *Digital Government: Building a 21st Century Platform to Better Serve the American People* (Washington, D.C.: May 23, 2012); and Executive Order No. 12906, *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*, 59 Fed. Reg. 17,671 (Apr. 11, 1994).

likelihood of success on several of these geospatial initiatives.⁴⁶ Table 5 summarizes FGDC's responsibilities for key initiatives and our prior recommendations to improve those initiatives. Table 6 summarizes federal departments' responsibilities for key initiatives and our prior recommendations to improve those initiatives. The status of FGDC and the agencies' efforts are discussed later in this report.

Table 5: National Spatial Data Infrastructure Responsibilities and Related GAO Recommendations for the Federal Geographic Data Committee

Initiative	Description and related GAO recommendation
Strategic plan	<p>The Federal Geographic Data Committee (FGDC) is to prepare and maintain a strategic plan for the development and implementation of the National Spatial Data Infrastructure (including data themes, standards, metadata, clearinghouse, and partnerships).</p> <p>GAO recommendation: In 2012, we recommended that FGDC establish a time frame for creating and updating the strategic plan, and create and implement the plan within the established time frame. We also recommended that the plan address foundational elements of strategic planning as recognized by federal statute and OMB guidance, such as goals, objectives, and performance measures.</p>
Portfolio management of data themes	<p>FGDC is to manage the data themes and their associated key datasets as capital assets using a portfolio management approach, and provide guidance to federal departments on how to implement this management approach internally within their agencies.</p> <p>GAO recommendation: In 2012, we recommended that FGDC establish a time frame for completing a plan to facilitate the implementation of OMB's portfolio management guidance, and develop and implement the plan within the established time frame. We also recommended that the plan, at a minimum, include goals and performance measures, and that FGDC report annually to OMB on the progress made on efforts to improve coordination and reduce duplication among themes.</p>
Clearinghouse	<p>FGDC is to</p> <ul style="list-style-type: none"> • develop a clearinghouse to serve as a centralized geospatial metadata repository that contains geospatial metadata records from federal agencies, state and local governments, and academic and private sector organizations; • provide a search function for the clearinghouse that permits searching of all files intended for public use, display search results in order of relevancy to search criteria; and • use analytics and customer service measurement tools to measure, analyze, and report on the effectiveness of the clearinghouse. <p>GAO recommendation: In 2012, we recommended that FGDC develop guidance for federal departments on identifying planned geospatial investments on the clearinghouse.</p>
Partnerships	FGDC is to promote and guide cooperation among federal, state, and local government agencies in the collection, production, sharing and use of geospatial information and the implementation of the National Spatial Data Infrastructure.

Source: GAO analysis of Executive Order 12906, OMB documents, and [GAO-13-94](#). | GAO-15-193

⁴⁶ [GAO-13-94](#).

Table 6: National Spatial Data Infrastructure Responsibilities and Related GAO Recommendations for Federal Departments

Initiative	Description and related GAO recommendation
Policy on geospatial metadata	Federal departments are to develop and implement a policy that requires their agencies to make their geospatial metadata available on the clearinghouse. GAO recommendation: In 2012, we recommended that the three federal departments in our prior review (Commerce, Interior, and Transportation) develop such a policy.
Procedures for accessing the clearinghouse	Federal departments are to adopt internal procedures to ensure that their agencies access the clearinghouse before they expend funds to collect or produce new geospatial data to determine (1) whether the information has already been collected by others, or (2) whether cooperative efforts to obtain the data are possible. GAO recommendation: In 2012, we recommended that the three federal departments in our prior review develop and implement such internal procedures.
Strategy	Federal departments are to prepare, maintain, publish, and implement a strategy for advancing geographic information and related geospatial activities appropriate to their mission. GAO recommendation: In 2012, we recommended that the three federal departments in our prior review develop and implement such strategies.
Partnerships	Federal departments are to coordinate and work in partnership with federal, state, and local government agencies, to efficiently and cost-effectively collect, integrate, maintain, disseminate, and preserve spatial data, building upon local data wherever possible.

Source: GAO analysis of Executive Order 12906, OMB documents, and [GAO-13-94](#). | GAO-15-193

FGDC Has Made Progress on the NSDI, but Shortfalls on Key Initiatives Exist, and States Are Dissatisfied with Coordination Efforts

FGDC has made progress in developing a strategic plan, implementing portfolio management practices for data themes, and establishing the clearinghouse infrastructure; however, these initiatives are not yet complete and shortfalls remain. In addition, selected state officials and the organizations that represent the states are generally dissatisfied with FGDC's efforts to coordinate with them. Details on each initiative follow:

- **Strategic plan.** In December 2013, FGDC issued a strategic plan for the NSDI that is consistent with OMB guidance and our prior recommendation. Specifically, the strategic plan includes a vision statement, three outcome-oriented goals, and nine objectives. Subsequently, in June 2014, FGDC created implementation plans for seven of the nine objectives that describe numerous supporting tasks necessary to achieve the objectives, and performance measures for monitoring the progress of the tasks. Implementation plans for the two remaining objectives are in development and are expected to be finalized in 2015. The implementation plans completed to date include 25 tasks that are to be completed in fiscal year 2014, as well as 40 tasks to be completed during fiscal years 2015 and 2016.

While most tasks in the implementation plans that were scheduled for completion in fiscal year 2014 were completed as scheduled, some

were not. Specifically, 19 tasks were completed by September 2014. In addition, 3 tasks were completed by January 2015 and 3 other tasks remain to be completed. Completed tasks include a number of activities in support of the Geospatial Platform, such as the establishment of agency funding agreements for the platform, the creation of guidance for the use of the platform's Marketplace feature,⁴⁷ and the award of a support contract for platform operations. The tasks that are behind schedule include the development of templates for service level agreements for hosting data on the Geospatial Platform, and the creation of surveys and tools to assess the maturity of NGDA theme-lead administrative processes and the status of NGDA datasets. FGDC officials stated that they are working to finalize the target dates for the remaining fiscal year 2014 tasks by March 2015.

- **Portfolio management.** FGDC issued a portfolio management plan for NGDA assets that calls for strategic planning, coordinated development and resource pooling, goals and performance measures for each asset, investment selection criteria, and review of the health of the datasets. The plan also includes goals and performance measures, as well as tasks to formalize annual reporting to OMB, consistent with our recommendation.⁴⁸ The portfolio management plan includes 7 tasks to be completed in fiscal year 2014, as well as 20 tasks to be completed during fiscal years 2015, 2016, and 2017.

While most of the tasks that were scheduled for completion by September 2014 were completed on time, some were not. Specifically, of the 7 tasks identified in the plan for completion by the end of fiscal year 2014, 5 were completed and 2 were expected to be completed by March 2015. Completed actions include items such as, establishing a coordination mechanism across the NGDA themes, identifying the initial baseline of NGDA datasets, and posting content for each of the data themes on the Geospatial Platform to encourage collaboration. The remaining 2 tasks include developing tools to assess and report on progress in developing NGDA datasets and themes.

⁴⁷The Marketplace is a function within the platform for agencies to identify their planned acquisitions to foster cooperative efforts to acquire data.

⁴⁸[GAO-13-94](#).

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- **Clearinghouse.** FGDC has created a centralized clearinghouse for geospatial metadata as part of the Geospatial Platform, and has issued guidance to federal departments on how to identify planned geospatial investments on it. However, the Geospatial Platform lacks important features called for in OMB guidance,⁴⁹ such as an effective search capability and performance monitoring. Specifically, officials from DHS and USDA noted that they had experienced problems finding datasets on the platform, and the managing partner for the Geospatial Platform stated that users had provided similar feedback.

We also encountered difficulty with the search capability. In searching for the exact title of a dataset as it appears in the Geospatial Platform catalog in July 2014, we estimated that 62 percent of aerial photography datasets and 97 percent of address datasets did not appear in search results.⁵⁰ In November 2014, FGDC officials stated that they were aware of the issues with the search function on the Geospatial Platform and had taken steps to identify and resolve these issues. However, our more recent searches in November and December 2014 also experienced similar difficulties. Until FGDC effectively oversees the search capabilities on the Geospatial Platform, and improves it as warranted, agencies may continue to experience challenges in finding relevant datasets. In addition, until all federal sources of geospatial data are easily discoverable from one centralized location, the potential for uncoordinated and duplicative data acquisitions remains.

Although FGDC has recognized the need for performance measures for the Geospatial Platform since 2011—such as numbers of downloads or site visits, percentage of customers who are repeat customers, number of downloads or website hits by user group (e.g., federal, state, or local government, private sector, academic, or citizen users), ease-of-use, and customer satisfaction survey scores—these measures have not yet been implemented. The FGDC Deputy Executive Director also noted that data for determining performance

⁴⁹OMB, *Policies for Federal Agency Public Websites*, M-05-04 (Dec. 17, 2004); and *Digital Government: Building a 21st Century Platform to Better Serve the American People* (Washington, D.C.: May 23, 2012).

⁵⁰These estimates are based on our selection of generalizable samples of datasets from the Geospatial Platform catalog and have a margin of error of plus or minus 7 and 4 percentage points respectively. See appendix I for more details on our selection of the generalizable samples.

measures will be collected when they are able to implement their new support contact for the Geospatial Platform, which was finalized in October 2014. However, FGDC has not yet established a schedule for when performance measures will be implemented because it is only now starting to work with the support contractor. Until it has a schedule for establishing performance measures, it is difficult to oversee progress on this important step. Moreover, until performance measures are in place, it will be difficult for FGDC to improve the operations of the Geospatial Platform.

- **Partnerships.** FGDC has initiated plans and activities for coordinating with state governments in the collection, production, sharing, and use of geospatial data and the implementation of the NSDI. These efforts include defining desired outcomes for collaboration, clarifying roles and responsibilities for federal agencies, and establishing methods for operating across organizational boundaries.

However, officials with six of the seven state or state-related entities we met with expressed dissatisfaction with FGDC's efforts. For example, NSGIC officials, who represent the interests of all 50 states, stated that they were frustrated that, although at one time states were allowed to participate in FGDC Steering Committee discussions of geospatial policy and plans that affect them directly, they no longer have a meaningful role because of FGDC's reliance on NGAC. NSGIC officials, officials from the Coalition of Geospatial Organizations, and an official from one of the five states are further concerned by this development because they perceive that the NGAC does not have any real influence over FGDC actions, and that NGAC's advice and recommendations are often ignored. Further, officials from NSGIC, Coalition of Geospatial Organizations, and two of the states in our sample criticized FGDC for operating from a "federal" perspective as opposed to a "national" perspective.

FGDC officials including the Executive Director, Deputy Executive Director, and Senior Policy Advisor are aware of concerns with their coordination with state governments. The FGDC Deputy Executive Director noted that FGDC plans to improve coordination with state and local officials and to collect data for performance measures on this coordination now that they have a new support contract in place. FGDC officials stated that the support contract's integrated work plan is expected to be issued in early 2015, and is to include tasks and staffing for communication and outreach efforts that they expect to result in better partnerships with state and local governments.

FGDC officials also provided their insights into other state concerns. Specifically, they noted that while the states and FGDC worked closely on technical and foundational issues for the NSDI, the states' direct involvement in FGDC's decision-making processes had to end once the focus shifted to federal policy and budgetary issues due to the sensitive nature of proposed budgets and contracts. The FGDC official noted, however, that the states' interests are still being represented on the committee that advises FGDC. In addition, FGDC officials stated that they made a concerted effort to make the strategic plan encompass a national vision by involving non-federal stakeholders throughout the process and that the plan was unanimously endorsed by the NGAC, including the six NGAC members who represent the interests of the state governments.

Federal Departments and Agencies Have Made Progress on NSDI Initiatives, but Shortfalls Remain and States Have Concerns about Changes in, Restrictions on, and Limitations of Coordination

Selected federal departments and agencies have made progress in complying with OMB guidance to facilitate the creation of an NSDI, including establishing policies for making their data available on the Geospatial Platform, procedures for checking the platform prior to expending funds to collect or produce new geospatial data, and strategic planning mechanisms. However, shortfalls remain in each of these initiatives. Further, while selected state officials voiced praise for some of their partnerships with federal agencies, they also have concerns about changes to coordination programs and restrictions on participating in them. Details on the initiatives follow:

- **Policy on geospatial metadata.** While the federal departments in our prior review (Commerce, Interior, and Transportation) have developed policies that require their agencies to make their geospatial metadata available on the Geospatial Platform, the two additional departments in this review (DHS and USDA) do not have such policies.

In addition, few agencies have made their metadata available on the platform. Of the 32 departments and agencies that make up the FGDC steering committee, 8 departments have made at least a portion of their metadata available on the platform. Further, FGDC identified 188 NGDA datasets as most critical, but as of December 2014, 111 datasets (59 percent) were registered on the platform. Of the six agencies we reviewed that are required to make their data available, five agencies had metadata on the platform and one had

not registered any NGDA datasets on the Geospatial Platform.⁵¹ Specifically, Census, FEMA, FSA, NOAA, and USGS had registered NGDA datasets on the platform, but BLM had not—even though the agency is responsible for 4 NGDA datasets.

The agencies provided several reasons for these shortfalls. DHS officials reported that they do not have policies or procedures for putting their metadata on the Geospatial Platform or accessing it before expending funds on geospatial data because they are currently in the process of revising and updating all of the department's geospatial documents and directives. Similarly, USDA officials acknowledged that they do not currently have such policies or procedures, but noted they are in the process of revising their existing guidance on making their metadata publicly available and plan to include a reference to posting this information on the Geospatial Platform. Neither agency provided a date for the planned completion of these policies. Until the agencies establish dates for completing their policies, it will be more difficult to oversee and ensure progress is being made.

Officials at BLM stated that they have been trying to publish their metadata on the Geospatial Platform for months, but have been experiencing technical problems in doing so. Other agencies, including the General Services Administration, USGS, and NOAA, reported experiencing similar technical problems. FGDC officials stated that they are working with the Geospatial Platform technical team to address these issues, and have created a metadata working group so that FGDC and affected departments can work together on these problems. FGDC's original goal was to have these problems resolved by December 31, 2014. As of January 2015, FGDC officials stated that they have identified the root causes of the technical issues and have implemented a solution. However, BLM's metadata were still not registered on the Geospatial Platform as of February 2015.

Until all departments have policies requiring them to make metadata available on the clearinghouse and are doing so, the federal government runs the risk of not managing its geospatial data assets in an effective manner. Specifically, if key datasets are not available on the platform, other agencies may not know when they are pursuing

⁵¹USPS is not required to register its datasets.

potentially duplicative investments. Such situations would result in the inefficient use of already limited resources.

- **Procedures for accessing the clearinghouse.** The federal departments in our prior review (Commerce, Interior, and Transportation) have issued internal procedures to ensure that their agencies access the Geospatial Platform's Marketplace before they expend funds to collect or produce new geospatial data to determine (1) whether the information has already been collected by others or (2) whether cooperative efforts to obtain the data are possible. However, the two additional departments in this review (DHS and USDA) do not have such procedures.

In addition, while Interior, Commerce, and Transportation have begun to implement these procedures, neither of the other agencies in our current review (DHS and USDA)—nor any of the federal agencies government-wide that are subject to the requirement to do so—are using the Geospatial Platform's Marketplace. Specifically, as of September 2014, three agencies government-wide have registered planned datasets to it: USGS and U.S. Fish and Wildlife Service (Interior), and NOAA (Commerce). While this is an improvement from 2012, when no agencies were using the Marketplace, this is not meeting the intent of the NSDI guidance.

Agency officials from DHS explained that they do not have procedures for using the Marketplace because it is still too immature. USDA officials stated that are not using the Marketplace because they rely on existing internal procedures and professional networks to identify opportunities for collaboration; however, they are in the process of revising their existing guidance to include a reference to using the Marketplace feature. Using existing professional networks and planning to add a reference to the Marketplace feature fall short of OMB's guidance to ensure agencies access the Marketplace before expending funds to avoid duplicative investments and to enhance coordination.

Officials with BLM, DHS, USGS, and the National Digital Orthoimagery Program also reported that they find existing personal and professional networks to be more effective in coordinating geospatial acquisitions than the current Marketplace technology. The NSDI Strategic Plan includes tasks for tracking the use of the Marketplace and documenting associated cost savings and avoidance that are targeted for completion in fiscal years 2015 and 2016.

We acknowledge that the Geospatial Platform's maturity is evolving. However, until agencies use the Geospatial Platform Marketplace to identify planned geospatial data acquisitions, they will likely miss opportunities to reuse or cooperatively acquire geospatial data and increase the likelihood of acquiring duplicative geospatial data.

- **Strategy.** One of the three federal departments in our prior review has prepared and begun implementing a strategy for advancing geographic information and related geospatial activities appropriate to its mission. Specifically, Interior published a plan in March 2014 that addresses the NSDI and includes outcome-oriented goals and objectives and descriptions of how the actions are to be achieved. Progress in implementing the strategy is being monitored by the department's geospatial advisory committee.

In contrast, the two other departments in our prior review, and the two new departments in this review, have made limited progress in developing such strategies. Specifically, Commerce published a strategic plan in March 2014; however, the strategy does not include descriptions of how its objectives will be achieved, or how progress will be measured. As of January 2015, Commerce officials stated that they plan to develop and approve the implementation plan containing those details by the end of the second quarter of fiscal year 2015. Officials from Transportation, DHS, and USDA stated that they are working on strategies that they anticipate publishing during fiscal year 2015.

- **Partnerships.** Agencies in the federal departments in our review coordinate with states in a number of partnerships and programs, some of which are considered very successful by the states. Programs considered successful by representatives from three of the five states in our sample, as well as NSGIC, include the National Telecommunications and Information Administration's State Broadband Initiative⁵² and Transportation for the Nation.⁵³ Both of

⁵²The State Broadband Initiative program's goal was to assist states in gathering data on the availability, speed, and location of broadband services, as well as the broadband services that community institutions, such as schools, libraries, and hospitals, use. These data were used to facilitate the integration of broadband and information technology into state and local economies.

⁵³Transportation for the Nation is an ongoing project by the Department of Transportation to develop comprehensive, publicly available, nationwide datasets for all modes of transportation, including roads, railways, airports, and water.

these programs were lauded for their ability to work with local governments to build nationwide datasets. Officials from three of the states also commended the NOAA Coastal Services Center,⁵⁴ and officials from four states commended the USGS National Digital Elevation Program,⁵⁵ and the U.S. Fish and Wildlife Service's National Wetlands Inventory⁵⁶ for their focus on providing products and services that meet states' needs.

However, each of the five states as well as NSGIC expressed concerns about several federal coordination efforts. Specific concerns include (1) changes to USGS programs that have negatively impacted the states, (2) legal and administrative restrictions on sharing federal data, and (3) datasets not being built from the local level up. These concerns are discussed below:

- All five of the state officials and one of the two state organizations we reviewed expressed concerns about changes to partnerships that had been considered successful. One example is the USGS Geospatial Liaison program. This program had established liaisons to engage and support state, local, tribal, and regional partners in improving the timeliness, quality, and accessibility of geospatial data for the community and the NSDI. However, USGS is no longer replacing liaisons that leave the agency or retire, and is reducing travel funding. Further, due to an agency shift in priorities, USGS liaisons are now focusing their efforts on elevation and hydrography, instead of assisting states in coordinating in other areas such as aerial photography.

Similarly, USGS is ending its long-time support of the Department of Defense's National Geospatial-Intelligence Agency's Urban

⁵⁴The Coastal Services Center collects coastal LIDAR elevation data from a variety of federal, state, and local governments.

⁵⁵Under the National Digital Elevation Program, federal and state agencies work together to acquire high-quality elevation data for the United States and its territories. USGS reported that it is currently transitioning to its 3D Elevation Program as the next generation elevation layer. The program was designed based on the 2012 National Enhanced Elevation Assessment, which identified more than 600 requirements for 3D elevation data to address the mission-critical uses of federal agencies, states, local, and tribal governments, and private industries.

⁵⁶The National Wetlands Inventory was established to conduct a nationwide inventory of U.S. wetlands to provide biologists and others with information on the distribution and type of wetlands to aid in conservation efforts.

Area Imagery Program after 2014, again due to its changing focus away from orthoimagery and toward elevation data.⁵⁷ The Urban Area Imagery Program was originally created after the terrorist attack on the United States on September 11, 2001, to collect imagery and other geospatial data layers over densely populated urban areas for homeland security and emergency operation purposes. With USGS acting as primary liaison to the states, the program has since expanded beyond its federal scope to become one of the primary mechanisms available to state and local governments for partnering to collect high-resolution imagery over additional urban and non-urban areas as well.

- Each of the five state officials and one of the two state organizations reported that legal and administrative restrictions prevent states from getting the federal data that they need. For example, state officials reported that state and local government agencies work closely with Census to provide updated address data, but that due to legal restrictions on what Census can share, they do not obtain reciprocal address updates from Census.⁵⁸ In addition, state officials reported being hampered in participating in the partnerships to acquire imagery through FSA's National Agriculture Imagery Program.⁵⁹ According to state officials, this is because FSA requires payment for the data upfront, while some states' procurement rules require delivery of the product prior to payment. According to FSA, upfront payments allow the agency to make the data available to the states pursuant to federal law.
- All five state officials reported that departments have not always taken advantage of opportunities to integrate local preferences into their data collection efforts as suggested by OMB's

⁵⁷Although the program is administered by the National Geospatial-Intelligence Agency, to date the data collection, management, handing, and quality control aspects of the program have been executed by the USGS.

⁵⁸13 U.S.C. § 9 prohibits Census from disclosing data it collects about individuals and establishments in a manner that would identify those individuals and businesses.

⁵⁹The National Agriculture Imagery Program acquires 1-meter aerial imagery during the agricultural growing seasons in the coterminous United States in a 2-year cycle. The resulting digital orthophotography is available to governmental agencies and the public for a nominal fee. FSA also allows federal, state, and local agencies to contract for more detailed orthophotography collections, known as "buy-ups," subject to its approval, and at additional costs to the partners.

guidance.⁶⁰ Instead, state officials said that agencies tend to structure their programs to focus on collecting data that support their federal missions. An example of this is the National Agriculture Imagery Program. Some states believe the program would be much more effective and efficient if imagery were collected at the higher resolution preferred by local governments; the images could then be re-sampled to meet the lower resolution requirements of the federal government. Another example where states report that national data would be better collected at the local level, and then rolled up, is address data (which is discussed later in this report).

In response to the state concerns regarding changes to federal programs' coordination with states, officials from USGS noted that funding constraints have forced the changes to the Geospatial Liaison Program and the Urban Area Imagery Program. USGS officials stated while the Urban Area Imagery Program will still be able to use USGS's Geospatial Product and Service Contracts to contract for the data collection, users will have to find other arrangements for the quality assurance and data management activities that USGS can no longer provide. Officials with FSA's National Agriculture Imagery Program noted that state and local governments can still purchase the imagery, or enter into their own contracts for specific imagery products. FSA has a website to facilitate these actions. Given the current budgetary environment, it will be important for agencies to identify and use tools and cooperative agreements that are not heavily reliant on funding.

OMB Has Not Prioritized or Overseen NSDI Efforts

Part of the reason that FGDC and federal agencies are falling short on their responsibilities for the NSDI is that OMB has not made it a priority to ensure that these responsibilities are implemented. While OMB has oversight responsibilities for federal IT systems and acquisition activities—including those that deal with geospatial data—OMB has not made it a priority to oversee agency actions in regard to their geospatial responsibilities. Specifically, although OMB guidance requires agencies to report annually on their strategic planning, agencies have not reported to OMB. Moreover, OMB has not requested agencies provide updates on their progress on NSDI initiatives or provided oversight of agencies'

⁶⁰OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities* (Aug. 19, 2002).

progress. Similar to our prior report, OMB e-government staff told us that this initiative is not a priority for them. Further, while FGDC, with OMB serving as Vice Chair, is required to serve as the lead federal executive body charged with directing and facilitating national implementation of the NSDI, committee officials stated that they are challenged in overseeing the tasks in the strategic plan. Officials stated that this is because they do not have authority over the other federal departments that are responsible for the day-to-day implementation of the NSDI.

As a result, it is now 20 years since the guidance to establish the NSDI was issued and the federal government has not yet fully implemented the NSDI as a mechanism to facilitate the effective and efficient collection, sharing, and dissemination of geospatial data. Unless actions are taken to identify and address federal agency shortcomings, the full realization of the NSDI across all levels of government and the private sector will take even longer, during which opportunities for increased collaboration, reduced duplication, and potential cost savings will be lost.

Federal Agencies and States Invest in Potentially Duplicative Geospatial Data; Initiatives to Reduce Duplication Face Key Challenges

Federal agencies and states invest in potentially duplicative geospatial data. While there are initiatives in place to reduce the possibility of duplication, these initiatives face several challenges. OMB guidance encourages the avoidance of duplicative geospatial efforts and investments. In its most recent version of Circular A-16, OMB states that implementation of this guidance is essential to help federal agencies eliminate duplication, avoid redundant expenditures, and improve the efficiency and effectiveness of the sharing and dissemination of geospatial data. Nevertheless, several examples of duplication and the potential for duplication exist in the two types of geospatial data we assessed. Duplication of geospatial data can waste resources; create fragmented and conflicting datasets (in cases where different collection efforts gather outdated or poorly geocoded data); and in some cases where having the correct address data is critical, such as in providing emergency services, risk lives.

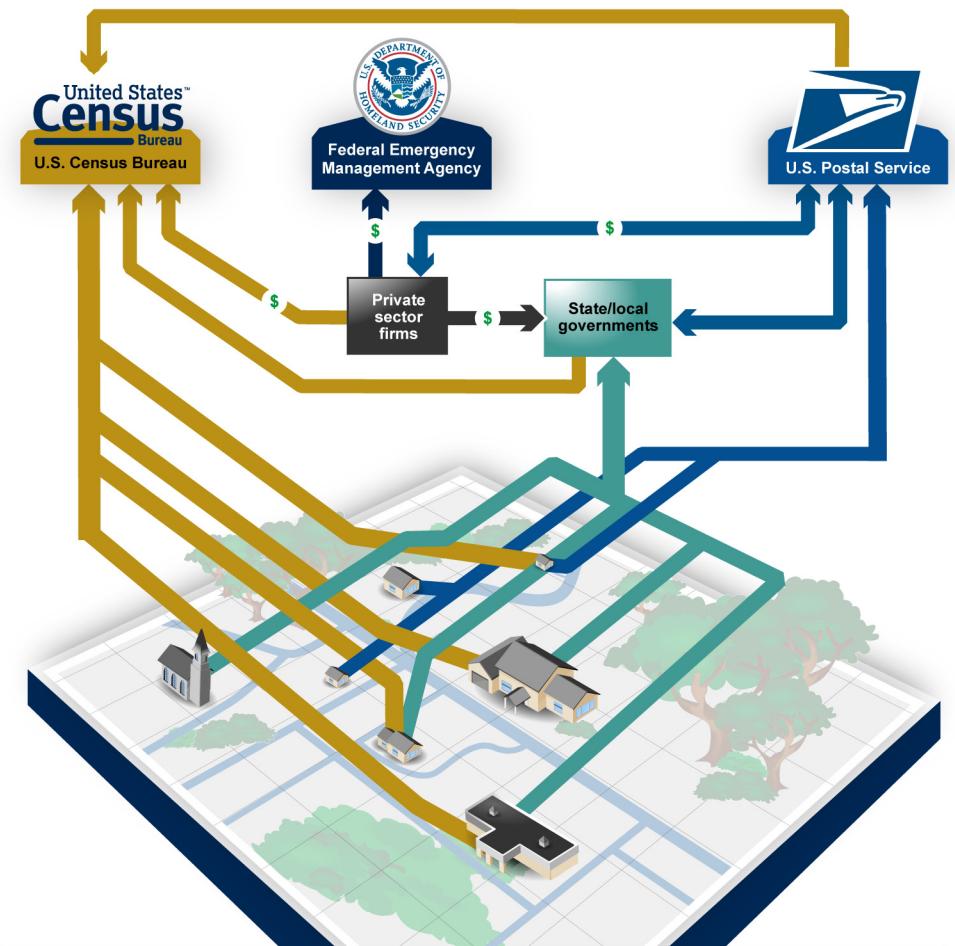
Duplicative Address Data Exist within State and Federal Governments; Multiple Initiatives to Reduce Duplication of Address Data Face Challenges

Address data are collected and purchased multiple times by federal, state, and local entities, resulting in duplication of effort and resources. According to NGAC officials, addresses are typically generated at the local level—in a city, town, or county. When state and federal government agencies use address data to support their missions, some go to the local government for the updated address data while other agencies collect their own address data or purchase them from vendors. For example, a developer building a new neighborhood will seek addresses from the local government. Then, the local addressing officials provide updated address data to the USPS, which, in turn, provides a subset of these data to Census and sells address matching services to private vendors.⁶¹ Vendors can then repackage the address data and sell or license them to other organizations, including government agencies. For instance, FEMA licenses address data and geocoding tools from a private vendor, which allows them to geocode the locations of applications for emergency assistance. In addition to using USPS address data, according to agency officials, Census also collects its own supplementary address data, aggregates them from state or local governments and, in some cases, leases or purchases address data from private firms to assist with address research. USPS also reports that it leases address data from vendors to discover new addresses.

In addition to multiple federal and state data collection efforts, address datasets are also sometimes duplicated by agencies within a single state. For example, Washington state's Chief Information Officer estimated that approximately 15 or 16 state agencies have purchased or licensed their own address datasets and that the state would save \$1.3 million by eliminating that duplication. That state's GIS Coordinator and Program Manager stated that she believed the potential cost savings to be much higher. See figure 17 for an illustration of duplication in efforts to collect address data.

⁶¹A 2011 study for the Census Bureau showed that the majority of private vendors rely primarily on USPS for their address data. See M. Dobson, Ph.D., D. Cowen, Ph.D., and S. Guptill, Ph.D. *Reporting the State and Anticipated Future Directions of Addresses and Addressing*, a report to the Geography Division, U.S. Bureau of the Census, Deliverable #2 – Syneren Technologies Contract – Task T005 (Jan. 5, 2011).

Figure 17: A Simplified Visualization of Duplicative Efforts to Collect Address Data



Source: GAO analysis of agency documentation, responses, and interviews. | GAO-15-193

Note: This is intended to be a simplified visualization and does not capture all address collection efforts done by all federal agencies or reflect Census's current plan to perform reengineered address canvassing in the 2020 Decennial Census.

Duplicative or similar datasets can also be inconsistent or inaccurate. Because there are differences in when data were collected, how the data were geocoded, and how often the data are updated, it is not unusual to have different address datasets with inconsistent data. Using inaccurate address data could cause inconvenience, extra work, or—in a worst case scenario—risk lives. For example, for Census, mailing forms to an inaccurate address could cause the agency to send caseworkers out to visit the location to correct the address. However, for local emergency

services entities, having an inaccurate address could cause a delayed response and put lives at risk.

However, it is important to note that many address data collection efforts are not duplicative. In some cases, datasets that appear to be duplicative have customized features that make them distinct. That is, one address file may provide data that another dataset will not, such as geo-locations or parcel data. For example, one of FEMA's datasets includes parcel data, while the other does not. In addition, the intended use of the dataset may differentiate the datasets. For example, Census maintains three address datasets, but each has its own intended use, such as maintaining a comprehensive list of addresses for all the governments within the United States to assist in the census of governments or a file that has an address for each living quarter in order to conduct the census.

Even so, it is evident that there is duplication of effort, resources, and spending between various levels of government within the address data category. For example, almost any effort to collect or purchase address data would duplicate Census's past and future efforts to collect, update, and verify its database of millions of addresses. In addition, entities often maintain several purchased address datasets from different vendors. For instance, USPS has five contracts dealing with address data. USPS has recognized this and plans to consolidate the contracts to a single contract in the future. The agencies and states that we reviewed maintained 29 address data files that cost up to \$1.4 billion over 10 years. One state reported approximately 13 different address files within its state government alone. Table 7 provides the address datasets created or used by each of our selected agencies and states.

Table 7: Address Data Created or Used by Selected States and Federal Agencies

Organization	Dataset	Use	Coverage area	Source of data	Estimated cost
Census	Master Address File	Conducting the decennial census, as well as other census products	Nationwide	Collected and aggregated	\$1.4 billion over 10 years for the 2010 Census ^a
	Geographic program participants database	Providing contact information for participants in census programs	Approximately 39,000 state and local governments' contact information	Collected	Unable to quantify
	Governments Master Address File	Providing contact information on governmental participants	Nationwide—state/local governments	Collected	Unable to quantify
FEMA	Licensed address data within software	Geocoding locations	Unknown	Purchased	\$12,589
	Licensed address data within software	Standardizing and correcting addresses	Nationwide	Purchased	\$710,018
USPS	Address Management System	Delivering mail to every address in the country	Nationwide	Aggregated and purchased	\$36 million/yr for operations and maintenance
	Licensed address data within software	Providing a locator function on USPS.com to find post offices	Unknown	Purchased	\$39,383
	Licensed address data within software	Creating maps that mail carriers follow on route	Nationwide	Purchased	\$4.3 million
	Licensed address data within software	Managing mail carrier routes	Unknown	Purchased	\$358,630
	Licensed address data within software	Preparing for the effects of disasters on mail delivery	Unknown	Purchased	\$65,770
	Licensed address data within software	Ensuring package delivery and manage carrier performance	Nationwide	Purchased	\$1.8 million
Maryland	Address point locations	Assisting all state agencies in completing their missions, including health, human resources, education, and public safety	Statewide	Aggregated	\$75,000/yr
Montana	Statewide address database	Assisting state agencies in completing their missions, including natural resource planning, disaster recovery, and delivering government services	Statewide	Aggregated	\$80,000/yr
Ohio	Location Based Response System County Addresses Database	Assisting state agencies in completing their missions, including emergency response, tax determinations, geocoding, and crash analysis	Statewide—80 of 88 counties	Aggregated	Approximately \$16 million to develop \$400,000 in FY13 and FY14

Organization	Dataset	Use	Coverage area	Source of data	Estimated cost
Ohio	Statewide Master Address File	Assisting state agencies in completing their missions, including emergency response, tax determinations, geocoding, and crash analysis	Statewide	Aggregated	\$0
South Carolina	State Address Point Program	Assisting state agencies in completing their missions, including crime mapping, homeland security, research and statistics, and voter validation	Statewide—38 of 46 counties	Aggregated	\$6.2 million to develop
Washington ^b	13 different address files	Assisting state agencies in completing their missions, including tracking cancer clusters, determining location of public health services, and issuing permits	Various	Aggregated and purchased	Unable to quantify

Source: GAO analysis of agency documentation, responses, and interviews. | GAO-15-193

Notes:

^aU.S. Census Bureau, *High-Quality Maps and Accurate Addresses Are Needed to Achieve Census 2020 Cost-Saving Goals*, OIG-12-024-1 (Washington, D.C.: May 10, 2012).

^bAccording to state officials, Washington does not currently have a single master address file. Many of its departments maintain their own address data. Washington is in the process of creating a master address file for the state.

Acronyms and abbreviations: Census = U.S. Census Bureau; FEMA = Federal Emergency Management Agency; USPS = United States Postal Service.

Efforts Are Under Way to Reduce Duplication and Increase the Sharing of Address Data

Several efforts are under way to reduce duplication and increase address sharing across governments, including an initiative to create a national address database; a Census initiative to collect address data from state and local governments; and an initiative to modernize the 9-1-1 emergency calling system, called Next Generation 9-1-1.

- **National Address Database Initiative.** At FGDC's request, in December 2012, NGAC published a whitepaper on the need for developing a national address database.⁶² Acknowledging that address data are an essential requirement for a wide variety of governmental functions (including emergency management, administration, research, publications, mapping, routing, and navigation), NGAC reported that there is a critical need for a national address database as a single repository for storing, aggregating, and sharing essential address information.

⁶²NGAC, *The Need for a National Address Database, A Report Submitted by the National Geospatial Advisory Committee* (December 2012).

NGAC's vision for a national address database was a continuously updated, nationwide, publicly available address database that meets the needs of governments at all levels where address data are developed locally, with local and state custodians acting as regional integrators. The report provided several potential alternatives for the development and the management of a database, including housing the database within one federal agency or having several stakeholder agencies share responsibility for the database.

NGAC reported that the benefits of a national address database would be improved ability to respond to emergency and public safety incidents, improved government services, less fragmented address systems, and cost savings. Further, in December 2014, NGAC identified seven user scenarios to demonstrate the value of a national address database, including federal, state, and local government uses for activities such as emergency response and voter registration. While NGAC did not define the total potential cost savings, the amount could be quite large. For instance, if the address data were improved, Census could move to more targeted address canvassing and potentially save \$196 million on the 2020 census. Further, DHS estimated a cost avoidance of \$2 million per year for address data access. This did not account for the benefit of time savings for incident response such as survivor identity validation and eligibility, individual housing assistance, damage assessments, and public assistance. Given the number of federal, state, and local agencies that collect and maintain address data on an ongoing basis, it is clear that a coordinated and comprehensive national address database could potentially lead to significant savings. Going forward, NGAC recommended that (1) FGDC add addresses as a new data theme and identify a theme lead agency and (2) FGDC agencies coordinate and collaborate to develop a business requirements plan for a national address database during fiscal year 2015.

There are several potential challenges to moving forward on a national address database. First, according to NGAC officials there are questions regarding where the national database should reside and which agency should lead the effort. Further, given statutory limits affecting Census and USPS, NGAC officials expressed concern that

the agencies' involvement could limit the access to the information.⁶³ Additionally, privacy professionals have expressed a concern regarding whether a building's physical address is personally identifiable information, and therefore private.⁶⁴ NGAC has recognized these concerns and proposed that the national address database should only contain addresses and not identities of individuals, owners, or occupants. Officials noted that buildings have no right to privacy.

- **Geographic Support System Initiative.** In fiscal year 2011, Census initiated its Geographic Support System, a \$674 million, 10-year project. As part of this project, Census's Geography Division is working on an initiative with USPS; other federal agencies; and state, local, and tribal governments to allow them to regularly share and continuously update their address lists and road data with Census. The Chief of the Geography Division estimated that, as of August 2014, they had collected data for about one-third of the population. Census anticipates collecting the data throughout the decade leading up to the 2020 Decennial Census. Census has estimated that this initiative may yield a reduction in the cost of address canvassing throughout the nation on the order of \$1 billion.

However, we recently reported that Census's lack of milestones, deadlines, and measurable goals with regard to this effort make it difficult to know whether the bureau is on track to meet its goals.⁶⁵ We recommended the agency develop a detailed plan for its data sources for the 2020 Decennial Census that includes measurable goals, track performance against these goals, and set a timeline. The agency generally agreed with our recommendations.

⁶³13 U.S.C. § 9 prohibits Census from disclosing data it collects about individuals and establishments in a manner that would identify those individuals and businesses. Similarly, 39 U.S.C. § 412 prohibits USPS from disclosing names or addresses (past or present) of postal patrons or other persons. However, the Census Address List Improvement Act of 1994 authorized USPS to share its address information with Census.

⁶⁴Personally identifiable information is any information that can be used to distinguish or trace an individual's identity, such as name, date, and place of birth, Social Security number, or other types of personal information that can be linked to an individual, such as medical, educational, financial, and employment information.

⁶⁵GAO, *2020 Census: Census Bureau Can Improve Use of Leading Practices When Choosing Address and Mapping Sources*, GAO-15-21 (Washington, D.C.: Oct. 2, 2014).

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- **Next Generation 9-1-1.** We recently reported that public safety entities are in the process of implementing the next generation of 9-1-1 services to, among other things, improve their capabilities to communicate with callers, increase resiliency of their 9-1-1 operations, and enhance information sharing among first responders.⁶⁶ Next Generation 9-1-1 is expected to use Internet-protocol-based, broadband technology that is capable of carrying voice plus large amounts of varying types of data, such as instant messaging, wireline calls, voice over Internet protocol calls, photographs, and live video feeds from an emergency scene.

The original 9-1-1 system was designed to carry only the caller's telephone number with the call, and the associated fixed address was obtained from an established database. However, the mobility of wireless callers makes fixed street addresses unreliable as location indicators. Next Generation 9-1-1 is to map the caller's geospatial coordinates and route the call to the appropriate Public Safety Answering Points—the locations answering 9-1-1 phone calls. Some local and state governments are using this opportunity to develop centralized address databases that share information across departments and with the local 9-1-1 authority. While this initiative holds promise, it is not clear when it will be completed.

Agencies and States Face Challenges in Preventing Duplication in Address Data

Agencies and states report facing two key challenges in preventing duplication in address data collection efforts. They include limited sharing of address data due to statutory restrictions and a lack of federal sponsorship.

- **Statutory restrictions.** While Census has a massive address database that must be updated with new address data on an ongoing basis, agency officials stated that the agency is limited in sharing the address data it collects due to statutory restrictions under Title 13.

Specifically, to protect privacy, Section 9 of Title 13 of the U.S. Code prohibits Census from disclosing data it collects about individuals and establishments in a manner that would identify those individuals and businesses. Consequently, Census can collect address data from multiple sources, but it believes it cannot share those data with other

⁶⁶GAO, *Critical Infrastructure Protection: More Comprehensive Planning Would Enhance the Cybersecurity of Public Safety Entities' Emerging Technology*, GAO-14-125 (Washington, D.C.: Jan. 28, 2014).

federal or state government agencies. For example, the Census Address List Improvement Act of 1994 authorized USPS to share its address data with Census; however, Census does not share its address data with USPS. Similarly, Section 412 of Title 39 of the U.S. Code prohibits USPS from disclosing names or addresses (past or present) of postal patrons or other persons.

This lack of sharing leads to duplication of effort and inefficiency. For example, in 2009, Commerce's National Telecommunications and Information Administration began its state broadband initiative to allow users to view broadband availability across the United States. The agency awarded grants to each state or the states' designee to assist in gathering data on the availability, speed, and location of broadband services. In order to gather those data by address, 17 states used \$13 million in agency-provided grants to create, update, or complete statewide address databases. Had the address data been already available, those funds could have been directed elsewhere. A reexamination of the restrictions on address data could allow for greater coordination and reduce duplicative efforts.

- **Federal sponsorship.** Another challenge agencies face is that there is no federal sponsorship at the national level for address data. While both NSGIC and NGAC have an address subcommittee, according to FGDC officials, FGDC does not have a similar subcommittee to address these particular issues because it does not currently recognize address data as its own data theme. FGDC's Executive Director stated that this was because there was no specific agency champion to serve as theme lead. Both NSGIC and the Urban and Regional Information Systems Association⁶⁷ have petitioned Interior and FGDC to include address data as its own data theme noting that its addition would help reduce duplication.

In the absence of a single, authoritative, and publicly available address database, multiple agencies from all levels of government are building, maintaining, and/or paying for multiple address databases. The result is inconsistent data, redundant business processes, and wasted taxpayer dollars. In addition, since addresses are the most commonly used way to

⁶⁷The Urban and Regional Information Systems Association is a nonprofit association of professionals using GIS and other information technologies to solve challenges in state/provincial, regional, and local government agencies and departments.

communicate the location of an emergency, the results of inaccurate or incomplete address data could affect emergency response and public safety. Until there is increased focus on building a national address database and providing federal sponsorship for that effort, there will continue to be duplicative address datasets developed at every level of government.

Current Aerial Photography Datasets Appear to Have Limited Duplication, but Opportunity Exists for More Coordination

Selected agencies and states have multiple aerial photography datasets, which appear to have limited duplication. Specifically, selected agencies and states reported having 12 aerial photography datasets. The datasets differ mostly due to specific agency and state business needs requiring varying resolutions and coverage area. Two organizations may both need imagery data, but for different purposes, using different definitions and different levels of precision or accuracy, such as resolution. An example of this is the National Agriculture Imagery Program and states' own collection of imagery. While the National Agriculture Imagery Program does have imagery of the states, such as South Carolina, it is not always helpful to the states to use the program's imagery. According to South Carolina officials, when trees are thick with foliage, the program's leaf-on imagery does not allow mapping of certain features, such as streets, streams, and houses. Additionally, South Carolina (like many states) requires a higher resolution for imagery so that certain features can be mapped closer to the ground (e.g., road features and houses). However, according to state officials, some states, like Washington and Montana, depend on the program to provide the state's only statewide aerial photography. Table 8 provides a summary of aerial imagery collected and acquired by selected state and federal agencies.

Table 8: Aerial Imagery Collected or Acquired by States and Federal Agencies

Organization	Dataset	Collection cycle	Leaf-on/leaf-off	Resolution	Coverage area	Source of data	Estimated cost for FY13 and FY14
BLM	Oregon/Washington Cyclic Aerial Photography	5 years	Leaf-on	24 inch	Oregon	Purchased	\$337,698
	Multiple individual aerial photography projects	Varies	Varies	Varies	Varies	Purchased	\$1.3 million ^a
FSA	National Agriculture Imagery Program	2-2.5 years	Leaf-on	1 meter	States in the continental U.S.	Purchased	\$9.6 million ^a \$10.1 million ^b

Organization	Dataset	Collection cycle	Leaf-on/leaf-off	Resolution	Coverage area	Source of data	Estimated cost for FY13 and FY14
NOAA	Coastal Aerial Imagery	5-15 years based on susceptibility to change	Leaf-off is preferred	35 centimeter	Coastal regions	Collected, leveraged, and purchased	Not provided
NOAA	Emergency Response Imagery	Event-driven	Event-driven	25 centimeter	Event-driven	Collected, aggregated, and purchased	Not provided
National Geospatial-Intelligence Agency (with USGS) ^d	High Resolution Orthoimagery/133 Urban Areas	2 years	Leaf-off	1 foot	Urban areas nationwide	Purchased and collected	\$5,091,855 ^a \$4,035,856 ^b (just USGS costs)
Maryland	High Resolution Aerial Imagery	3 years	Leaf-off	6 and 3 inch	Statewide	Purchased	\$815,939 ^a \$810,062 ^b
Ohio	High Resolution 4-band Aerial Imagery	3 years or when funds available	Leaf-off	1 foot, with 3 or 6 inches for various counties	Statewide	Purchased	\$452,000 ^a \$418,000 ^b
	Oblique Imagery	As needed by locals	Leaf-off	3-8 inch, depending on rural or urban setting	Statewide	Purchased	\$0 ^c
South Carolina	High Resolution Orthoimagery	10 years	Leaf-off	6 or 12 inch	County-by-county basis	Leveraged	\$340,000 (local imagery) \$210,000 (federal imagery)
	Oblique Imagery	One-time or every other year	Unknown	3-12 inches	Selected counties	Purchased	Not provided
	Ortho Quarter Quadrangles	4-6 years	Leaf-off	1 meter	Statewide	Leveraged	\$0 ^c

Source: GAO analysis of agency documentation, responses, and interviews. | GAO-15-193

Note: Washington and Montana currently do not have statewide aerial photography programs and therefore they rely on the National Agriculture Imagery Program.

^aExpenditure is from fiscal year 2013.

^bExpenditure is from fiscal year 2014.

^cNo expenditure in fiscal years 2013 and 2014.

Acronyms and abbreviations: BLM = Bureau of Land Management; FSA = Farm Service Agency; NOAA = National Oceanic and Atmospheric Administration; USGS = U.S. Geological Survey.

Programs That Support the Coordination of Aerial Photography Face Challenges That Could Result in Duplication

To coordinate the acquisition and collection of imagery, several imagery programs have been established and evolved to include all levels of government, while making low costs and public access a priority. These programs include the National Digital Orthoimagery Program, the USGS Geospatial Liaison Network, the National Agriculture Imagery Program, and the 133 Major Urban Areas Program. These intergovernmental partnerships to acquire imagery have clear advantages: lower costs, reduced duplication of effort, greater standardization, and more data available to users. However, these programs face challenges, including changing priorities and limited resources for coordination efforts that could reduce collaboration and therefore potentially result in duplication. A summary of each program and its challenges follows.

- **The National Digital Orthoimagery Program.** The National Digital Orthoimagery Program is a consortium of agencies that acts as the FGDC subcommittee for imagery. While its members are principally federal—including the USGS, FSA, Natural Resources Conservation Service, U.S. Forest Service, BLM, FEMA, Census, and NOAA—state governments are represented by NSGIC. The program’s goal is to provide national orthoimagery coverage by combining funding resources and creating partnerships to coordinate requirements and costs with federal, state, other government agencies, and the private sector. According to program officials, their outreach efforts ensure that state and local governments are always aware of opportunities to partner with federal government agencies.

However, none of the states included in our review reported having any direct or recent interactions with the program. According to National Digital Orthoimagery Program officials, this could be attributable to the fact that, due to budget constraints, it is no longer able to conduct its bi-annual meetings at locations where opportunities to build relationships with state and local officials could occur.

- **USGS Geospatial Liaison Network.** As previously stated, USGS Geospatial Liaisons engage and support state, local, tribal, and regional partners in improving geospatial data. Specifically, USGS Geospatial Liaisons develop partnerships and agreements that improve the data holdings and the products and services of The National Map, including imagery. For example, in 2012, USGS Geospatial Liaisons helped to facilitate 52 agreements for leaf-off high-resolution imagery in 35 states. However, a declining budget and change of priorities have caused significant changes to the liaison program. Major changes to the program include a reduction in the

number of liaisons and a change in priorities to focus primarily on the elevation and hydrography themes, rather than assisting with any other geospatial issues, including aerial photography. By focusing on elevation-related issues, states can no longer rely on their liaison to coordinate shared aerial photography partnerships.

- **National Agriculture Imagery Program.** FSA funds and administers the National Agriculture Imagery Program, which acquires 1-meter aerial imagery during the agricultural growing seasons in the coterminous United States in a 2-year cycle. Other agencies share about 36 percent of the costs.⁶⁸ The resulting digital orthophotography is available to government agencies and the public to download at no charge. FSA allows federal, state, and local agencies to partner for more detailed orthophotography collections, known as “buy-ups,” subject to FSA approval and at additional costs.

Officials from four of the states in our review report that they rely on the 1-meter imagery, and NSGIC officials consider the program a great success. However, it is challenging for states and some agencies to participate in the buy-ups that would provide for the more detailed orthophotography. Specifically, according to agency officials, the buy up program requires upfront payment, which is not always possible in the budget environment of states. Officials with three of the five states in our sample noted that FSA’s requirement that contracting partners pay in advance for specialized data collections precludes them from participating in the buy-ups, because their states’ procurement rules prohibit payment in advance of receipt of a product.

- **133 Major Urban Areas Program.** Coordinated through USGS and the National Geospatial-Intelligence Agency, the 133 Major Urban Areas imagery program acquires imagery for 133 urban areas of the United States to meet critical homeland security and emergency services requirements at a more detailed resolution than that of the National Agriculture Imagery Program—1-foot imagery, as opposed to 1-meter imagery. This effort leverages the resources of multiple partners to achieve significant savings through economies of scale. The agency and USGS have also coordinated with state and local agencies to address their special needs when possible, resulting in

⁶⁸These agencies consist of six Interior agencies (USGS, BLM, Bureau of Reclamation, Bureau of Indian Affairs, National Park Service, and U.S. Fish and Wildlife Service) and USDA’s Natural Resources Conservation Service and U.S. Forest Service.

cost savings. However, in 2014, due to limited resources and changing priorities, USGS ended its support for the program. As a result, the program's future is uncertain.

In an attempt to increase partnership between federal, state, and local governments, in 2004, NSGIC proposed the Imagery for the Nation initiative, which was intended to provide a sustainable and flexible national digital imagery program that would meet the needs of most government agencies by collecting and disseminating standardized multi-resolution products. The program was to combine the National Agriculture Imagery Program and an effort to collect 1-foot, leaf-off imagery for the entire nation in order to leverage the resources of multiple partners (including state and local governments) and achieve significant cost savings for all parties and improve the federal government's imagery collection. In 2007, USDA and USGS conducted a cost-benefit analysis on the program that evaluated several alternative concepts to implement it. The analysis showed that the program could save federal, state, and local governments up to \$938 million dollars over 10 years. By 2009, FGDC had acknowledged the need for a national imagery program and initiated a project to define the federal role in the program. Further, in 2010, FGDC, in collaboration with the National Geospatial-Intelligence Agency, issued a request for information to determine the most effective and efficient options for the program.

However, despite the promise of considerable cost savings, the program's progress stalled in 2011. According to the Executive Director of FGDC, the initiative is now dormant due to a lack of funding and a lack of interest in reviving the program. Contrary to this, officials from several states stated that they would use such a program and expressed disappointment that it never got started. A Maryland state official reported that the state has implemented such an imagery program by consolidating the funding received from an Enhanced 9-1-1 trust fund to conduct a statewide aerial photography acquisition that meets the needs of the state's counties. The official noted that this approach has been very efficient and effective in getting the counties the level of data they need, while providing the state with one coordinated dataset, resulting in cost savings to both levels of government.

Given the benefits that a more comprehensive approach to national imagery offers and the current budgetary environment, it is more important than ever for the federal government to create efficiencies and cost savings by taking advantage of intergovernmental partnerships. Without a national imagery program that incorporates the needs—as well

as the resources—of all levels of governments, increasingly scarce resources will not be spent efficiently and effectively in obtaining data critical to the missions and operations of our federal, state, and local governments.

Conclusions

While the use of geospatial data by the federal and state governments is ubiquitous and federal agencies and states report spending significant funds on these data, the estimated costs to the taxpayer are significantly underreported. In 2012, we recommended that OMB develop a mechanism to identify and report on all geospatial-related investments, and efforts to address that recommendation are under way. In addition, a recently passed law—the Digital Accountability and Transparency Act of 2014—could provide OMB with another opportunity to improve information about federal spending on geospatial data and investments.⁶⁹

Initiated in 1994 to coordinate investments in geospatial data, the NSDI still holds promise; however, more remains to be done to fully implement it and reap its benefits. In fulfilling its responsibilities for the NSDI, FGDC has initiated strategic planning and portfolio management practices and established the Geospatial Platform as a clearinghouse for sharable datasets. However, these efforts have not yet reached a level of maturity necessary for effectively implementing the NSDI. Specifically, the search capability within the clearinghouse does not always identify relevant datasets, FGDC does not yet have a schedule for when it will implement performance measures for the clearinghouse, and state organizations believe that they do not have a meaningful role in the NSDI. In addition, the federal departments and agencies in our review have made only limited progress in complying with their NSDI responsibilities, such as making their data available on the Geospatial Platform, checking the platform prior to expending funds to collect or produce new geospatial data, and developing strategic planning mechanisms. Specifically, Commerce and Interior established policies for identifying their geospatial datasets on the platform, and procedures for accessing the platform prior to investing in new geospatial data, while USDA and DHS did not. Both agencies are revising their existing policies, but have not yet set schedules for implementing them.

⁶⁹Pub. L. No. 113-101, also known as the DATA Act.

Until FGDC is able to provide a mature foundation for the NSDI (including having an effective search engine and a schedule for measuring performance), federal departments and agencies (including USDA and DHS) are fully implementing their responsibilities by establishing a schedule for when key policies will be implemented, and all federal stakeholders are working effectively with states to collect data of national interest, the vision of the NSDI to improve the coordination of geospatial data will not be fully realized, and limited resources will likely not be used effectively.

One reason that FGDC and agencies are lagging in their efforts to establish the NSDI is a lack of oversight. While FGDC provides guidance, it does not have authority to oversee other federal departments in their geospatial responsibilities. OMB, pursuant to its responsibility to ensure the efficient and effective use of information technology, is in a position to oversee agency efforts, but has not made it a priority to provide this oversight. Until OMB provides this much-needed oversight, it is likely that multiple agencies will continue to delay efforts to populate and use the Geospatial Platform. As a result, key opportunities for improving coordination and reducing duplication will be missed.

While OMB guidance states that agencies are to eliminate duplication, avoid redundant expenditures, and improve the efficiency and effectiveness of sharing and dissemination of geospatial data, several examples of duplication and the potential for duplication exist within address data. Specifically, address data are collected multiple times by federal, state, and local entities, resulting in duplication in effort and resources. Several efforts are under way to reduce duplication and increase address sharing across the government, including an initiative to create a national address database. However, agencies and states face challenges in effectively coordinating these efforts, such as limited sharing of address data due to statutory restrictions and the lack of federal sponsorship. Further, selected agencies and states have multiple aerial photography datasets, which appear to be similar but not duplicative, mostly due to efforts to coordinate the acquisition and collection of imagery. However, these programs face challenges, including declining resources and changing priorities, which could reduce coordination and therefore potentially result in duplication. Until there is consistent coordination across the national geospatial data infrastructure, there will continue to be duplicative datasets developed at every level of government, resulting in wasted resources, fragmented and conflicting datasets, and in some cases, risked lives.

Matter for Congressional Consideration

To increase coordination between various levels of government and reduce duplication of effort, resources, and costs associated with collecting and maintaining accurate address data, Congress should consider assessing the impact of the disclosure restrictions of Section 9 of Title 13 and Section 412 of Title 39 of the U.S. Code in moving toward a national geospatial address database. If warranted, Congress should consider revising those statutes to authorize the limited release of addresses, without any personally identifiable information, specifically for geospatial purposes. Such a change, if deemed appropriate, could potentially result in significant savings across federal, state, and local governments.

Recommendations for Executive Action

To better facilitate the coordination of—and accountability for—the estimated billions of dollars in federal geospatial investments, and to reduce duplication, we are making a total of nine recommendations to OMB, FGDC, and two federal departments.

Specifically, to make progress toward an effective national infrastructure and to improve oversight on federal spending on geospatial data and assets, we recommend that the Director of OMB take the following action:

- Improve oversight of progress on the NSDI by requiring federal agencies to report on their efforts to establish and implement policies for identifying geospatial metadata on the Geospatial Platform and their procedures for utilizing the Marketplace feature of the Geospatial Platform before making new investments in geospatial data.

In addition, we recommend that the Secretary of the Interior, as the FGDC Chair, direct the FGDC Steering Committee to take the following four actions:

- Correct the search function of the Geospatial Platform so that it effectively identifies applicable datasets, and oversee the effectiveness of the search function on a regular and ongoing basis.
- Establish a schedule for collecting performance measures for the Geospatial Platform and report on these measures during Steering Committee meetings.
- Create an address data theme with associated subcommittees and working groups to assist in furthering a national address database.
- Direct the National Digital Orthoimagery Program to reassess the feasibility of the “Imagery for the Nation” initiative, with the goal of identifying discrete steps that could be taken to further a national imagery program benefitting governments at all levels.

To help ensure the success of departmental efforts to improve geospatial coordination and reduce duplication, we recommend that the Secretary of Agriculture direct the designated senior agency official for geospatial information to take the following two actions:

- Establish a schedule for developing and implementing a policy that requires the department to make its geospatial metadata available on the Geospatial Platform.
- Develop and implement internal procedures to ensure that it accesses the Geospatial Platform Marketplace before it expends funds to collect or produce new geospatial data to determine (1) whether the information has already been collected by others and (2) whether cooperative efforts to obtain the data are possible.

To help ensure the success of departmental efforts to improve geospatial coordination and reduce duplication, we recommend that the Secretary of Homeland Security direct the designated senior agency official for geospatial information to take the following two actions:

- Establish a schedule for developing and implementing a policy that requires the department to make its geospatial metadata available on the Geospatial Platform.
- Develop and implement internal procedures to ensure that it accesses the Geospatial Platform Marketplace before it expends funds to collect or produce new geospatial data to determine (1) whether the information has already been collected by others and (2) whether cooperative efforts to obtain the data are possible.

Agency Comments and Our Evaluation

We requested comments on a draft of this report from the four agencies to which we made recommendations (OMB, Interior, USDA, and DHS), as well as from the three agencies that did not receive recommendations (Commerce, GSA, and USPS). OMB, Interior, USDA, and DHS generally agreed with our recommendations. Commerce agreed with our findings, and provided technical comments. GSA responded that it did not have comments on the draft report. USPS did not agree or disagree with our findings, but provided comments. Each agency's comments, where applicable, are discussed in more detail below:

- In e-mail comments provided by the Chief of Policy, Budget, and Communications of the Office of E-Government and Information Technology on January 16, 2015, OMB generally agreed with our recommendation and stated that it appreciated our careful review of federal geospatial data and associated spending, agency progress in

establishing the NSDI, and analysis of potential challenges agencies face in coordinating geospatial data collection efforts.

- In written comments, Interior generally agreed with our recommendations, but noted that there were some key points missing from the report. Specifically, the agency stated that until the term “geospatial data costs” is defined and a consistent method and set of investment assets for reporting are defined and consistently applied, it is conjectural to make general statements of over- or under-reporting of costs. While we agree that “geospatial data costs” needs to be better defined and that a mechanism for collecting the data needs to be consistently applied, we believe it is appropriate to assess existing OMB-required reporting mechanisms to gain insight into what agencies report they are spending on geospatial investments. Further, we believe it is appropriate to make the case that spending on geospatial investments is underreported by identifying programs that clearly gather or use geospatial data that are not captured by OMB’s current reporting mechanisms. As previously stated, OMB and FGDC have made plans to improve cost tracking to address a previous GAO recommendation.

In addition, Interior stated that while federal and non-federal partnerships can be very successful, often the partnerships rely on federal funding. Interior further noted that in the funding environment of the last several years, these types of investments have been predominantly cut, and agencies have had to reduce or eliminate some of these partnerships. While the majority of the partnerships we reviewed were most successful when they had stable funding, in the current budgetary environment, it is important for agencies to identify and use tools and cooperative agreements that are not heavily reliant on funding.

Further, in technical comments accompanying its letter, Interior generally agreed that congressional assessment of Section 9 of Title 13 of the U.S. Code could potentially result in cost savings across government. In addition, the agency stated that the Census Bureau and the Department of Transportation are collaborating on an analysis of requirements for a national address database, and that the need for and approach to creating an address data theme and its associated subcommittee will be evaluated as part of the analysis and submitted to the steering committee for consideration. The agency’s written comments are provided in appendix V.

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- In written comments, USDA agreed with our findings and stated that the agency intends to move forward with actions to complete the two recommendations. Specifically, the agency plans to include appropriate agency-level geospatial data policy guidance and procedure best practices in its governance documents. In addition, the agency acknowledged the value of reassessing deployment alternatives for “Imagery for the Nation,” which it continues to endorse. The agency’s written comments are provided in appendix VI.
 - In written comments, DHS concurred with the recommendations and stated that it plans to update existing geospatial management policy and procedures to reflect the recommendations by September 30, 2015. The agency’s written comments are provided in appendix VII. DHS also provided technical comments, which we incorporated as appropriate.
 - In e-mail comments provided by a Commerce liaison on January 15, 2015, Commerce concurred with the general findings as they applied to the Department of Commerce. Commerce also provided technical comments which we incorporated as appropriate.
 - In written comments, USPS did not agree or disagree with our findings. However, it provided several comments on the report. Specifically, USPS provided comments explaining its address products, and as a result, we clarified the language in our report that describes these products. Further, USPS requested that we expand the matter for congressional consideration so that Congress would also consider assessing the statutory requirements that impact USPS—Section 412 of Title 39. We considered including Title 39 in our matter for congressional consideration and agree that USPS’s suggestion has merit. As a result, we modified our matter for congressional consideration to include an assessment of Title 39. The agency’s written comments are provided in appendix VIII.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies to interested Congressional committees, the Director of the Office of Management and Budget, the Secretary of the Department of Agriculture, the Secretary of the Department of Commerce, the Secretary of the Department of Homeland Security, the Secretary of the Department of the Interior, the Postmaster General and Chief Executive Officer of the United States Postal Service,

the Administrator of the General Services Administration, and other interested parties. In addition, the report will be available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-9286 or pownerd@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix IX.



David A. Powner
Director
Information Technology Management Issues

Appendix I: Objectives, Scope, and Methodology

The objectives of our review were to (1) describe the geospatial data that selected federal agencies and states are using to support their missions, and identify how much is spent on geospatial data; (2) assess progress in establishing the National Spatial Data Infrastructure (NSDI); and (3) determine whether selected federal agencies and states invest in potentially duplicative geospatial data.

To address our objectives, we selected two key data types, seven federal agencies, and five states. We selected the two key data types—addresses and imagery resulting from aerial photography—based on (1) the need to appropriately scope of our review due to the large amounts of geospatial data, (2) the importance of these types of data to the work of the federal government, and (3) the potential for duplication within these data types, as noted in prior federal reports.

We selected agencies based on three factors. Specifically, we selected agencies whose missions were closely tied to the selected data types (addresses and aerial photography). In further selecting from among these agencies, we sought a mix of agencies who participate in the geospatial clearinghouse¹ and those who do not. In addition, we sought to include departments that were not the subject of our prior geospatial report.² The federal agencies we selected because of their reliance on address data are the Department of Commerce's (Commerce) Census Bureau (Census), the Department of Homeland Security's (DHS) Federal Emergency Management Agency (FEMA), and the United States Postal Service (USPS). The federal agencies we selected because of their reliance on aerial photography are the U.S. Department of Agriculture's (USDA) Farm Service Agency (FSA), Commerce's National Oceanic and Atmospheric Administration (NOAA), and the Department of the Interior's (Interior) Bureau of Land Management (BLM) and U.S. Geological Survey (USGS). As of November 2013, when we determined the scope of this engagement, four of these agencies (Census, FEMA, NOAA, and USGS)

¹The geospatial clearinghouse is one feature of the National Spatial Data Infrastructure. It is intended to be a centralized geospatial metadata repository that contains geospatial metadata records from federal agencies, state and local governments, and academic and private sector organizations that can be searched to determine whether needed geospatial data exist and can be shared. The clearinghouse is currently part of the Federal Geographic Data Committee's Geospatial Platform.

²GAO, *Geospatial Information: OMB and Agencies Need to Make Coordination a Priority to Reduce Duplication*, GAO-13-94 (Washington, D.C.: Nov. 26, 2012).

participated in the clearinghouse and the other three did not.³ Further, Interior and Commerce were included in our prior review, while USDA, DHS, and USPS were not.

We selected the states in our review based on whether they were reported to have both state imagery and address data programs, and whether the state hosted federal imagery programs (so that we could determine whether duplication existed between federal government and states). In addition, we sought states that would provide regional diversity within the United States. The selected states are Maryland, Montana, Ohio, South Carolina, and Washington.

To describe the geospatial data that the selected federal agencies and states are using to support their missions, we reviewed documentation regarding federal and state use of geospatial data, including Congressional Research Service reports, the National States Geographic Information Council's (NSGIC) data inventory, the Federal Geographic Data Committee's (FGDC) list of National Geospatial Data Asset (NGDA) datasets, FGDC's Geospatial Platform and its recent annual reports, and attended a geospatial data users conference. In order to assess the reliability of the FGDC list of datasets, we traced the datasets back to the Geospatial Platform, reviewed FGDC and Office of Management and Budget (OMB) guidance on registering datasets on the platform, and asked agency officials to verify their datasets. In order to assess the reliability of the NSGIC inventory, we reviewed selected states' datasets, traced the datasets back to the Geospatial Platform, and interviewed NSGIC officials. We also interviewed the selected agencies' and states' officials to determine which types of geospatial data they were using and how they were using them. We determined that these data were sufficient for our purposes.

To identify how much is spent on geospatial data, we analyzed agency-reported data on IT investments and acquisitions from the IT Dashboard and USASpending.gov. As part of that analysis, we isolated the costs of geospatial data by filtering results by the geospatial categorization (where available). We also requested cost estimates on geospatial data from state and agency officials. To assess the reliability of the cost data, we searched the IT Dashboard and USASpending.gov website for

³As of December 2014, only BLM did not participate in the Geospatial Platform.

investments that were not categorized as geospatial by using targeted key word searches and comparing those results to those that were categorized as geospatial. We also reviewed the results of previous GAO reports on the IT Dashboard and USASpending.gov that had identified deficiencies in the accuracy and reliability of the reported data.⁴

To assess the reliability of agency and state cost estimates, we reviewed supporting documentation, where available, and interviewed state and agency officials on the sources of their estimates and their data controls. We also had the agencies verify the results. We determined that the cost data from the two websites and from the agencies, while incomplete, were sufficient for our purpose of demonstrating the lack of comprehensive data on the cost of geospatial data.

To assess progress in establishing the NSDI, we focused on activities being undertaken government-wide by the FGDC and on activities undertaken within the departments selected for this review. We reviewed FGDC and federal department and agency documentation, such as policies, procedures, strategic plans, implementation plans, and program information. We assessed this information against responsibilities identified in Executive Order 12906,⁵ OMB Circular A-16,⁶ and OMB M-11-03;⁷ identified any discrepancies and discussed them with relevant

⁴GAO, *Data Transparency: Oversight Needed to Address Underreporting and Inconsistencies on Federal Award Website*, [GAO-14-476](#) (Washington, D.C.: June 30, 2014); *Information Technology: Reform Initiatives Can Help Improve Efficiency and Effectiveness*, [GAO-14-671T](#) (Washington, D.C.: June 10, 2014); *IT Dashboard: Agencies Are Managing Investment Risk, but Related Ratings Need to Be More Accurate and Available*, [GAO-14-64](#) (Washington, D.C.: Dec. 12, 2013); *Information Technology Dashboard: Opportunities Exist to Improve Transparency and Oversight of Investment Risk at Select Agencies*, [GAO-13-98](#) (Washington, D.C.: Oct. 16, 2012); *IT Dashboard: Accuracy Has Improved, and Additional Efforts are Under Way to Better Inform Decision Making*, [GAO-12-210](#) (Washington, D.C.: Nov. 7, 2011); *Information Technology: OMB Has Made Improvements to Its Dashboard, but Further Work Is Needed by Agencies and OMB to Ensure Data Accuracy*, [GAO-11-262](#) (Washington, D.C.: Mar. 15, 2011); and *Information Technology: OMB's Dashboard Has Increased Transparency and Oversight, but Improvements Needed*, [GAO-10-701](#) (Washington, D.C.: July 16, 2010).

⁵Executive Order No. 12906, *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*, 59 Fed. Reg. 17,671 (Apr. 11, 1994).

⁶OMB, Circular No. A-16, *Coordination of Geographic Information and Related Spatial Data Activities* (Aug. 19, 2002).

⁷OMB, *Issuance of OMB Circular A-16 Supplemental Guidance*, M-11-03 (Nov. 10, 2010).

agency officials. We also followed up on activities being taken by federal departments and agencies that had open recommendations from our prior review,⁸ which included the Department of Transportation and the Bureau of Transportation Statistics, in addition to Commerce, NOAA, Interior, and USGS.

In order to determine the progress being made in establishing a clearinghouse, we evaluated the effectiveness of the Geospatial Platform's search function by extracting 1,054 aerial photography and 10,272 address metadata records from the Geospatial Platform. We then randomly selected a generalizable sample of 178 aerial photography and 192 address metadata records. To assess the reliability of the records, we reviewed documentation on the Geospatial Platform's architecture, traced the records back to the platform, and interviewed Geospatial Platform officials. We determined that the data were sufficient for our purpose of assessing the functionality of the Geospatial Platform. To determine if each selected record appeared in search results, we searched for these datasets on the Geospatial Platform using the exact names of the datasets as they appeared in the catalog.

To determine the extent to which federal agencies have made their metadata available on the Geospatial Platform, we conducted searches of the platform, filtered by agencies and reviewed FGDC documentation on NGDA datasets. We asked agencies to confirm the datasets to verify that the results were accurate. We discussed our findings regarding the search function of the Geospatial Platform with the General Services Administration, which is responsible for the platform catalog's operations. We also conducted a search of the Marketplace tab on the Geospatial Platform to determine how many agencies were posting information about efforts to collect or purchase new geospatial data.

To assess the progress of FGDC's and federal departments' and agencies' efforts to collaborate with states, we took the following actions. Our results are not generalizable to all states.

- We analyzed position papers, memos, cost estimates, and other documentation on geospatial data developed by states and state representatives.

⁸ GAO-13-94.

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- We interviewed state geospatial officials from Maryland, Montana, Ohio, South Carolina, and Washington.
 - We interviewed personnel from organizational bodies representing states' interests, including NSGIC, the Association of American Geographers, the Cartography and Geographic Information Society, the Coalition of Geospatial Organizations, the Management Association for Private Photogrammetric Surveyors, and the Urban and Regional Information Systems Association.
 - We attended the 2014 NSGIC Midyear Meeting in February 2014, which brought together geospatial data experts representing a large number of state governments and included sessions on challenges and solutions in coordinating geospatial data between state governments and the federal government.

To determine whether selected federal agencies and states invest in potentially duplicative geospatial data, we extracted 1,054 aerial photography and 10,272 address metadata records from the Geospatial Platform. In order to identify duplicative datasets, we compared each metadata record to the others to identify those records with the same location, and then further analyzed those records using other attributes of aerial photography and address datasets, including date, data format, and resolution. We also compared our selected states' address and aerial photography metadata records on NSGIC's inventory⁹ to those from the Geospatial Platform in order to identify those with overlapping locations. We then further analyzed those records using other attributes of aerial photography and address datasets to determine if they were duplicative.

Given that several of our selected states and agencies do not or cannot have key datasets on either the Geospatial Platform or NSGIC's inventory and the difficulties with locating the datasets on the Geospatial Platform, we broadened our search to include the data collection efforts. We also performed literature searches on our key data types to identify current and potential aerial photography and address data coordination and collection efforts at the federal and state levels. We reviewed agency documentation, and reports and whitepapers from sources such as the National Geospatial Advisory Committee, Census, NSGIC, and Interior on aerial photography and address collection. We compared these

⁹ <http://gisinventory.net>.

coordination and collection efforts to each other and to Circular A-16 to identify any duplication or overlap of effort. In addition, we asked selected agency and state officials to identify their key address and aerial photography datasets, and compared those to each other using various attributes to determine the existence of duplication. We reviewed a range of documentation on the key datasets, including standards and specifications. In addition, we interviewed agency and state officials to determine the extent of duplication and the challenges in avoiding duplication in geospatial data.

We conducted this performance audit from January 2014 to February 2015 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Description of National Geospatial Data Asset Data Themes

The table below provides a description of the National Geospatial Data Asset data themes.

Table 9: Definitions of 16 National Geospatial Data Asset Data Themes

Category of data	Definition
Biota	Pertain to, or describe, the dynamic processes, interactions, distributions, and relationships between and among organisms and their environments.
Cadastre	Past, current, and future rights and interests in real property, including the spatial information necessary to describe geographic extents. Rights and interests are benefits or enjoyment in real property that can be conveyed, transferred, or otherwise allocated to another for economic remuneration. Rights and interests are recorded in land record documents. The spatial information necessary to describe geographic extents includes surveys and legal description frameworks such as the Public Land Survey System, as well as parcel-by-parcel surveys and descriptions. Does not include federal government or military facilities.
Climate and Weather	Meteorological conditions, including temperature, precipitation, and wind, that characteristically prevail in a particular region over a long period of time. Weather is the state of the atmosphere at a given time and place, with respect to variables such as temperature, moisture, wind velocity, and barometric pressure.
Cultural Resources	Features and characteristics of a collection of places of significance in history, architecture, engineering, or society. Includes National Monuments and Icons.
Elevation	The measured vertical position of the earth's surface and other landscape or bathymetric features relative to a reference datum typically related to sea level. These points normally describe bare earth positions but may also describe the top surface of buildings and other objects, vegetation structure, or submerged objects. Elevation data can be stored as a three-dimensional array or as a continuous surface such as a raster, triangulated irregular network, or contours. Elevation data may also be represented in other derivative forms such as slope, aspect, ridge and drainage lines, and shaded relief.
Geodetic Control	Survey control points or other related datasets which are accurately tied to the National Spatial Reference System (the official, common federal system for establishing coordinates for geospatial data that are consistent nationwide). Geodetic control examples include passive geodetic control marks, active geodetic observing systems, data from Global Navigation Satellite Systems (e.g., the Global Positioning System), gravity measurements, and models of the earth's gravity field (geoid).
Geology	Geographically referenced data pertaining to the origin, history, composition, structure, features, and processes of the solid earth, both onshore and offshore. Includes geologic, geophysical, and geochemical maps, stratigraphy, paleontology, geochronology, mineral and energy resources, and natural hazards such as earthquakes, volcanic eruptions, coastal erosion, and landslides. Does not include soils.
Governmental Units and Administrative and Statistical Boundaries	Boundaries that delineate geographic areas for uses such as governance and the general provision of services (e.g., states, American Indian reservations, counties, cities, and towns), administration and/or for a specific purpose (e.g., congressional districts, school districts, fire districts, and Alaska Native Regional Corporations), and/or provision of statistical data (census tracts, census blocks, and metropolitan and micropolitan statistical areas). Boundaries for these various types of geographic areas are either defined through a documented legal description or through criteria and guidelines. Other boundaries may include international limits, those of federal land ownership, the extent of administrative regions for various federal agencies, as well as the jurisdictional offshore limits of U.S. sovereignty. Boundaries associated solely with natural resources and/or cultural entities are excluded from this theme and are included in the appropriate subject themes.

Appendix II: Description of National Geospatial Data Asset Data Themes

Category of data	Definition
Imagery	Georeferenced images of the earth's surface, which have been collected via aerial photography or satellite data. Orthoimagery is prepared through a geometric correction process known as orthorectification to remove image displacements due to relief and sensor characteristics, allowing their use as base maps for digital mapping and analyses in a geographic information system. Specific imagery datasets created through image interpretation and classification, such as a land cover image, can be found under themes specific to the subject matter. Includes imagery such as Landsat, the National Agriculture Imagery Program, and Digital Orthophoto Quarter Quadrangles.
Land Use-Land Cover	"Land Use-Land Cover" refers collectively to natural and man-made surface features that cover the land (Land Cover) and to the primary ways in which land cover is used by humans (Land Use). Examples of Land Cover may be grass, asphalt, trees, bare ground, and water. Examples of Land Use include urban, agricultural, ranges, and forest areas.
Real Property	The spatial representation (location) of real property entities, typically consisting of one or more of the following: unimproved land, a building, a structure, site improvements and the underlying land. Complex real property entities (that is "facilities") are used for a broad spectrum of functions or missions. This theme focuses on spatial representation of real property assets only and does not seek to describe special purpose functions of real property such as those found in the Cultural Resources, Transportation, or Utilities themes.
Soils	Depicts the geography and attributes of the many kinds of soils found in the landscape at both large and small map scales. A living dynamic resource providing a natural medium for plant growth and habitat for living organisms, soil recycles nutrients and wastes, stores carbon, and purifies water supplies. Soil has distinct layers (called "horizons") that, in contrast to underlying geologic material, are altered by the interactions of climate, landscape features, and living organisms over time.
Transportation	Means and aids for conveying persons and/or goods. The transportation system includes both physical and nonphysical components related to all modes of travel that allow the movement of goods and people between locations.
Utilities	Means, aids, and usage of facilities for producing, conveying, distributing, processing or disposing of public and private commodities including power, energy, communications, natural gas, and water. Includes sub themes Energy, Drinking Water and Water Treatment, and Communications.
Water-Inland	Interior hydrologic features and characteristics, including classification, measurements, location, and extent. Includes aquifers, watersheds, wetlands, navigation, water quality, water quantity, and groundwater information.
Water-Oceans and Coasts	Features and characteristics of salt water bodies (e.g., tides, tidal waves, coastal information, and reefs) and features and characteristics that represent the intersection of the land with the water surface (i.e. shorelines), the lines from which the territorial sea and other maritime zones are measured (i.e., baseline maritime) and lands covered by water at any stage of the tide (e.g., Outer Continental Shelf), as distinguished from tidelands, which are attached to the mainland or an island and cover and uncover with the tide.

Source: Federal Geographic Data Committee. | GAO-15-193

Appendix III: Status of Prior GAO Recommendations

The following table provides the implementation status of recommendations from our previous report on geospatial data.¹

Table 10: Implementation Status for Recommendations from GAO-13-94

Recommendation	FGDC	Commerce	Interior	Transportation	OMB
1. The Secretary of the Interior, as the Federal Geographic Data Committee (FGDC) Chair, should direct the FGDC Steering Committee to establish a time frame for completing a plan to facilitate the implementation of the Office of Management and Budget's (OMB) portfolio management guidance, and develop and implement the plan within the established time frame. The plan, at a minimum, should include goals and performance measures, and the FGDC should report annually to OMB on the progress made on efforts to improve coordination and reduce duplication among themes.	●	n/a ^a	n/a ^a	n/a ^a	n/a ^a
2. The Secretary of the Interior, as the FGDC Chair, should direct the FGDC Steering Committee to develop and implement guidance for identifying planned geospatial investments using the Geospatial Platform, and establish a time frame for doing so.	●	n/a ^a	n/a ^a	n/a ^a	n/a ^a
3. The Secretary of the Interior, as the FGDC Chair, should direct the FGDC Steering Committee to establish a time frame for creating and updating a strategic plan to improve coordination and reduce duplication, and create and implement the plan within the established time frame. The plan, at a minimum, should include (1) a vision statement for the National Spatial Data Infrastructure (NSDI); (2) outcome-oriented goals and objectives that address all aspects of the NSDI; (3) a description of how the goals and objectives are to be achieved, including a description of the resources needed to achieve the goals and objectives and how the FGDC is to work with other agencies to achieve them; (4) performance measures for achieving the stated goals; and (5) external factors that could affect the achievement of the goals and objectives.	●	n/a ^a	n/a ^a	n/a ^a	n/a ^a
4. The Secretaries of Commerce and Transportation should designate a senior agency official who has department-wide responsibility, accountability, and authority for geospatial information issues.	n/a ^a	●	n/a ^b	●	n/a ^a

¹GAO, *Geospatial Information: OMB and Agencies Need to Make Coordination a Priority to Reduce Duplication*, GAO-13-94 (Washington, D.C.: Nov. 26, 2012).

**Appendix III: Status of Prior GAO
Recommendations**

Recommendation	FGDC	Commerce	Interior	Transportation	OMB
5. The Secretaries of the departments in our review should direct their senior agency officials for geospatial information to prepare, maintain, publish, and implement strategies for each of their departments for advancing geographic information and related geospatial data activities appropriate to their missions.	n/a ^a	○	●	○	n/a ^a
6. The Secretaries of the departments in our review should direct their senior agency officials for geospatial information to develop policies that require each of the departments to make its geospatial metadata available on the NSDI clearinghouse.	n/a ^a	●	●	●	n/a ^a
7. The Secretaries of the departments in our review should direct their senior agency officials for geospatial information to develop and implement internal procedures to ensure that the departments access the NSDI clearinghouse before they expend funds to collect or produce new geospatial data to determine (1) whether the information has already been collected by others and (2) whether cooperative efforts to obtain the data are possible.	n/a ^a	●	●	●	n/a ^a
8. The Secretaries of the Interior and Transportation should direct their theme points of contact to prepare goals relating to all datasets within the relevant theme that support the NSDI, and as needed, collect and analyze user needs and include those needs in the theme-related goals.	n/a ^a	n/a ^b	●	○	n/a ^a
9. The Secretaries of the Interior and Transportation should direct their theme points of contact to develop and implement plans for the nationwide population of the relevant themes that addresses all datasets within the theme and that includes (1) the development of partnership programs with states, tribes, academia, the private sector, other federal agencies, and localities that meet the needs of users; (2) human and financial resource needs; (3) standards, metadata, and the clearinghouse needs; and (4) a timetable for the development for the theme.	n/a ^a	n/a ^b	○	○	n/a ^a
10. The Secretaries of the departments in our review should direct their theme points of contact to create and implement a plan to develop and implement relevant theme standards.	n/a ^a	●	○	○	n/a ^a
11. The Director of the Office of Management and Budget should develop a mechanism, or modify existing mechanisms, to identify and report annually on all geospatial-related investments, including dollars invested and the nature of the investment.	n/a ^a	n/a ^a	n/a ^a	n/a ^a	○

Key:

● = Fully implemented—the agency provided evidence that the recommendation was implemented.

○ = Partially implemented—the agency provided evidence that showed progress, but the recommendation was not yet fully implemented.

○ = Not implemented—the agency did not provide evidence that the recommendation was implemented.

Source: GAO analysis of agency documentation. | GAO-15-193

**Appendix III: Status of Prior GAO
Recommendations**

Notes:

^aThe recommendation was not applicable to that agency because it was outside of the agency's responsibilities.

^bThe recommendation was not applicable because the department or agency was reported by GAO to have been in compliance with the criteria associated with the recommendation at the time of the review.

Acronyms and abbreviations: BLM = Bureau of Land Management; FSA = Farm Service Agency; NOAA = National Oceanic and Atmospheric Administration; USGS = U.S. Geological Survey.

Appendix IV: Use of Geospatial Data Themes by Selected Federal Agencies and States

Selected federal agencies and states use a variety of geospatial data to support their missions. Table 11 identifies the data themes used by selected federal agencies. Table 12 identifies the data themes used by selected states. For both tables, we have included addresses¹ as a theme even though OMB and FGDC do not recognize it as a theme. We did this because one of our areas of focus in this report is address data.

Table 11: Federal Uses of Geospatial Data Themes

Theme	BLM	Census	FEMA	FSA	NOAA	USGS	USPS
Addresses ^a	Yes	Yes	Yes				Yes
Biota	Yes				Yes	Yes	
Cadastre	Yes	Yes	Yes	Yes			Yes
Climate and Weather	Yes		Yes		Yes	Yes	
Cultural Resources	Yes	Yes				Yes	
Elevation	Yes		Yes	Yes	Yes	Yes	
Geodetic Control	Yes		Yes		Yes	Yes	
Geology	Yes		Yes			Yes	
Governmental Units, and Administrative and Statistical Boundaries	Yes	Yes	Yes	Yes	Yes	Yes	
Imagery ^b	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Land Use-Land Cover	Yes	Yes	Yes		Yes	Yes	
Real Property	Yes		Yes				
Soils	Yes			Yes		Yes	
Transportation	Yes	Yes	Yes		Yes	Yes	Yes
Utilities	Yes		Yes				
Water—Inland	Yes	Yes	Yes		Yes	Yes	
Water—Oceans and Coasts	Yes	Yes	Yes		Yes		

Source: GAO analysis of agency data. | GAO-15-193

Notes:

^aOMB and FGDC do not recognize addresses as a data theme.

^bThe Imagery data theme includes aerial photography.

¹Address data include the house number and street or road name or other designation assigned to a housing unit, special place, business establishment, or other structure for purposes of mail delivery and/or to enable emergency services, delivery people, and visitors to find the structure. Sometimes addresses include a geocoded reference such as latitude and longitude coordinates.

**Appendix IV: Use of Geospatial Data Themes
by Selected Federal Agencies and States**

Acronyms and abbreviations: BLM = Bureau of Land Management; FSA = Farm Service Agency; NOAA = National Oceanic and Atmospheric Administration; USGS = U.S. Geological Survey.

Table 12: State Uses of Geospatial Data Themes

Theme	Maryland	Montana	Ohio	South Carolina	Washington
Addresses ^a	Yes	Yes	Yes	Yes	Yes
Biota	Yes	Yes	Yes	Yes	Yes
Cadastre	Yes	Yes	Yes	Yes	Yes
Climate and Weather	Yes	Yes	Yes	Yes	Yes
Cultural Resources	Yes	Yes	Yes	Yes	Yes
Elevation	Yes	Yes	Yes	Yes	Yes
Geodetic Control	Yes	Yes	Yes	Yes	Yes
Geology	Yes	Yes	Yes	Yes	Yes
Governmental Units, and Administrative and Statistical Boundaries	Yes	Yes	Yes	Yes	Yes
Imagery ^b	Yes	Yes	Yes	Yes	Yes
Land use-Land Cover	Yes	Yes	Yes	Yes	Yes
Real Property	Yes	Yes	Yes	Yes	Yes
Soils	Yes	Yes	Yes	Yes	Yes
Transportation	Yes	Yes	Yes	Yes	Yes
Utilities	Yes	Yes	Yes	Yes	Yes
Water—Inland	Yes	Yes	Yes	Yes	Yes
Water—Oceans and Coasts	Yes		Yes	Yes	Yes

Source: GAO analysis of state data. | GAO-15-193

Notes:

^aOMB and FGDC do not recognize addresses as a data theme.

^bThe Imagery data theme includes aerial photography.

Acronyms and abbreviations: BLM = Bureau of Land Management; FSA = Farm Service Agency; NOAA = National Oceanic and Atmospheric Administration; USGS = U.S. Geological Survey.

Appendix V: Comments from the Department of the Interior



United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, DC 20240

Mr. David A. Powner
Director, Information Technology
Management Issues
U.S. Government Accountability Office
441 G Street, N.W.
Washington, DC 20548

JAN 23 2015

Dear Mr. Powner:

Thank you for the opportunity to review and comment on the Government Accountability Office (GAO) draft report entitled, *GEOSPATIAL DATA: Progress Needed on Identifying Expenditures, Building and Utilizing a Data Infrastructure, and Reducing Duplicative Efforts* (GAO-15-193). We appreciate GAO's efforts to review federal and state coordination of geospatial data and to evaluate costs.

Enclosed are the general and specific comments in response to the draft report. The Department of the Interior (DOI) generally agrees with the recommendations directed to the Department and the Federal Geographic Data Committee (FGDC) and appreciates your consideration in incorporating the specific comments in the enclosure.

If you have any questions about this response, please contact Jerry Johnston, Geospatial Information Officer at (202) 208-4262 or jerry_johnston@ios.doi.gov

Sincerely,
A handwritten signature in black ink, appearing to read "Kristen J. Sarri".

Kristen J. Sarri
Principal Deputy Assistant Secretary
Policy, Management and Budget

Enclosure

**Department of the Interior
Comments on Draft GAO Report Entitled
GEOSPATIAL DATA: Progress Needed on Identifying Expenditures, Building and
Utilizing a Data Infrastructure, and Reducing Duplicative Efforts**

We are in general agreement with the report's "Recommendations for Executive Action" directed to the Department of the Interior and FGDC, pg. 74. We are providing general observations on the GAO engagement objectives, some key points for consideration that are missing from the report, and specific comments and highlighted corrections that should be addressed to be factual and ensure the report's accuracy.

KEY MISSING POINTS

We request that GAO consider addressing the following key points:

1. **Levels of Investments** – Both this draft report, and the November 2012 GAO Report (GAO-13-94), state that there are no accurate methods in place for OMB or Federal agencies to report their investments in geospatial data. The FGDC agencies are working to develop a more consistent method for defining and reporting agency investments in geospatial assets, an action resulting in part from the 2012 report recommendations. Until a consistent method and set of investment assets for reporting are defined and consistently applied to get actual investment data, it is conjectural to make general statements of over or under reporting. We suggest **qualifying such statements**, as in the 1st paragraph of the Highlights section, to make it clear that if (for example) investments in satellites should be included, an additional XX number of dollars could be counted.
2. **Federal to non-Federal Partnerships** – Throughout the report there are references to successes and challenges with Federal to non-Federal partnerships. It is important to note that while Federal to non-Federal partnerships can be very successful, are often sought by both Federal and non-Federal programs (the report cites some), and can result in cost avoidance and cost savings, the majority of these partnership programs rely on the Federal agencies to provide the primary funding for staff, minimal thresholds of data investment, or broad distributed funding to non-Federal partners. Examples in this report include, Broadband Mapping (millions to States), Imagery for the Nation (large Federal investment in imagery, with the ability of States to add additional investment), even the conceptual National Address Database managed by a Federal agency would require a substantial Federal investment.

2

In the funding environment of the last several years, these types of investments have been predominantly cut (the exception is Broadband), and agencies have had to reduce, eliminate, or not fund programs where money is made available to non-Federal partners. Several examples have been provided to GAO, including the FGDC NSDI Cooperative Agreements Program, the USGS Geospatial Liaison Network, and 133 Major Urban Areas Program, and the Imagery for the Nation initiative. While monetary resources are not the only component of a successful partnership, it has proven to be a corner stone for successful, sustainable, and satisfying partnerships. **This key point – the importance of Federal funding to support non-Federal partnerships – is not addressed in GAO's report.** The Federal agencies are challenged to implement partnership programs that yield satisfactory results for non-Federal partners, if there is not a large Federal funding source that can be leveraged or used by the non-Federal partners, especially if it is for a data initiative.

Appendix VI: Comments from the Department of Agriculture


United States Department of Agriculture

JAN 23 2015

Departmental Management
Office of the Chief Information Officer
1400 Independence Avenue S.W.
Washington, DC 20250

Mr. David A. Powner
Director, Information Technology
Management Issues
U.S. Government Accountability Office
441 G St. N.W.
Washington, DC 20548

Dear Mr. Powner,

United States Department of Agriculture has reviewed the "draft" report titled, "*Geospatial Data: Progress Needed on Identifying Expenditures, Building and Utilizing a Data Infrastructure, and Reducing Duplicative Efforts (GAO-15-193)*". We have maintained the confidentiality of this report, and accept with no contest, Government Accountability Office's (GAO) findings, audit number 311299.

We intend to move forward with the two recommendations with regard to formalizing a Department-wide policy for publication of USDA agency geospatial data in the National Geospatial Platform Clearinghouse, and establishing internal procedures for review of Marketplace data prior to acquisition. To help ensure operations-oriented Department governance documents, USDA will include appropriate agency level geospatial data policy guidance and procedure best practices. Moreover, we acknowledge the value of reassessing deployment alternatives for "*Imagery for the Nation*", which we continue to endorse. We applaud GAO for recognizing and recommending the need of clear, specific guidance for government-wide sharing and reuse of geospatial data.

Ensuring the efficient and effective use of government information technology resources is one of my highest priorities. USDA accepts GAO's report as written.

Sincerely,


Dr. Gregory L. Parham
fca Assistant Secretary
for Administration

AN EQUAL OPPORTUNITY EMPLOYER

Appendix VII: Comments from the Department of Homeland Security

U.S. Department of Homeland Security
Washington, DC 20528



Homeland Security

January 23, 2015

David A. Powner
Director, Information Technology Management Issues
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Re: Draft Report GAO-15-193, "GEOSPATIAL DATA: Progress Needed on Identifying Expenditures, Building and Utilizing a Data Infrastructure, and Reducing Duplicative Efforts"

Dear Mr. Powner:

Thank you for the opportunity to review and comment on this draft report. The U.S. Department of Homeland Security (DHS) appreciates the U.S. Government Accountability Office's (GAO's) work in planning and conducting its review and issuing this report.

The Department is pleased to note GAO's acknowledgement of the Federal Emergency Management Agency's use of geospatial information in support of disaster response and recovery, and related efforts to reduce duplication through geospatial data partnerships with other federal, state, and local agencies. DHS is committed to providing the level of geospatial preparedness required to protect the nation's critical infrastructure, strategic assets, the economic base, and America's citizens.

The draft report contained two recommendations for DHS with which the Department concurs. Specifically, GAO recommended that the Secretary of Homeland Security direct the designated senior agency official for geospatial information to:

Recommendation 1: Establish a schedule for developing and implementing a policy that requires the department to make its geospatial metadata available on the Geospatial Platform.

Response: Concur. The Department's Geospatial Information Officer (GIO), working within the Office of the Chief Information Officer, will work with the Department's operating Components to update geospatial management policy to require publication of geospatial metadata to the Geospatial Platform. Estimated Completion Date (ECD): September 30, 2015.

**Appendix VII: Comments from the Department
of Homeland Security**

Recommendation 2: Develop and implement internal procedures to ensure that it accesses the Geospatial Platform Marketplace before it expends funds to collect or produce new geospatial data to determine (1) whether the information has already been collected by others and (2) whether cooperative efforts to obtain the data are possible.

Response: Concur. The Department's GIO will update existing geospatial management procedures to require use of the Geospatial Platform Marketplace to address the items specified in this recommendation. ECD: September 30, 2015.

Again, thank you for the opportunity to review and comment on this draft report. Technical comments were previously provided under separate cover. Please feel free to contact me if you have any questions. We look forward to working with you in the future.

Sincerely,



Jim H. Crumpacker, CIA, CFE
Director
Departmental GAO-OIG Liaison Office

Appendix VIII: Comments from the United States Postal Service



January 15, 2015

Mr. Phillip R. Herr
Managing Director, Physical Infrastructure
General Accountability Office
441 G Street NW
Washington, DC 20548-0001

Dear Mr. Herr:

The U.S. Postal Service respectfully submits the following comments to the draft report, *Geospatial Information: Progress Needed on Identifying Expenditures, Building and Utilizing a Data Infrastructure, and Reducing Duplicative Efforts* (GAO-15-193):

The reference on page 58 denoted by Footnote 61 is not completely accurate.

For example, a developer building a new neighborhood will seek addresses from the local government. Then, the local addressing officials provide updated address data to the USPS, which, in turn, provides a subset of these data to Census and sells them to private vendors.⁶¹ Vendors can then repackage the address data and sell or license them to other organizations, including government agencies.

⁶¹ A 2011 study for the Census Bureau showed that the majority of private vendors rely solely on USPS for their address data. See M. Dobson, Ph.D., D. Cowen, Ph.D., and S. Guptill, Ph.D. *Reporting the State and Anticipated Future Directions of Addresses and Addressing*, a report to the Geography Division, U.S. Bureau of the Census, Deliverable #2 – Syneren Technologies Contract – Task T005 (Jan. 5, 2011).

The USPS does not sell address data and is specifically restricted by Section 412 of Title 39 of the U.S. Code from doing so. The USPS provides the ZIP + 4® Product which contains a range-based representation of street addresses, as an example 100 – 198 Main Street, that vendors and others can use for address hygiene processes to standardize their address data to conform to USPS standards. The USPS also provides the DPV Product which allows a vendor or others to validate if a specific address falls within the ranged-based data, as example 124 Main Street, by returning an indicator – but not the actual address contents – as to whether the specific address exists or not in USPS data. The format of the DPV Product does not allow a vendor or anyone else to extract a listing from the DPV Product data as no text representation of address information is maintained in the DPV Product construct.

In addition to the recommendation on page 73 that Congress consider assessing the requirements under Section 9 of Title 13 of the U.S. Code that it also consider at the same time assessing the requirements impacting the USPS under Section 412 of Title 39.

Matter for Congressional Consideration

To increase coordination between various levels of government and reduce duplication of effort, resources, and cost associated with collecting and maintaining accurate address data, Congress should consider assessing the requirements under section 9 of Title 13 of the U.S. Code to determine if addresses, without any personally identifiable information, could be excluded from the privacy restrictions. Such a change, if deemed appropriate, could potentially save billions of dollars across federal, state, and local governments.

Appendix VIII: Comments from the United States Postal Service

The Postal Service would like to thank the GAO for the opportunity to comment on this draft report. If you or your staff wish to discuss our response further, please contact Sally Haring, Manager, Corporate Audit and Response Management, at 202-268-3753, to arrange a meeting.

Sincerely,



Robert Cintron
Vice President, Product Information

cc: Sally Haring, Manager, Corporate Audit and Response Management

Appendix IX: GAO Contact and Staff Acknowledgments

GAO Contact

David A. Powner, (202) 512-9286 or pownerd@gao.gov

Staff Acknowledgments

In addition to the contact name above, individuals making contributions to this report included Colleen Phillips (Assistant Director), Chris G. Businsky, Kathleen Lovett Epperson, Rebecca Eyler, John Mingus, Jamelyn Payan, Tina M. Torabi, and Jessica Waselkow.

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