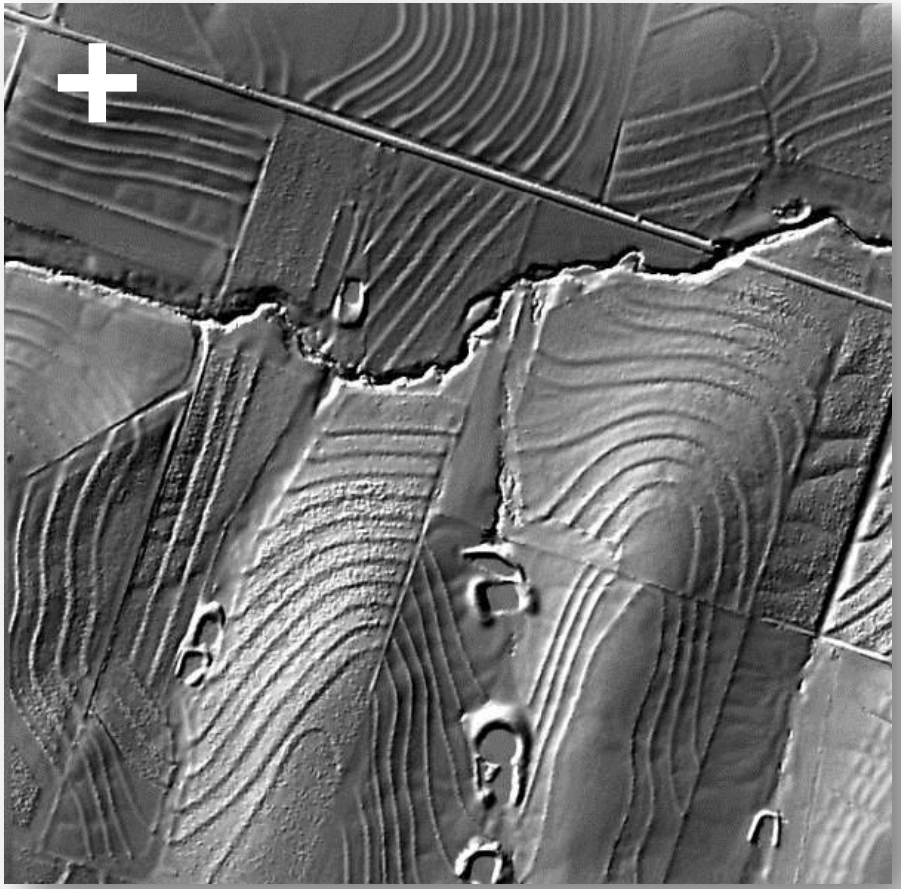


3D Elevation Program

GeoCue Webinar

April 29, 2014

USGS

The National Map

3D Elevation Program (3DEP)

Topics

- What is the 3DEP? – Overview and background:
  - National Elevation Dataset
  - National Enhanced Elevation Assessment
- 3DEP products and services
- Data acquisition and inventory
- Budget outlook
- Resources

What is the 3D Elevation Program?

A call for action to…

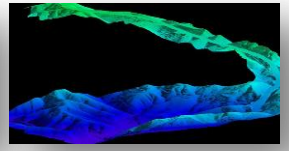
- Accelerate the acquisition of high quality light detection and ranging (lidar) data in the conterminous U.S. (CONUS), Hawaii, and the U.S. Territories; and interferometric synthetic aperture radar (ifsar) data in Alaska
- Completely refresh the National Elevation Dataset (NED) with new lidar and ifsar elevation data products and services
- Leverage collaboration among federal, states, local and tribal partners to systematically complete national 3D elevation data coverage in eight years
- Raise governance to the executive level and build on the structure already in place at the operational level under the National Digital Elevation Program (NDEP)
- Increase the overall investment in 3D elevation to $146 million annually to return more than $690 million annually in new benefits

Natural Resource Conservation

Infrastructure Management

Flood Risk Mitigation

Precision Farming


Land Navigation and Safety

Geologic Resources and Hazards Mitigation

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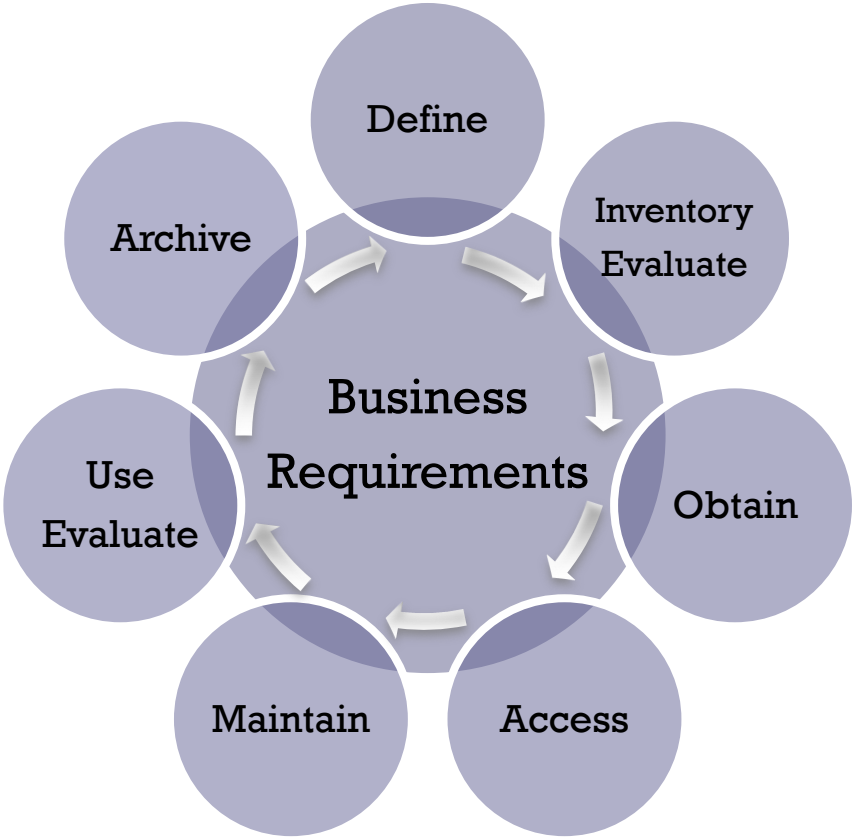
USGS Lead Agency for Terrestrial Elevation

Office of Management and Budget Circular A-16

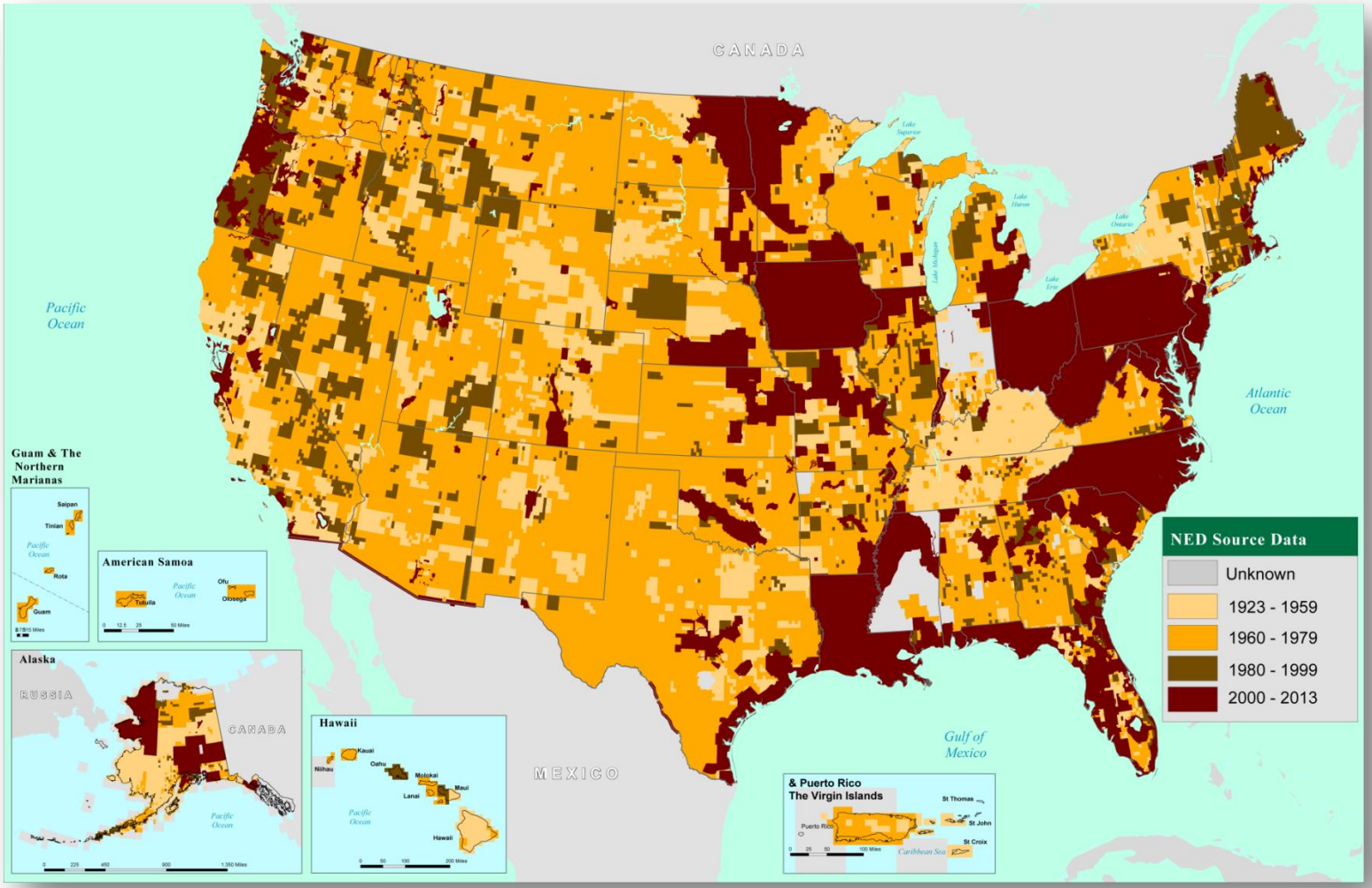
- For more than 15 years, the USGS has managed the National Elevation Dataset (NED) and coordinated acquisition through the National Digital Elevation Program (NDEP) on a project-by-project basis
- We are at a point in the data lifecycle of defining the next generation national elevation program



Geospatial Data Lifecycle

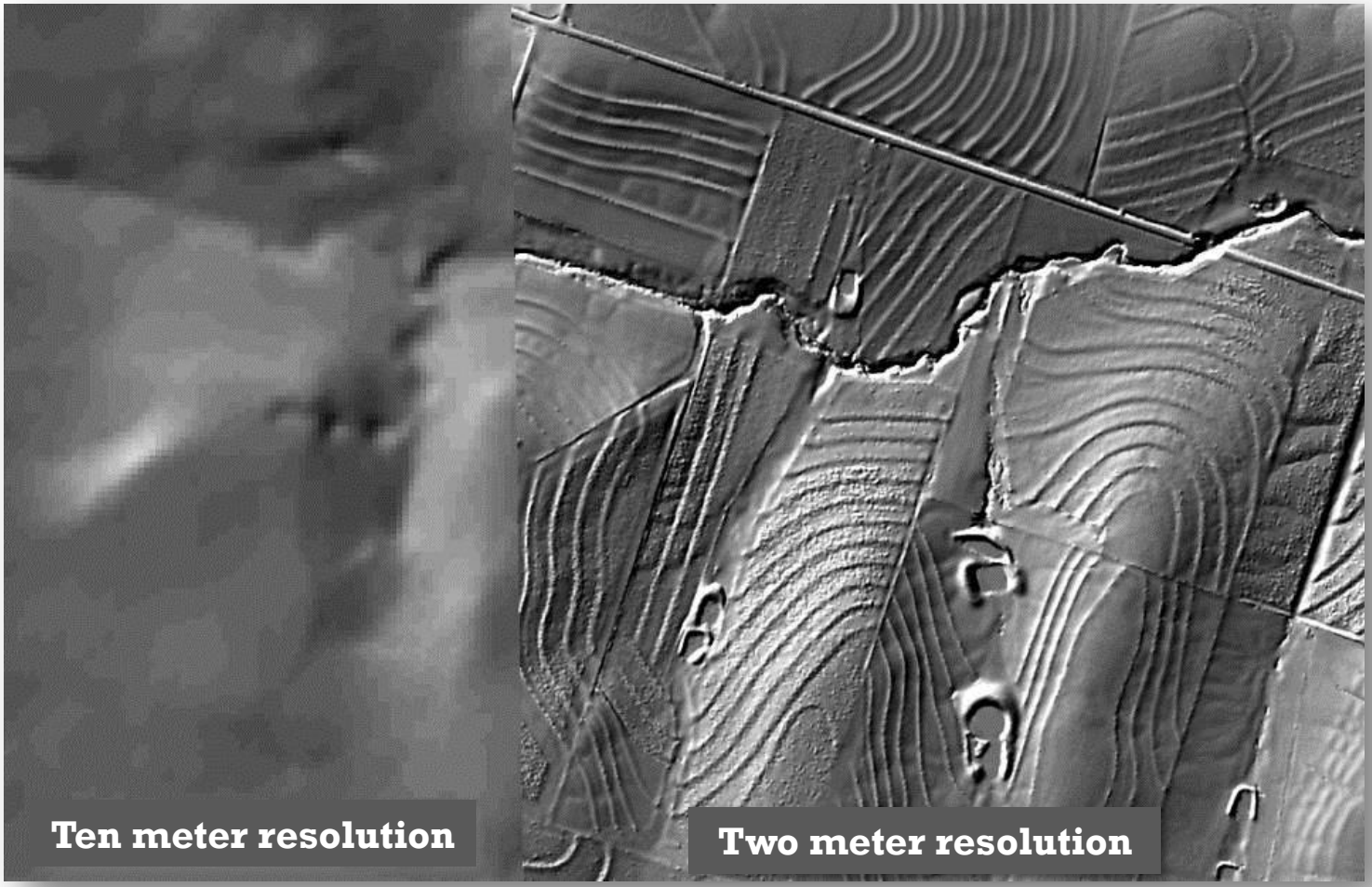
The National Elevation Dataset

Status



Current as of December, 2013

Lidar Improves Data Quality



Courtesy of NRCS

National Enhanced Elevation Assessment

At a Glance

- Sponsored by the National Digital Elevation Program (NDEP) and funded by USGS, NGA,FEMA, NRCS and NOAA to:
  - Document national requirements for lidar and ifsar data
  - Estimate the benefits and costs of meeting these requirements
  - Evaluate multiple national program scenarios considering data quality, update frequency, and geographic coverage to optimize benefits
- 602 mission-critical activities that require enhanced elevation data were identified by:
  - 34 Federal agencies and 50 states
  - A sampling of local governments, tribes, private and not-for profit organizations
- **A national program has the potential to generate $1.2 billion to $13 billion in new benefits each year**

Example: USGS Geologic Resource Assessment and Hazards Mitigation

Mission critical use: Identify areas, level of activity and risk associated with earth hazards to reduce losses and increase public safety

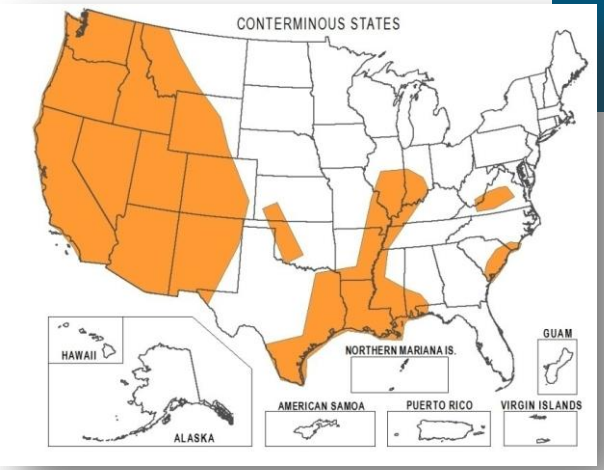
Data requirement: Predominantly quality level 1

Update frequencies: 4-10 years

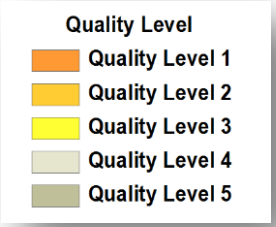
Expected combined benefits: $31.25M/year

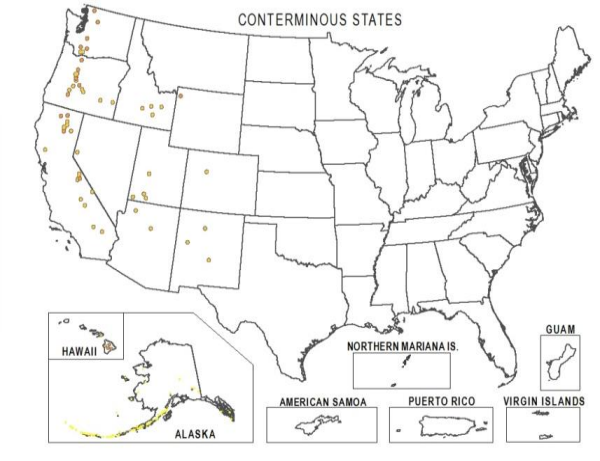
Example applications:

- Identify faults/landslides under thick vegetation
- Enhance infrastructure engineering design
- Estimate size, speed and effects of landslides
- Create loss mitigation strategies
- Provide maps and models to emergency planners

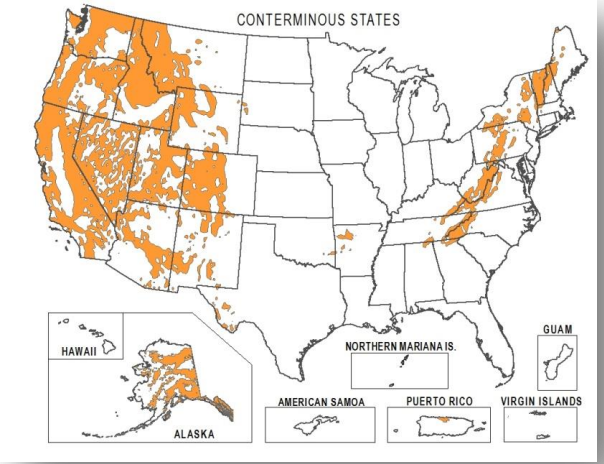


Seismic





Volcanos



Landslides

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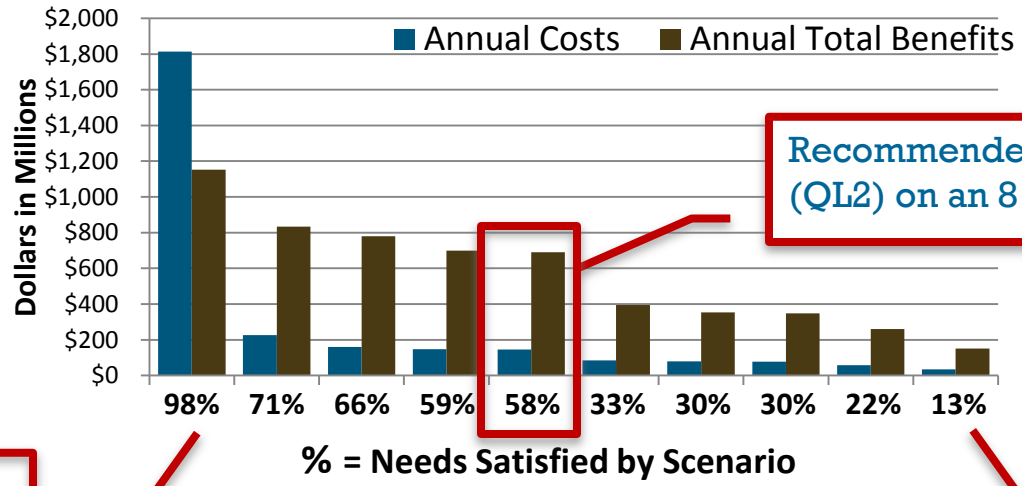
Benefits for Top Business Uses

Rank		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
	Total for all Business Uses (1 – 27)	**$1.2B**	**$13B**

National Program Recommendation

Multiple Scenarios Considered

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



Recommended program (QL2) on an 8 year cycle

Highest quality level (QL1) on an annual cycle

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

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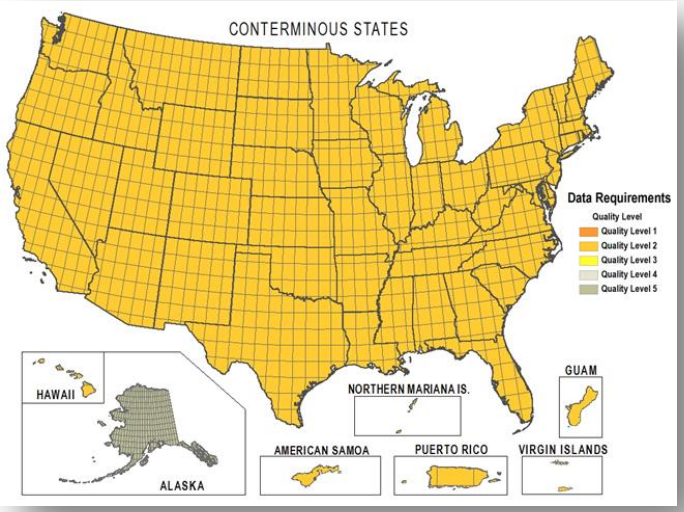
3D Elevation Program (3DEP)

Recommended Uniform Higher Quality



- QL2 lidar data for the conterminous United States, Hawaii, and the territories on an 8-year cycle (compared to QL3 commonly acquired to date)
- QL5 ifsar data for Alaska
- Lidar point cloud data and other products to be publically accessible
- Goal to be operational in early 2015

Quality Level	Source	Vertical Accuracy RMSEz	Nominal Pulse Spacing (NPS)	Nominal Pulse Density (NPD)	DEM Post Spacing
QL1	Lidar	10 cm	0.35 m	8 points/sq. meter	1 meter
QL2	Lidar	10 cm	0.7 m	2 points/sq. meter	1 meter
QL3	Lidar	20 cm	2.0 m	0.7 points/sq. meter	3 meters
QL4	Imagery	139 cm	5 m	0.04 points/sq. meter	5 meters
QL5	Ifsar	185 cm	5 m	0.04 points/sq. meter	5 meters

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3DEP Products and Services

Initial Products

Product	Planned Coverage on Release Date	Source(s)	Planned Product	Planned Availability and Product Release Dates
1 meter DEM	Partial Coverage U.S. and some Territories	Lidar	Tiles (TBD) by download	The National Map in January 2015 (new data) and TBD for pre-2014 data
5 meter DEM	Partial Alaska	Ifsar	Tiles (TBD) by download	Earth Explorer in October 2013, from The National Map in April 2014
1/9 arc-second DEM - legacy	Partial Coverage U.S. and some Territories	Lidar, Ifsar, Photogrammety	15 min block by download	The National Map now
1/3 arc-second DEM	CONUS, HI, some Territories, partial Alaska	Lidar, Ifsar, Photogrammety	1x1 degree block by download	The National Map now
1 arc-second DEM	CONUS, HI, AK and U.S. Territories	Lidar, Ifsar, Photogrammety	1x1 degree block by download	The National Map now
2 arc-second DEM	Alaska	Lidar and Ifsar, Photogrammetry	1x1 degree block by download	The National Map now
Elevation Point Query	CONUS, HI, some Territories, AK	1/3 arc-second, 1 arc-second in AK	Application service	The National Map now
Hillshade	CONUS, HI, some Territories, AK	1/3 arc-second, 1 arc-second in AK	Viewing service	The National Map now
5 to 120 foot Contours	CONUS, HI, some Territories, AK	1/3 arc-second, 1 arc-second in AK	1 degree block by download and viewing service	The National Map now

3DEP Products and Services

Source Data

Source Data	Planned Coverage on Release Date	Source(s)	Planned Product	Planned Availability and Service Release Dates
Lidar Full Point Cloud - Unclassified	Partial Coverage – U.S.	Lidar – QL1, QL2, QL3	Project areas by special request	EROS by special request now (pre-2014 data) NGTOC now (data acquired 2014 and later)
Lidar Full Point Cloud - Classified	Partial Coverage – U.S.	Lidar - QL1, QL2, QL3	Project tiles by download	Earth Explorer now. The National Map in October 2014
Ifsar Digital Surface Model	Partial Coverage – Alaska	Ifsar – QL5	Project tiles by download	Earth Explorer now, The National Map in January 2015
Orthorectified Ifsar Intensity Image	Partial Coverage – Alaska	Ifsar – QL5	Project tiles by download	Earth Explorer now, The National Map in January 2015
Source resolution DEM	Partial Coverage U.S. and some Territories	Lidar, Ifsar	Project tiles by download	The National Map now (new data) and TBD for pre-2014 data

Specifications for 3DEP data

- **Version 1.1** to be completed in FY14 to define specifications for QL 2 and QL 1 data

- **Version 2.0** will be released in FY15 and will be the "total" 3DEP specification
  - Horizontal Accuracy assessments (ASPRS Accuracy Standards)
  - Revisions to reflect technological developments such as Geiger, Flash lidar
  - Addition of vector features to support lidar data and derivatives
  - Expanded hydrography feature collection
  - Low Confidence polygons
  - Incorporation of a GIS Data Dictionary

- **Vertical Reference System** - North American Vertical Datum of 1988 (NAVD88); the geoid model used to convert between ellipsoid heights and orthometric heights shall be the latest hybrid geoid model of NGS, supporting the latest realization of NAD 83 (currently GEOID12A)

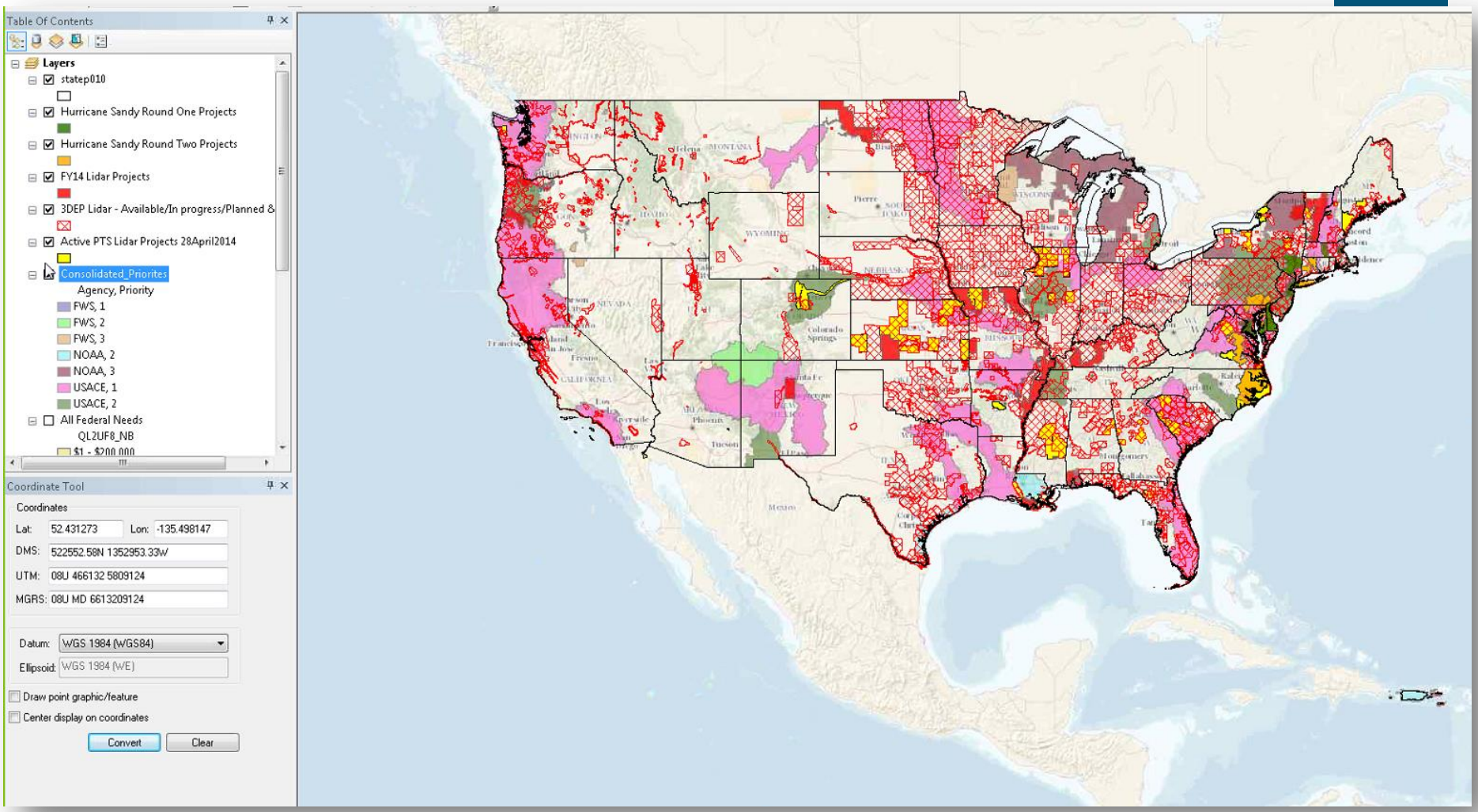
3DEP Data Acquisition

Broad Agency Announcement (BAA)

Implementation of a process where known priorities are broadcast to develop partnership opportunities for acquisition:

- Solicit agency priorities from NDEP agencies and state plans; obtain out-year plans and priorities where possible
- Analyze submitted priorities compared to baseline coverage in U.S. Interagency Elevation Inventory (USIEI) and prioritization criteria
- Develop joint priorities for new acquisition; review and approve plan among NDEP/3DEP agencies
- Issue BAA; review and accept proposals; implement data acquisition strategy; combination of USGS data acquisition, as well as partner acquisition
- Acquire and distribute data

3DEP Data Acquisition



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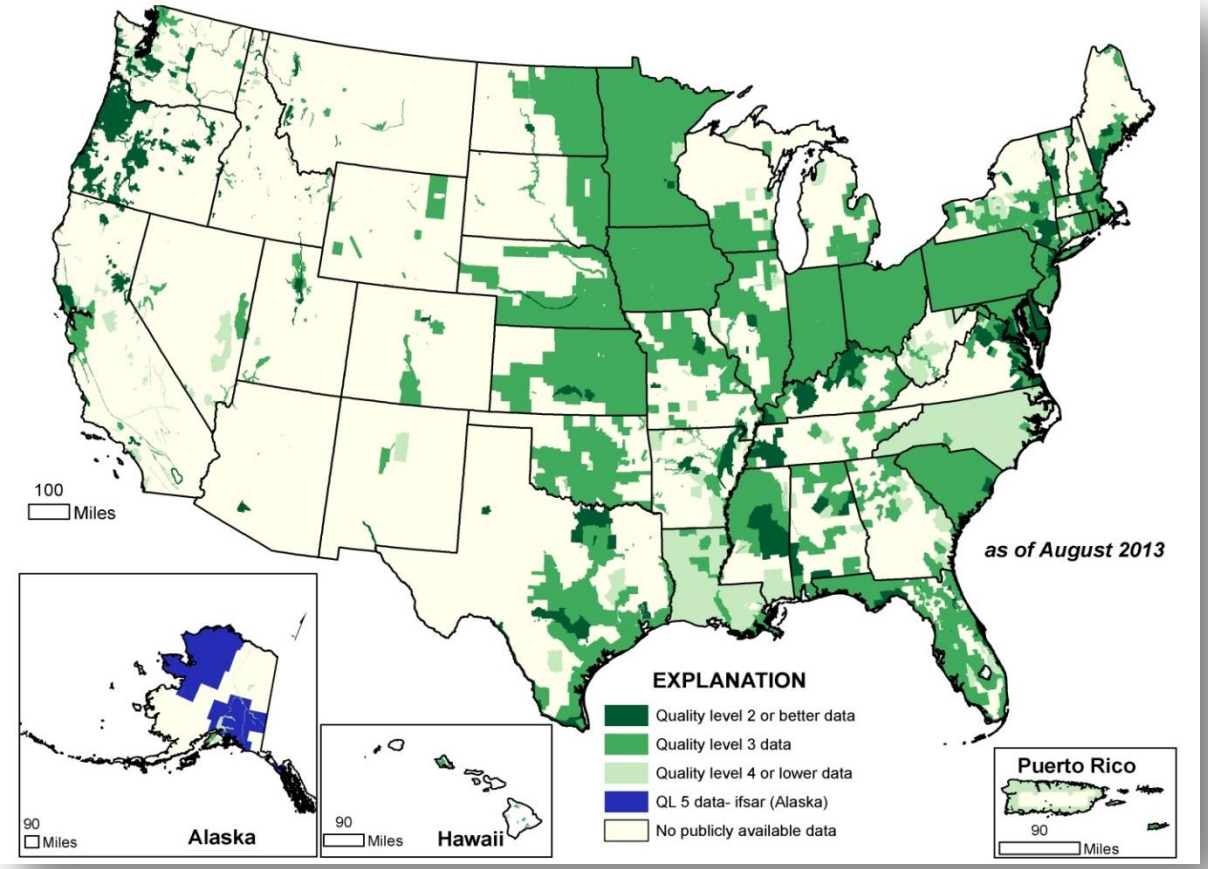
U.S. Interagency Elevation Inventory

2013 Status Map of Publically Available Lidar and Ifsar



Lidar: 38% of the lower 49 states has coverage

- ***Only 4 percent meets the 3DEP goal of QL2 or better***

Ifsar: 43.5% of Alaska has coverage

- ***More than half the State needs ifsar data to complete the 3DEP goal for coverage***

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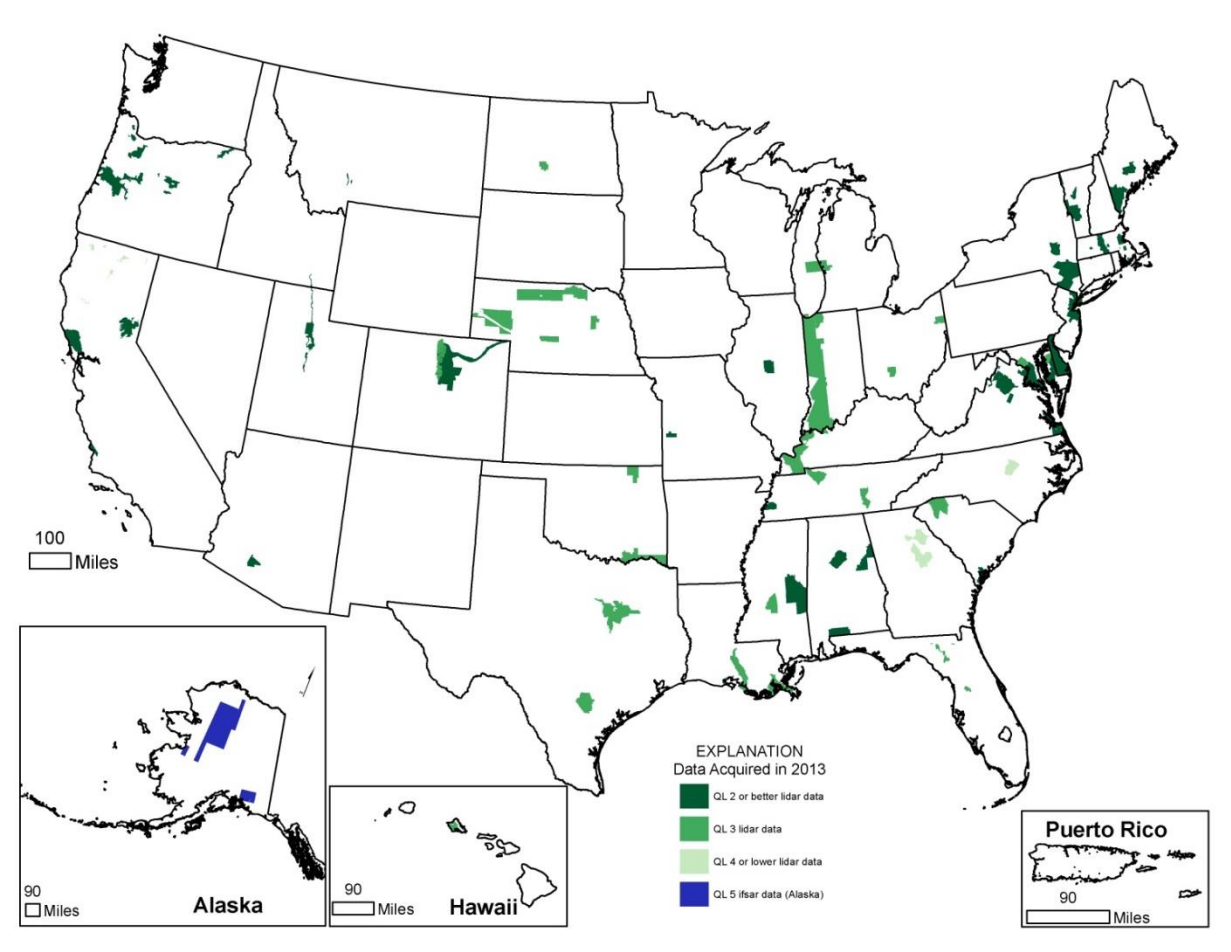
To view the inventory go to:
www.csc.noaa.gov/inventory

U.S. Interagency Elevation Inventory

Data acquired in 2013

- **6 % of the nation** was acquired (includes all QLs)
- **Need to acquire 12%** each year at QL2 or higher (QL5 in AK) to meet 3DEP national coverage goals



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3DEP Budget Outlook

USGS Component

- **FY14 President's Budget** – USGS 3DEP increase of $9M plus $1M for Alaska ifsar; Omnibus resulted in $760K increase for Alaska and $1M in USGS Coastal Marine Geology for Coastal National Elevation Dataset
- **Endorsements** – 3DEP was endorsed or received letters of budget support from:
  - American Association of State Geologists (AASG)
  - American Association of Photogrammetry and Remote Sensing (ASPRS)
  - Association of State Floodplain Managers
  - Coalition of Geospatial Organizations (COGO)
  - Management Association of Private Photogrammetric Surveyors (MAPPS)
  - National Geospatial Advisory Council (NGAC)
  - National Society of Professional Surveyors (NSPS)
  - National States Geographic Information Council (NSGIC)
- **FY15 President's Budget** – USGS 3DEP $5M, Alaska Mapping $236K, Ecosystems: Columbia River $350K and Puget Sound $450K
- **National Academy of Public Administration (NAPA) report** - The November, 2013 report entitled **"FEMA Flood Mapping: Enhancing Coordination to Maximize Performance"** included the following recommendation:

  "The Office of Management and Budget should use the 3DEP implementation plan for nationwide elevation data collection to guide the development of the President's annual budget request."

3DEP Executive Forum

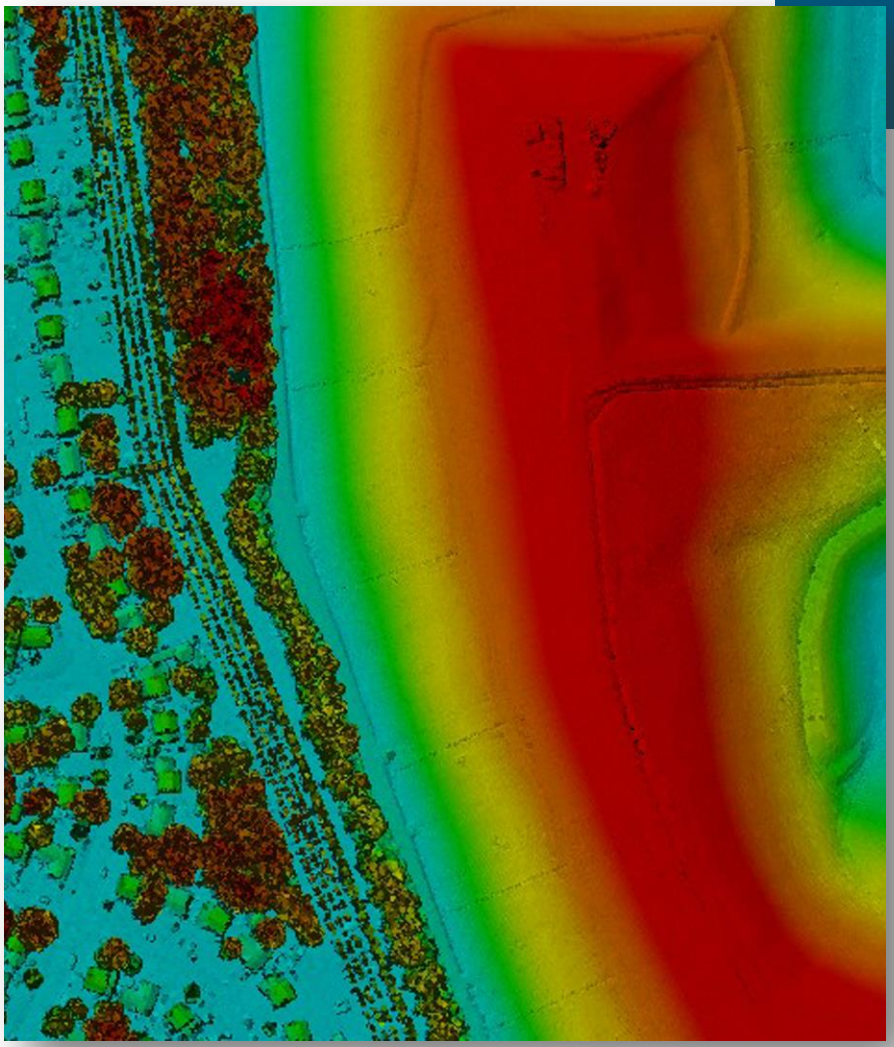
Governance and Executive Outreach

- **Purpose** - to facilitate executive dialog and collaboration on strategies to implement and sustain 3DEP for the benefit of all its stakeholders
- **Leadership** – Chair is Kevin Gallagher, USGS Associate Director for Core Science Systems
- **Objectives**
  - Monitor status, plans and coordination actions for 3DEP implementation
  - Strategize on significant developments regarding elevation or related geospatial activities, for example, legislation, GAO studies, supplemental funding, etc.
  - Share insights and develop strategies to communicate with industry and other stakeholder groups that could play a role in 3DEP funding
  - Provide executive direction and input to NDEP as the operational coordinating body

3DEP Implementation

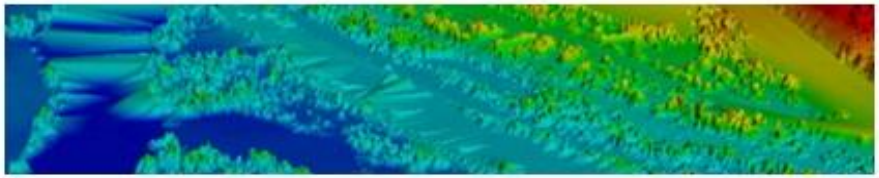
Moving ahead

- 3DEP initiative plan – final DRAFT in peer review
- System modernization milestones April, October and January 2015
- 3DEP Annual Report – in final stages of publication
- 3DEP official rollout – January, 2015



3DEP Resources

- NEEA Report
- 3DEP webpage
- USGS Fact Sheets
  - NEEA at a glance
  - 3D Elevation Program
  - State 3DEP Summaries
- Resources in work
  - Journal articles
  - 3DEP Plan
  - 3DEP Annual Report



Final Report of the National Enhanced Elevation Assessment

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http://nationalmap.gov/3DEP

Discussion