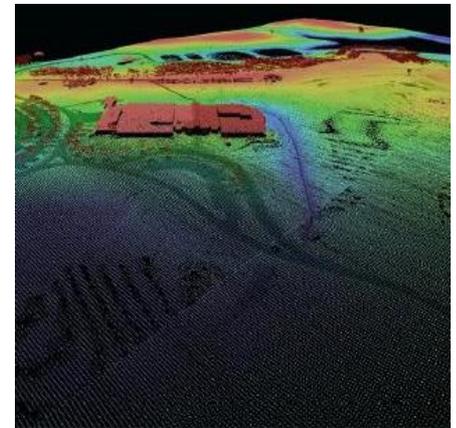
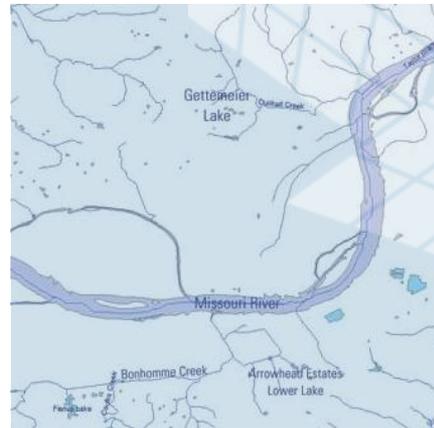
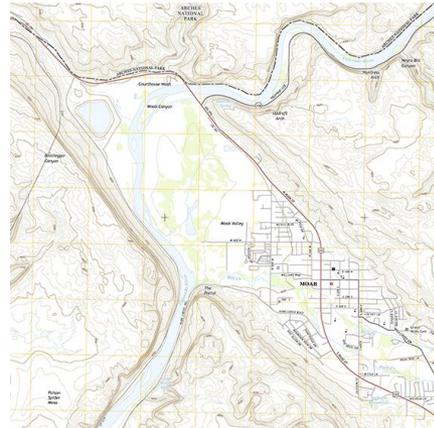


# 8 Steps to Developing a Successful National Lidar Program

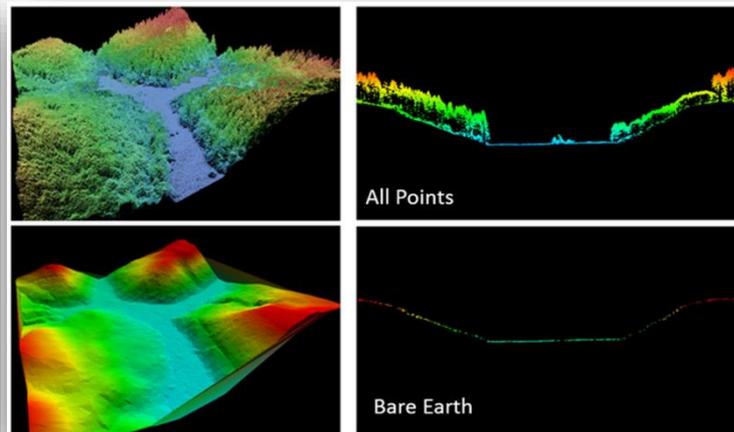
Based on the Experiences of the 3D Elevation Program



Michael Tischler, Ph.D  
Director, National Geospatial Program  
United States Geological Survey

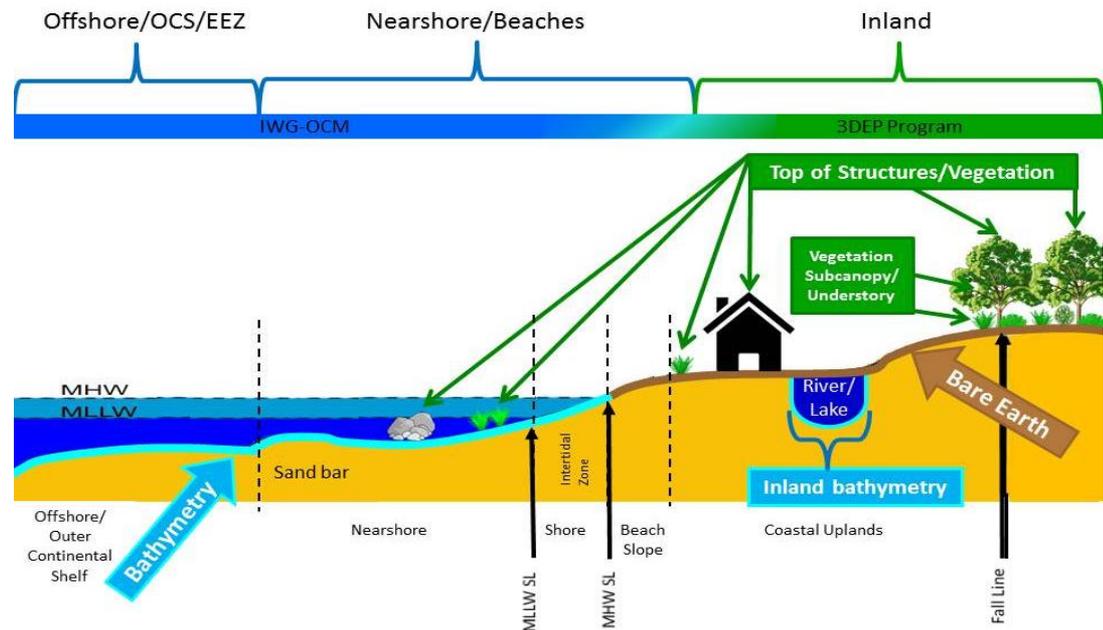
# 3D Elevation Program (3DEP)

- Apply lidar technology to map bare earth and 3D data of natural and constructed features
- Goal to complete acquisition of national lidar coverage with IfSAR in Alaska in 8 years
- Address the mission-critical requirements of 34 Federal agencies, 50 states, and other organizations documented in the National Enhanced Elevation Assessment
- ROI 5:1, conservative benefits of \$690 million/year with potential to generate \$13 billion/year
- Leverage the capability and capacity of private industry mapping firms
- Achieve a 25% cost efficiency gain by collecting data in larger projects
- Completely refresh national elevation data holdings with new products and services



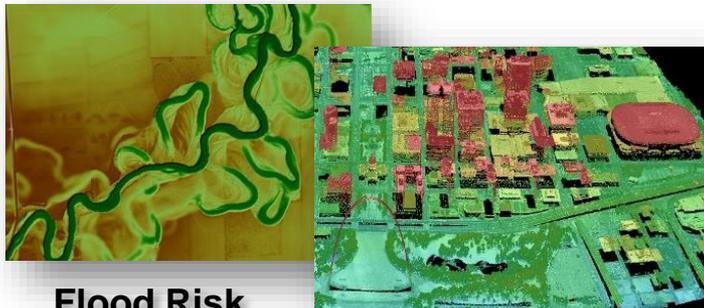
# 1. Document Requirements and Benefits

- ❑ Characterize the data needed by users
  - ❑ What features do users need?
  - ❑ At what accuracy?
  - ❑ How often do they need new data?
  - ❑ In what geographic areas?



# 1. Document Requirements and Benefits *continued*

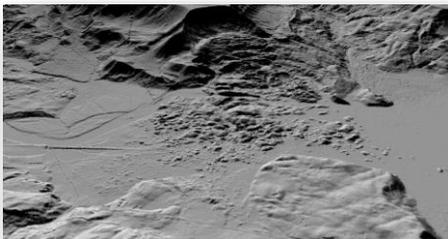
- ❑ Document the needs of the full range of potential users
- ❑ Document each business use and the expected benefits from the data



**Flood Risk Management**

**Infrastructure Management**

**Geologic Hazards**



The National Enhanced Elevation Assessment documented 602 mission-critical requirements from 34 Federal agencies, 50 states and a sampling of local governments, tribes, and other organizations

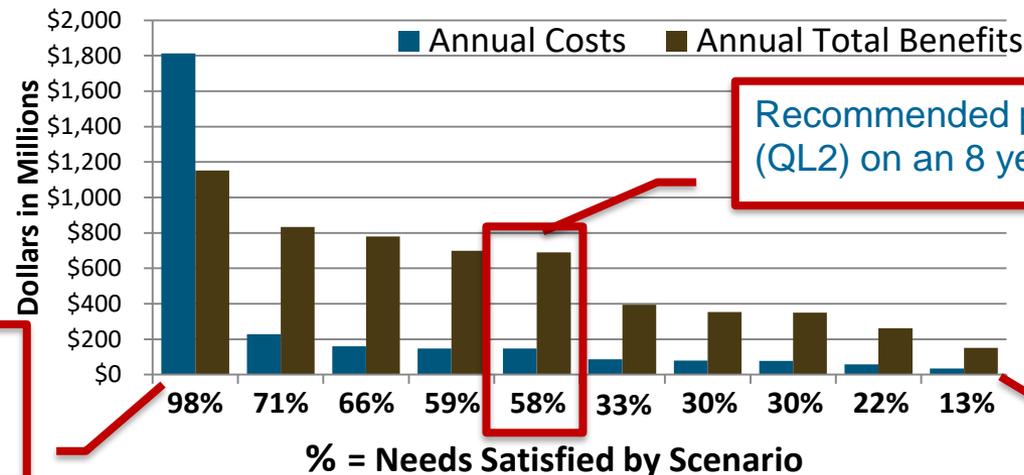
Rank	Business Use	Annual Benefits	
		Conservative	Potential
1	Flood Risk Management	\$295M	\$502M
2	Infrastructure and Construction Management	\$206M	\$942M
3	Natural Resources Conservation	\$159M	\$335M
4	Agriculture and Precision Farming	\$122M	\$2,011M
5	Water Supply and Quality	\$85M	\$156M
6	Wildfire Management, Planning and Response	\$76M	\$159M
7	Geologic Resource Assessment and Hazard Mitigation	\$52M	\$1,067M
8	Forest Resources Management	\$44M	\$62M
9	River and Stream Resource Management	\$38M	\$87M
10	Aviation Navigation and Safety	\$35M	\$56M
:			
20	Land Navigation and Safety	\$0.2M	\$7,125M
<b>Total for all Business Uses (1 – 27)</b>		<b>\$1.2B</b>	<b>\$13B</b>

## 2. Maximize Return on Investment

- ❑ Develop and compare a range of program scenarios to meet documented needs
- ❑ Balance benefits against costs
- ❑ Aim for a high – but not impossible – goal in terms of funding potential

Recommended Elevation Program:

- Average annual costs: \$146M
- Average annual benefits: \$690M
- Average annual net benefits: \$544M
- Benefit Cost Ratio - 4.7:1
- Total Benefits Satisfied: 58%



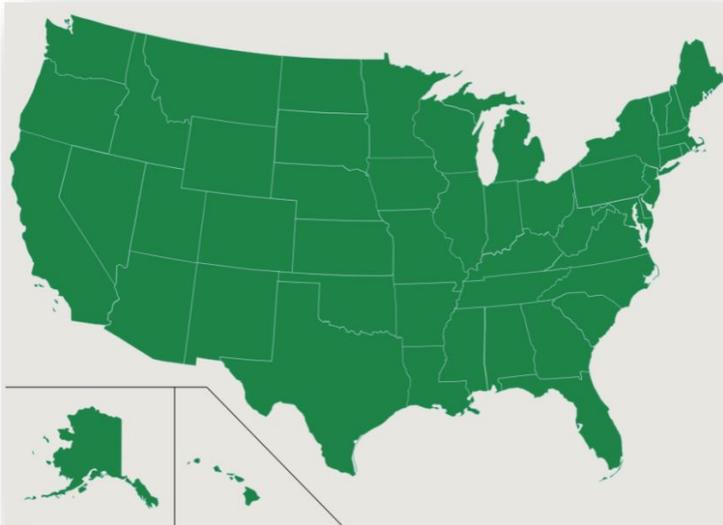
Highest quality level (QL1) on an annual cycle

Recommended program (QL2) on an 8 year cycle

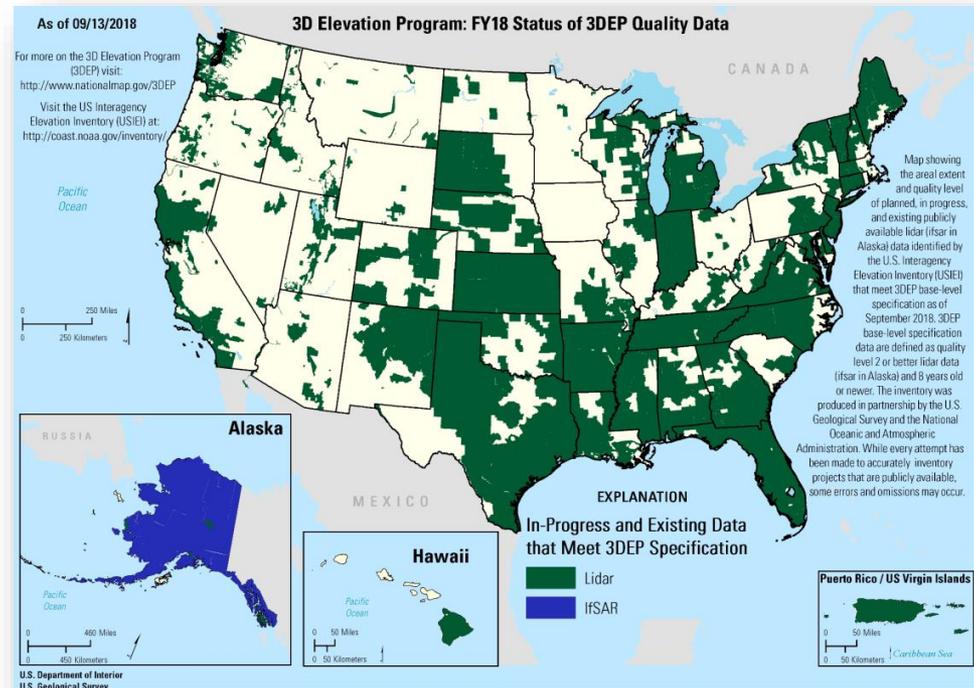
QL3 on a 25 year cycle (closest to pre-existing program)

# 3. Establish and Adhere to a Clear Program Goal

- ❑ Make the goal easily measurable
- ❑ Report against and repeat the goal at every opportunity



The 3DEP goal is to complete acquisition of Quality level 2 lidar data for Continental US and Quality level 5 IfSAR data for Alaska in 8 years, by 2023



The goal: complete coverage by 2023

3DEP current status 2018

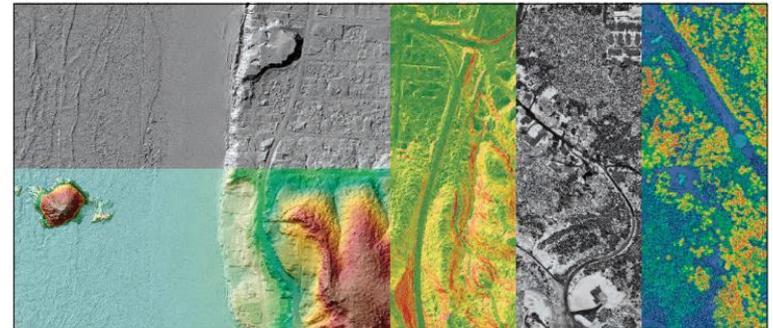
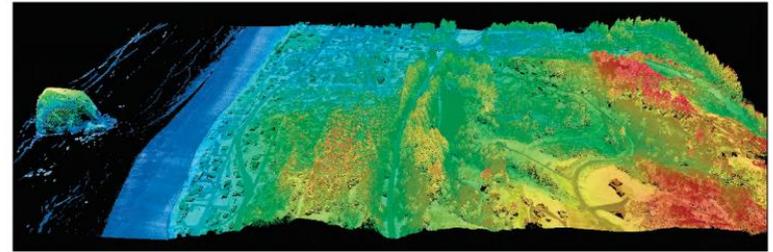
# 4. Vet and Publish a Program Plan

Solicit stakeholder input on a plan for implementation that includes:

- Schedule and milestones
- Leadership, outreach and growth
- Stakeholder roles
- Technical approach
- Products and services
- Research and technology
- Risks and mitigation



## The 3D Elevation Program Initiative—A Call for Action



Circular 1399

U.S. Department of the Interior  
U.S. Geological Survey

# 5. Establish the Operational Infrastructure

Develop capabilities that are scalable to growing investment

- Partnerships
- Contracting
- Quality Control
- Data processing and delivery



**Broad Agency Announcement** – Vehicle for soliciting partnerships

**Geospatial Products and Services Contracts (GPSC)** –



**A Great Team!**

## 6. Establish Governance

- Enlist a senior executive champion to provide high-level sponsorship and support
- Involve key partners in executive and operational coordination
- A strong operational group is critical to ongoing implementation

### 3DEP Executive Forum

- Led by USGS Associate Director for Core Science Systems
- Facilitates executive collaboration on strategies to fund and implement 3DEP for the benefit of all its stakeholders
- Provides direction to 3DEP Working Group

### 3DEP Working Group

- Operational direction
- Coordinates implementation of 3DEP

3DEP Member Agencies
Bureau of Land Management
Department of Homeland Security
Department of Transportation
Environmental Protection Agency
Federal Aviation Administration
Federal Communications Commission
Federal Emergency Management Agency
US Forest Service
US Fish and Wildlife Service
National Oceanic and Atmospheric Administration
National Park Service
Natural Resources Conservation Service
Office of Surface Mining Reclamation and Enforcement
US Department of Agriculture
US Army Corps of Engineers
US Geological Survey
American Association of State Geologists
National States Geographic Information Council

# 8. Provide outreach to critical stakeholders

- ❑ Provide ongoing program information to key stakeholders



- ❑ 3DEP state & industry factsheets
- ❑ Congressional briefings



## The 3D Elevation Program and America's Infrastructure

### Infrastructure Connects Us All

Infrastructure—the physical framework of transportation, energy, communications, water supply, and other systems—and construction management—the overall planning, coordination, and control of a project from beginning to end—are critical to the Nation's prosperity. The American Society of Civil Engineers (2013) warns that, despite the importance of the Nation's infrastructure, it is in far to poor condition and needs sizable and urgent investments to maintain and modernize it, and to ensure that it is sustainable and resilient.

Three-dimensional (3D) light detection and ranging (lidar) elevation data (fig. 1) provide valuable productivity, safety, and cost-saving benefits to infrastructure improvement projects and associated construction management (Dewberry, 2012). However, the acquisition of 3D elevation data primarily on a project-by-project basis can increase infrastructure project costs and risks, and

distract management attention from project goals (Chang and others, 2012).

By providing data to users, the 3D Elevation Program (3DEP) of the U.S. Geological Survey (USGS) (Sugarbaker and others, 2014; see sidebar) reduces users' costs and risks and allows them to concentrate on their mission objectives. 3DEP includes (1) data acquisition partnerships that leverage funding, (2) contracts with experienced private mapping firms, (3) technical expertise, lidar data standards, and specifications, and (4) most important, public access to high-quality 3D elevation data.

The size and breadth of improvements for the Nation's infrastructure and construction management needs call for an efficient, systematic approach to acquiring foundational 3D elevation data. The 3DEP approach to national data coverage will yield large cost savings over individual project-by-project acquisitions and will ensure that data are accessible for other critical applications.

### 3D Elevation Program (3DEP)

The 3D Elevation Program (3DEP) is a national program managed by the USGS to acquire high-resolution elevation data (Sugarbaker and others, 2014). It produces point clouds, bare-earth digital elevation models (DEMs), and other products.

3DEP is backed by a comprehensive assessment of lidar, interferometric synthetic aperture radar (IFSAR), and related elevation data requirements (Dewberry, 2012) and is now an operational program. The goal of this high-priority cooperative program is to have complete coverage of quality level 2 lidar data for the conterminous United States, Hawaii, and the U.S. territories, and IFSAR data for Alaska, by the end of 2023.

### Reduced Acquisition Costs and Risks

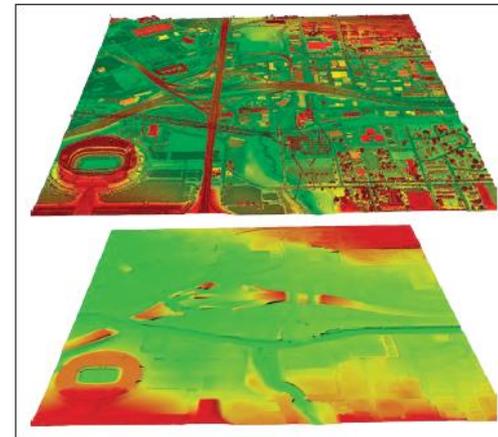
A funded national program will provide:

- *Economy of scale* by acquiring data for larger areas and reducing acquisition costs by 25 percent.
- *Predictable, efficient, and flexible Federal investments* that reduce costs for and allow better planning by Federal, State, Tribal, U.S. territorial, and local government partners, including the option of "buying up" to acquire higher quality data.
- *Consistent, high-quality, national coverage* that (1) provides data ready for applications that span project, jurisdictional, and watershed boundaries, (2) meets multiple needs, and (3) increases benefits to citizens.
- *Simpler data acquisition* that provides contracts, published data-acquisition specifications, and specialized quality assurance and information technology expertise. Partners reduce their risks and can concentrate on their business activities.

3DEP can conservatively provide new benefits of \$690 million per year and has the potential to generate \$13 billion per year in new benefits through applications that span the economy (Dewberry, 2012). The shared lidar, IFSAR, and derived elevation datasets would foster cooperation and improve decisionmaking among all levels of government and other stakeholders.

### High-Quality Data

For the conterminous United States, Hawaii, and the U.S. territories, the USGS and its partners acquire quality level 2 or better lidar data. Quality level 2 data have a minimum nominal pulse spacing of 0.7 meters



**Figure 1.** 3D elevation data for an area of Denver, Colorado, in the form of a lidar point cloud (top) and a derived bare-earth digital elevation model (bottom). These data along with other products provide valuable productivity, safety, and cost-saving benefits to infrastructure improvement projects. Image provided by Jason Stoker (USGS).

# RESULTS

- ❑ 3DEP Endorsed by 30 groups
- ❑ 3DEP Coalition

AGI american geosciences institute  
connecting earth, science, and people

ASCE AMERICAN SOCIETY OF CIVIL ENGINEERS

CENTER FOR DATA INNOVATION

asprs THE MAPPING & GEOSPATIAL INFORMATION SOCIETY

MAPPS

APWA AMERICAN PUBLIC WORKS ASSOCIATION  
Your Comprehensive Public Works Resource

AASG Association of American State Geologists

ICC INTERNATIONAL CODE COUNCIL®

NAA NATIONAL APARTMENT ASSOCIATION

Crop Science SOCIETY OF AMERIC

American Society of Agronomy

ASFP

IAEM International Association of Emergency Managers

ICWP Interstate Council on Water Policy

REALTOR

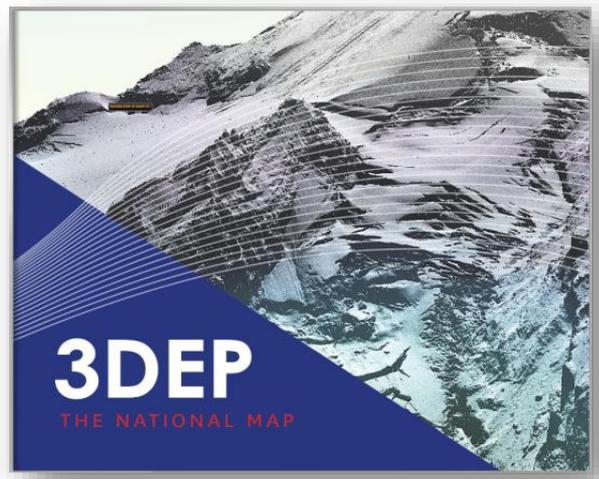
NEMA™ NATIONAL EMERGENCY MANAGEMENT ASSOCIATION

NFA NATIONAL FLOOD ASSOCIATION  
EDUCATE. INFORM. COLLABORATE.

NMHC

LICA Land Improvement Contractors of America

NATE Elevate Wireless



NATIONAL GEOSPATIAL ADVISORY COMMITTEE

Nathaniel F. Wienecke  
Senior Vice President for Federal Government Relations  
Property Casualty Insurers Association of America

PCI  
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Executive Director  
ociety of Professional Surveyors

NSPS

Molly Schar  
Executive Director  
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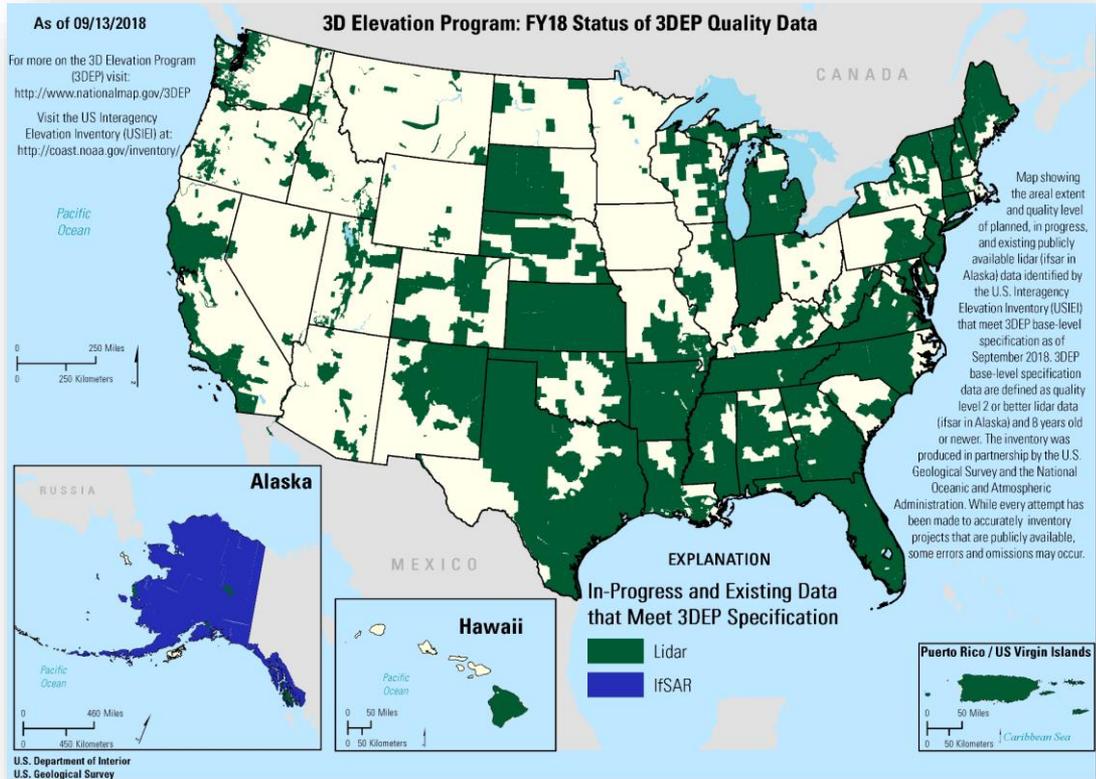
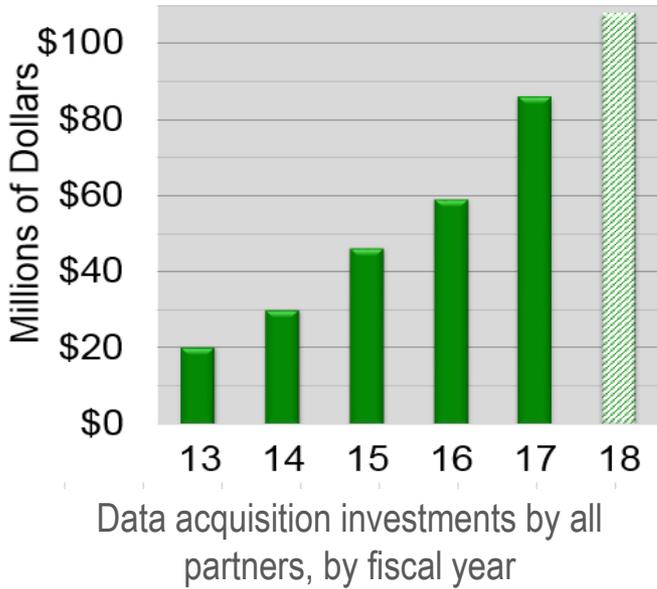
Ellen Bergfeld, PhD  
CEO  
Soil Science Society of America

Soil Science Society of America

USGS  
science for a changing world

The National Map  
Your Source for Topographic Information

# RESULTS



Data are available or in progress for 50% of the Nation

+

# Thank you!

