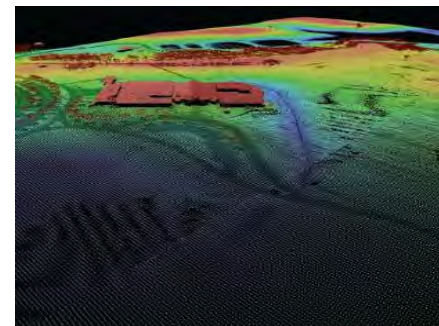
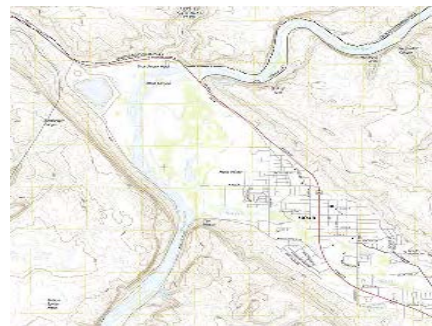




National Map Products and Services Delivery

July 22, 2019



Michael Tischler, Ph.D
Director
National Geospatial Program
USGS

+ USGS National Geospatial Program

2

The National Geospatial Program provides a foundation of digital geospatial data representing the topography, natural landscape, and built environment of the United States. **These data and derived products and services can be accessed through The National Map Data Download and Visualization Services.**

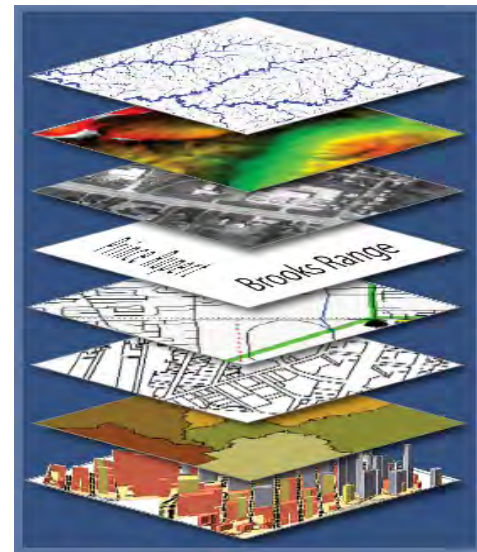


Overview



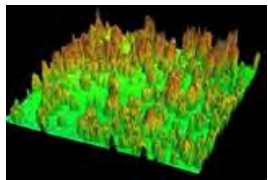
+ Underlying Concept of Operations: The National Map

- *The National Map* includes eight foundational data layers: **hydrography**, **elevation**, orthoimagery, **geographic names**, boundaries, transportation, land cover, structures
- Public domain data to support
 - ☐ USGS topographic maps at 1:24,000-scale
 - ☐ Products and services at multiple scales and resolutions
 - ☐ Analysis, modeling and other applications at multiple scales and resolutions
- *The National Map* is built on partnerships and standards
- Resource focus is on building and maintaining data; automating creation of derived products and services



+ NGP Principle Program Areas

Geospatial products and services support key priorities

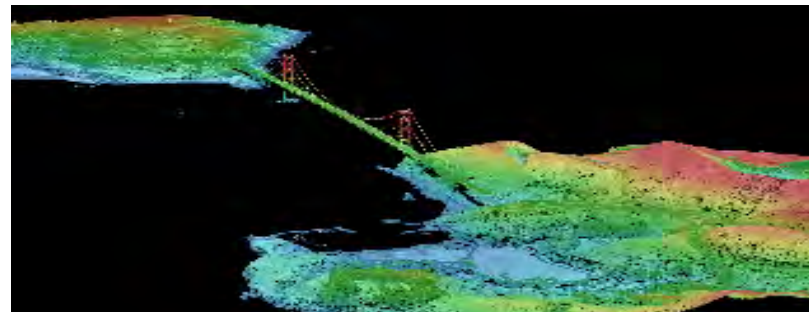
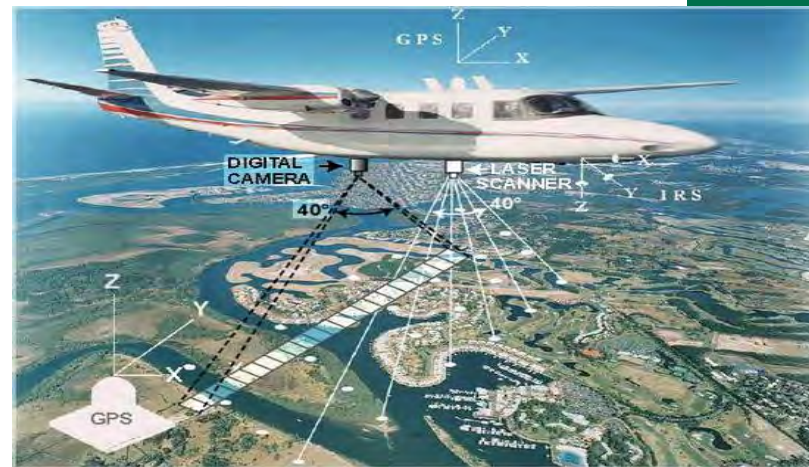


Area of National Leadership	Program Emphasis
A-16 Lead for Terrestrial Elevation	3D Elevation Program (3DEP)
A-16 Co-Lead for Inland Waters	National Hydrography and Watershed Boundaries Datasets, NHD+HR and Open Water Data Initiative
A-16 Lead for Geographic Names	Board on Geographic Names Executive Secretary, Geographic Names Information System
Nationwide Topographic Maps	U.S. Topo and Alaska Mapping

+ 3D Elevation Program (3DEP)

6

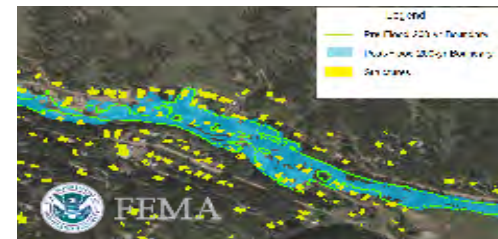
- Apply lidar technology to map bare earth and 3D data of natural and constructed features; increase the quality level of lidar being acquired to enable more accurate understanding, modeling, and prediction
- Goal to complete acquisition of national lidar coverage with IfSAR in Alaska in 8 years
- Address 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



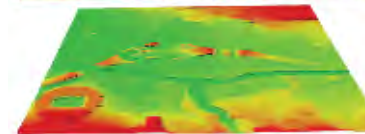
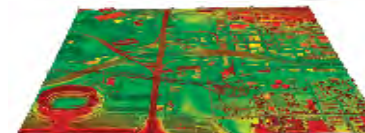
+ 3D Elevation Program

Mission Critical Applications

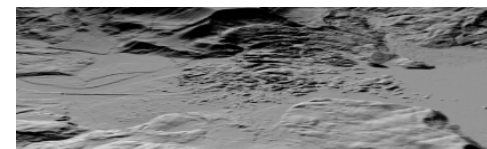
Rank	Business Use	Annual Benefits	
		Conservative	Potential
1	Flood Risk Management	\$295M	\$502M
2	Infrastructure and Construction Management	\$206M	\$942M
3	Natural Resources Conservation	\$159M	\$335M
4	Agriculture and Precision Farming	\$122M	\$2,011M
5	Water Supply and Quality	\$85M	\$156M
6	Wildfire 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
Total for all Business Uses (1 – 27)		\$1.2B	\$13B



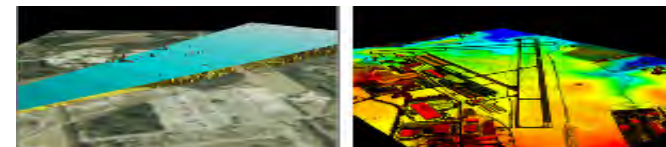
Flood Risk Management



Infrastructure



Geologic Hazards



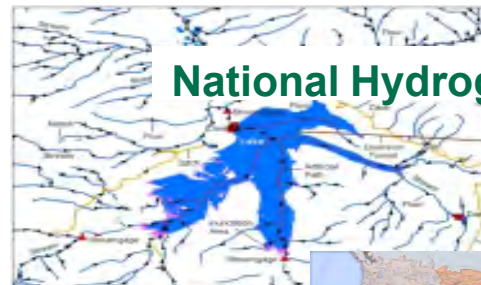
Aviation Safety

+ Foundational Hydrography Datasets

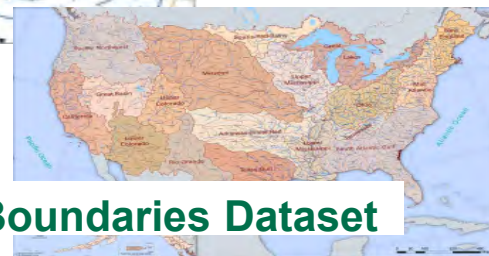
8

Surface water layers of *The National Map*

- **National Hydrography Dataset (NHD)** - the drainage network with features such as rivers, streams, canals, lakes, ponds, and stream gages
 - Allows modeling and tracing water downstream or upstream
 - Uses an addressing system based on reach codes and linear referencing to link information such as water discharge rates, water quality, and fish population
- **Watershed Boundaries Datasets (WBD)** - the drainage basins at 8 scales of a nested hierarchy; defines the areal extent of surface water drainage to a point
- **NHDPlus** - incorporates many of the best features of the NHD, WBD and elevation data to enable estimates of flow volume and velocity
 - NHD names and networking
 - Value-added attributes
 - Elevation-derived catchments for each stream segment
 - Stream and catchment attributes
 - Flow direction and accumulation grids



National Hydrography Dataset



Watershed Boundaries Dataset



NHDPlus

+ NHD Data Suite Comparison

9

- NHD+ (both resolutions) is made from the combination of elevation data, hydrography data (NHD), and watershed boundaries (WBD)
- NHD+HR uses higher resolution input data
- Elehydro products are derived completely from lidar

NHD



34.5 Million features

No Elevation input

Blue lines from NHD HR

No Watershed boundaries

WBD



100k features

NHDPlus - Med Res



NHDPlus - High Res



Number of features

3 Million nationally

34.5 M nationally

Elevation Input

National 1 Arc-Second Seamless DEM (30 meters)

National 1/3 Arc-Second Seamless DEM (10 meters)

NHD Input

Medium Resolution NHD 100K

High Resolution NHD Local, 24K

WBD Input

Composite 2010-2012

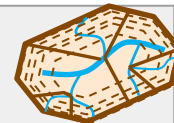
Updated WBD

Tile Size

HUC-2 (with exceptions) (avg. 200k square miles)

HUC-4 (avg. 20k square miles)

Elehydro



300 Million features

3DEP Lidar (1m)

1:5K NHD (derived from 1m lidar)

Catchments (derived from 1m lidar)

HUC8-12 (avg. 45-1750 square miles)

+ Enabling others through...

■ Products

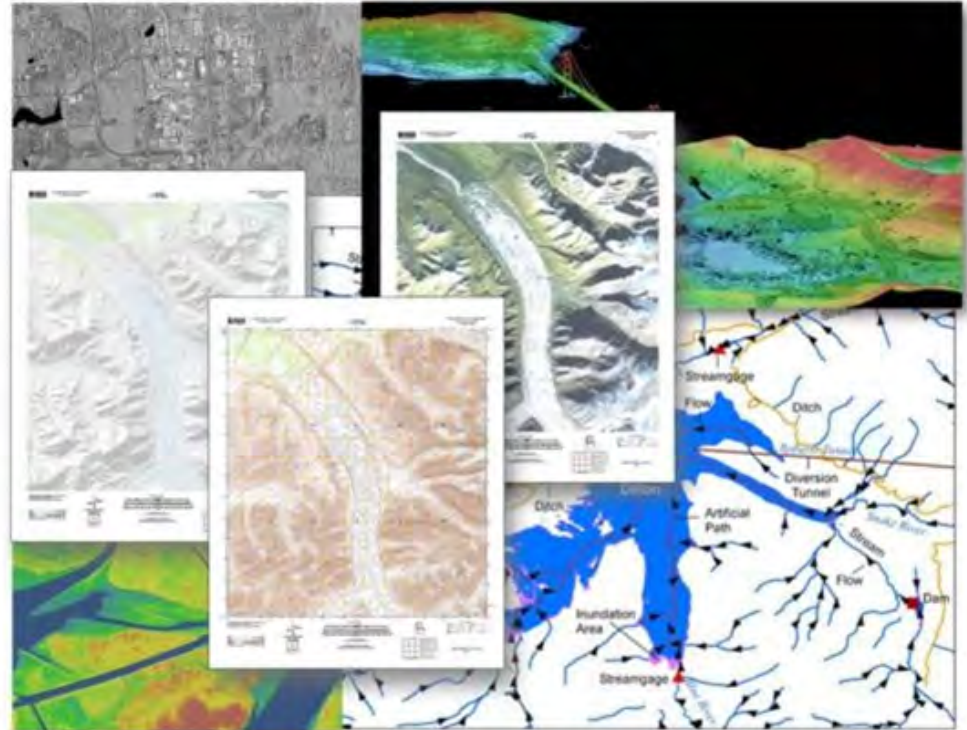
- US Topo, Map Data, etc.
- Data Download

■ GIS Services

- Base Maps
- Theme Overlays
- Index/Data Availability

■ Other APIs

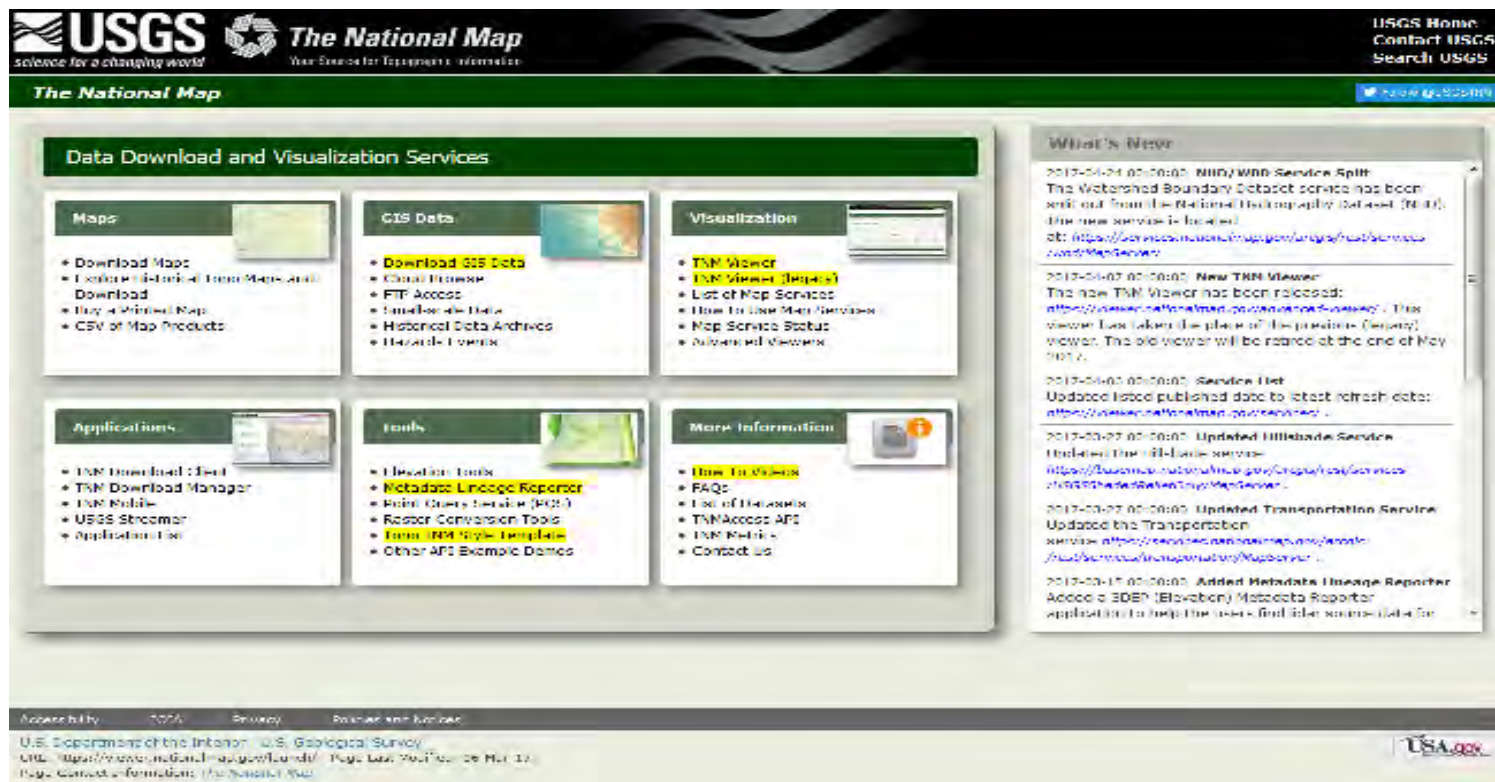
- TNMAccess
- ScienceBase.gov
- Data.gov



+ The National Map Launch Page

11

<https://viewer.nationalmap.gov/>



The screenshot shows the 'The National Map' website. At the top is the USGS logo with the tagline 'science for a changing world' and the text 'The National Map Your Source for Topographic Information'. A navigation bar includes 'USGS Home', 'Contact USGS', and 'Search USGS'. Below this is a 'The National Map' banner with a 'New USGS' button. The main content area is titled 'Data Download and Visualization Services' and is organized into six panels: 'Maps', 'GIS Data', 'Visualization', 'Applications', 'Tools', and 'More Information'. Each panel contains a list of links to various services and data. On the right side, there is a 'What's New' section with a list of recent updates, including the 'Watershed Boundary Dataset' and 'TIN Viewer' updates. The footer contains accessibility information, a privacy policy link, and the USGS logo.

USGS science for a changing world

The National Map Your Source for Topographic Information

The National Map [New USGS](#)

Data Download and Visualization Services

- Maps**
 - Download Maps
 - Explore a Stack of Top Maps and Download
 - Buy a Printed Map
 - CSV of Map Products
- GIS Data**
 - Download GIS Data
 - Cloud Browse
 - FTP Access
 - Database Data
 - Historical Data Archives
 - Harvard Events
- Visualization**
 - TIN Viewer
 - TIN Viewer (Legacy)
 - List of Map Services
 - How To Use Map Services
 - Map Service Status
 - Advanced Viewers
- Applications**
 - TIN Download Client
 - TIN Download Manager
 - TIN Mobile
 - USGS Streamer
 - Application List
- Tools**
 - Visualization Tools
 - Metadata Usage Reporter
 - Point Query Service (PQS)
 - Raster Conversion Tools
 - TIN TIN Style Template
 - Other API Example Demos
- More Information**
 - How To Access
 - FAQs
 - List of Data sets
 - TIN Access API
 - TIN Metrics
 - Contact us

What's New

- 2017-04-24 00:00:00: NHD/WHI Service Split**
The Watershed Boundary Dataset service has been split out from the National Hydrography Dataset (NHD). The new service is located at: <https://services.nationalmap.gov/whi/nhd/streams/cont/MapServer>
- 2017-04-07 00:00:00: New TIN Viewer**
The new TIN Viewer has been released: <https://viewer.nationalmap.gov/cont/tinviewer/>. This viewer has taken the place of the previous (legacy) viewer. The old viewer will be retired at the end of May 2017.
- 2017-04-07 00:00:00: Service List**
Updated listed published data to latest refresh date: <https://viewer.nationalmap.gov/services/>
- 2017-03-27 00:00:00: Updated Hillsshade Service**
Updated the Hillsshade service: <https://services.nationalmap.gov/cont/tinviewer/streams/cont/MapServer>
- 2017-03-27 00:00:00: Updated Transportation Service**
Updated the Transportation service: <https://services.nationalmap.gov/cont/tinviewer/streams/cont/MapServer>
- 2017-03-17 00:00:00: Added Metadata Usage Reporter**
Added a EDEP (Elevatory Metadata Reporter) application to help the users find data sources/data for

Accessibility: [TDD](#) [Privacy](#) [Partner and Vendor](#)

U.S. Department of the Interior | U.S. Geological Survey
URL: <https://viewer.nationalmap.gov/cont/tinviewer/> Page last Modified: 06 Mar 17
Page Contact Information: [The National Map](#)

USA.gov

+ Five Tile Cached Base Maps

12

<http://basemap.nationalmap.gov>

Hydro



Hillshade



USGS Topo



Imagery Topo

Imagery Only

+ Service Uptime Monitoring

13

- UptimeRobot is used for externally monitoring service reliability.
- <https://uptimerobot.com/>
- Our Base Maps are consistently in the 99.9% range.

Monitors

Status	Last 7 Days		Type	30 Jun	29 Jun	28 Jun	27 Jun	26 Jun	25 Jun	24 Jun
	99.702%	USGSHydroCached Base Map	http	100.00%	98.684%	99.853%	99.855%	99.700%	100.00%	99.933%
	99.971%	USGSIImageryOnly	http	100.00%	100.00%	99.832%	100.00%	100.00%	100.00%	100.00%
	99.969%	USGSIImageryTopo Base Map	http	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
	99.917%	USGSShadedReliefOnly	http	100.00%	100.00%	99.700%	99.937%	99.837%	100.00%	100.00%
	99.922%	USGSTopo Base Map	http	100.00%	100.00%	100.00%	99.765%	99.900%	100.00%	99.856%

+ Map Services List

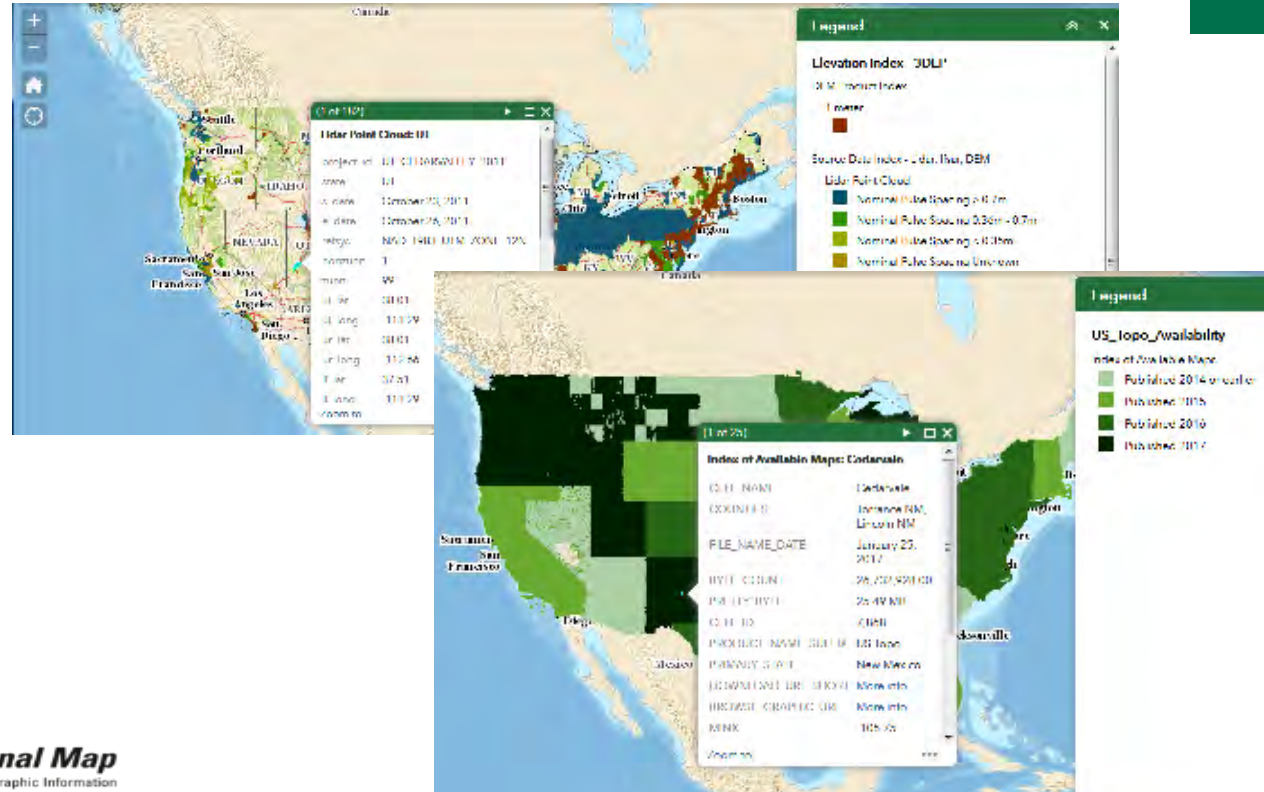
<https://services.nationalmap.gov>

14

+ Data Availability - Spatial Metadata Services

15

- Overlay services suitable for visualizing product availability and often backed by rich attribute information to further enhance filtering and visualization.
- 3DEP Elevation Index
- US Topo Availability



+ TNMAccess API

16

Home Page: <https://viewer.nationalmap.gov/tnmaccess/>

Guide: <https://viewer.nationalmap.gov/help/documents/TNMAccessAPIDocumentation/TNMAccessAPIDocumentation.pdf>

Services JSON: <https://viewer.nationalmap.gov/tnmaccess/api/services>

Datasets JSON: <https://viewer.nationalmap.gov/tnmaccess/api/datasets?>

Product Search Form: <https://viewer.nationalmap.gov/tnmaccess/api/productsForm>

Simplified search API for the National Map products and services.

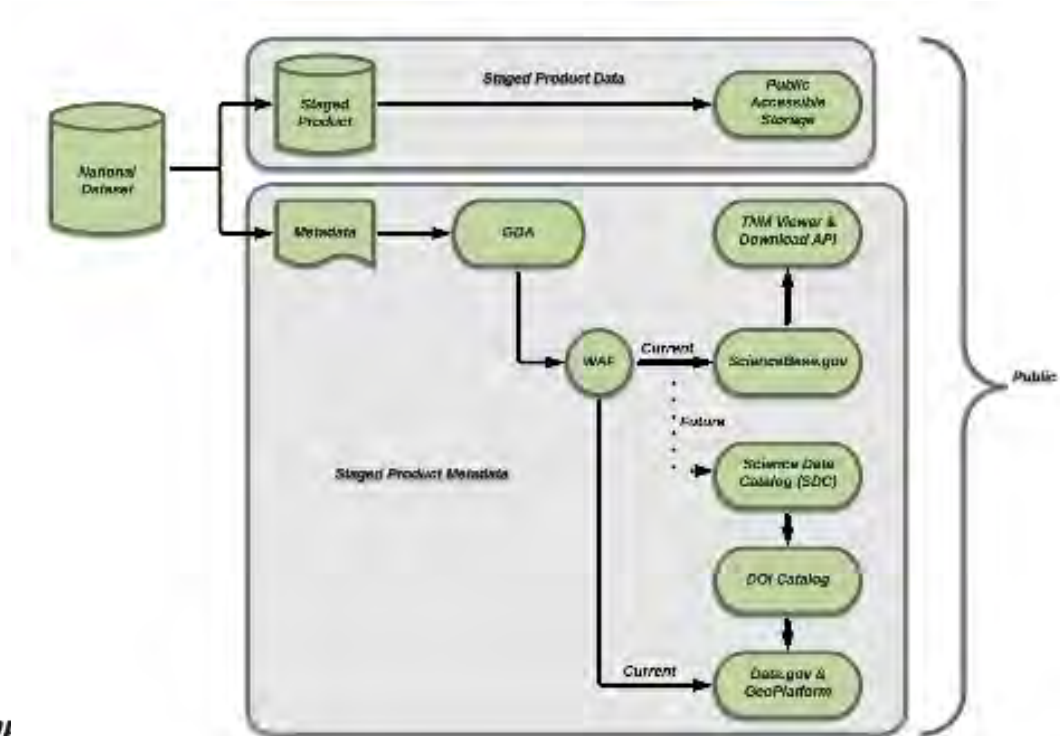
- Custom API
- Services
- Datasets (Collections)
- Products
- Notifications

Resolves download products by searching ScienceBase.gov.



+ Product Metadata Publishing

Metadata providing search, discovery and access to files in open data portals through our APIs





Demos



+ Demo Overview

19

■ Launch Page

- Mini portal to all our offerings
- Would like a good search function tied to our symantec needs

■ Download Client

- Access to all our Downloadable, Staged Products
- Driven by our TNMAccess API

■ Advanced Viewers

- ArcGIS Online Web App Builder hosted on USGS servers
 - Minimizes custom development & maintenance
 - Takes advantage of tools created, refined and maintained by Esri
- Cesium Viewer
 - Continued exploration of OpenSource capabilities
- TopoView Historical Map Viewer
- Bare Earth DEM Visualization (Prototype)
 - Application
 - Service with Raster Functions
- Lidar Point Cloud Viewer (Prototype)
 - Entwine Processing/Greyhound API

+ National Map Data Downloader

20

The screenshot displays the USGS National Map Data Downloader interface. On the left, the 'Datasets' section is active, showing 'Advanced Search Options'. The 'Find Products' button is circled in red. Below it, the 'Data' section is checked, and the 'Product Search Filter' is set to 'All Subcategories'. A yellow callout box with a red arrow points to the '1 meter DCM' option, with the text '(Displaying availability of 1-m DEMs)'. The main map area shows a map of Kansas with a red rectangle highlighting a specific region. A yellow callout box with a red arrow points to this rectangle, with the text '(Availability of 1/9th arcsecond DEM over the same area)'. The map includes labels for cities like Kansas City, Independence, and Overland Park, and counties like Platte, Leavenworth, and Jackson.

+ Lidar Data Download

21

The screenshot displays the USGS TNM Download (Beta V0.2.0) website interface. The top navigation bar includes the USGS logo, the title "TNM Download (Beta V0.2.0)", and links for "Quick Links", "Restart Order Process", and "Share Link". The "The National Map" logo is also present in the top right corner.

The left sidebar contains a "Categories" section with a search bar and a "Date Range" filter. Below this, there are two main sections: "Map" and "Data". The "Map" section includes links for "US Topo", "Historical Topographic Maps", "Boundaries - National Boundary Dataset", "Elevation Products (3DEP)", "Elevation Source Data (3DEP)", "Hydrography (NHD) and Watersheds (WBD)", "Imagery - 1 foot (HRD)", "Imagery - 1 meter (NASP)", "Map Indicators", "Names - Geographic Names Information System (GNIS)", "National Land Cover Database (NLCD)", "Small-scale Datasets", "Structures - National Structures Dataset", "Transportation - National Transportation Dataset", and "Woodland Text".

The main content area is titled "TNM Download (Beta V0.2.0)" and includes a "Customized View" button, a "Restart Order Process" button, and a "Share Link" button. Below this, there are tabs for "Categories" and "Products". The "Products" tab is selected, showing a list of "Available Products".

The "Available Products" section displays a list of products under the heading "Elevation Source Data (3DEP)". The list includes the following items:

- Burnt_2011_002160 2014-09-10 LAS
Last Updated: 2014-09-28
Published Date: 2014-09-10
File Format: LAS (108.91 MB), Data Extent: Varies
- USGS Lidar Point Cloud (LPC) OR_OLC-Burnt_2011_002160 2014-09-10 LAS
Last Updated: 2014-09-28
Published Date: 2014-09-10
File Format: LAS (119.48 MB), Data Extent: Varies
- USGS Lidar Point Cloud (LPC) OR_OLC-Burnt_2011_002160 2014-09-10 LAS
Last Updated: 2014-09-28
Published Date: 2014-09-10
File Format: LAS (110.57 MB), Data Extent: Varies
- USGS Lidar Point Cloud (LPC) OR_OLC-Burnt_2011_002160 2014-09-10 LAS
Last Updated: 2014-09-28
Published Date: 2014-09-10
File Format: LAS (55.79 MB), Data Extent: Varies
- USGS Lidar Point Cloud (LPC) OR_OLC-Burnt_2011_002160 2014-09-10 LAS
Last Updated: 2014-09-28
Published Date: 2014-09-10
File Format: LAS (53.10 MB), Data Extent: Varies

Each product entry includes a thumbnail image, a "Thumbnail" link, a "Zoom To" link, and a "Download" link. The fourth product entry is highlighted in yellow.

On the right side of the main content area, there is a map showing the geographic distribution of the data. The map includes a search bar, a "Go" button, and a "Clear" button. The map displays a topographic view with a grid overlay, indicating the locations of the data products.

The bottom of the page features the USGS logo with the tagline "science for a changing world" and the "The National Map" logo with the tagline "Your Source for Topographic Information".

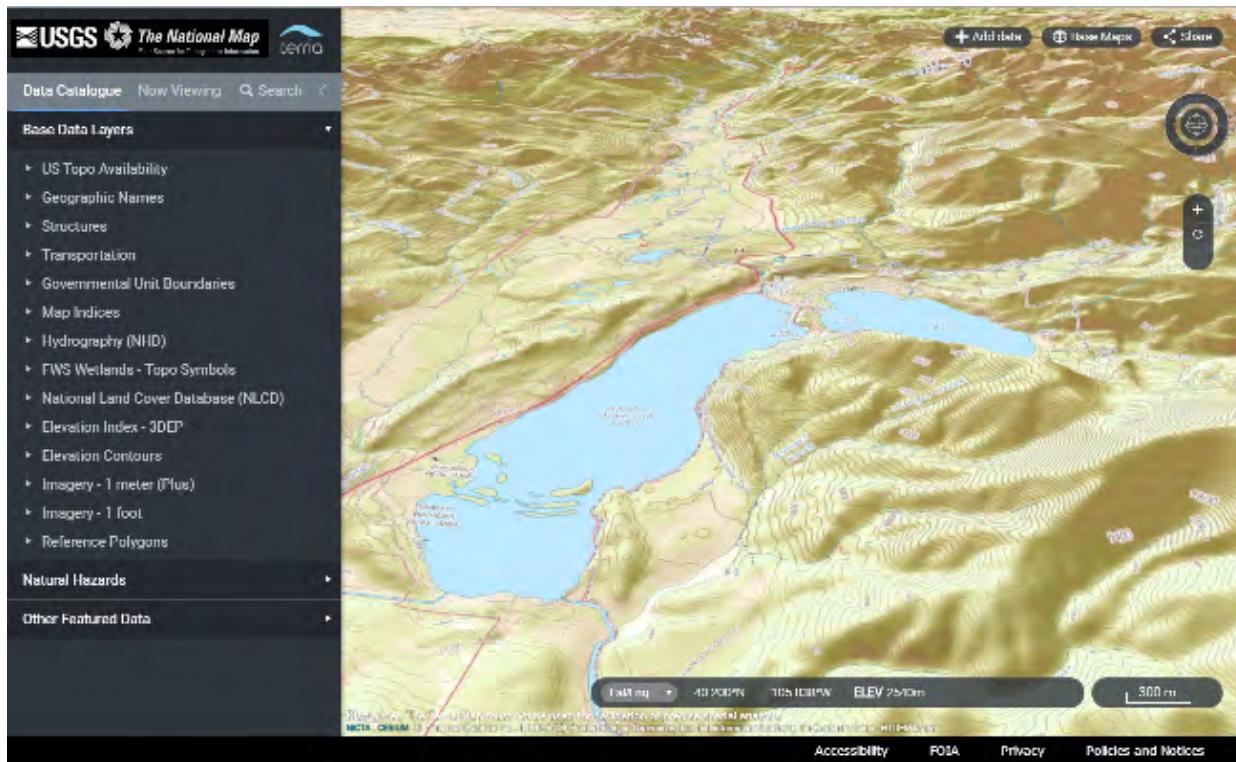
+ TNM Advanced Viewer

22



+ Cesium Advanced Viewer

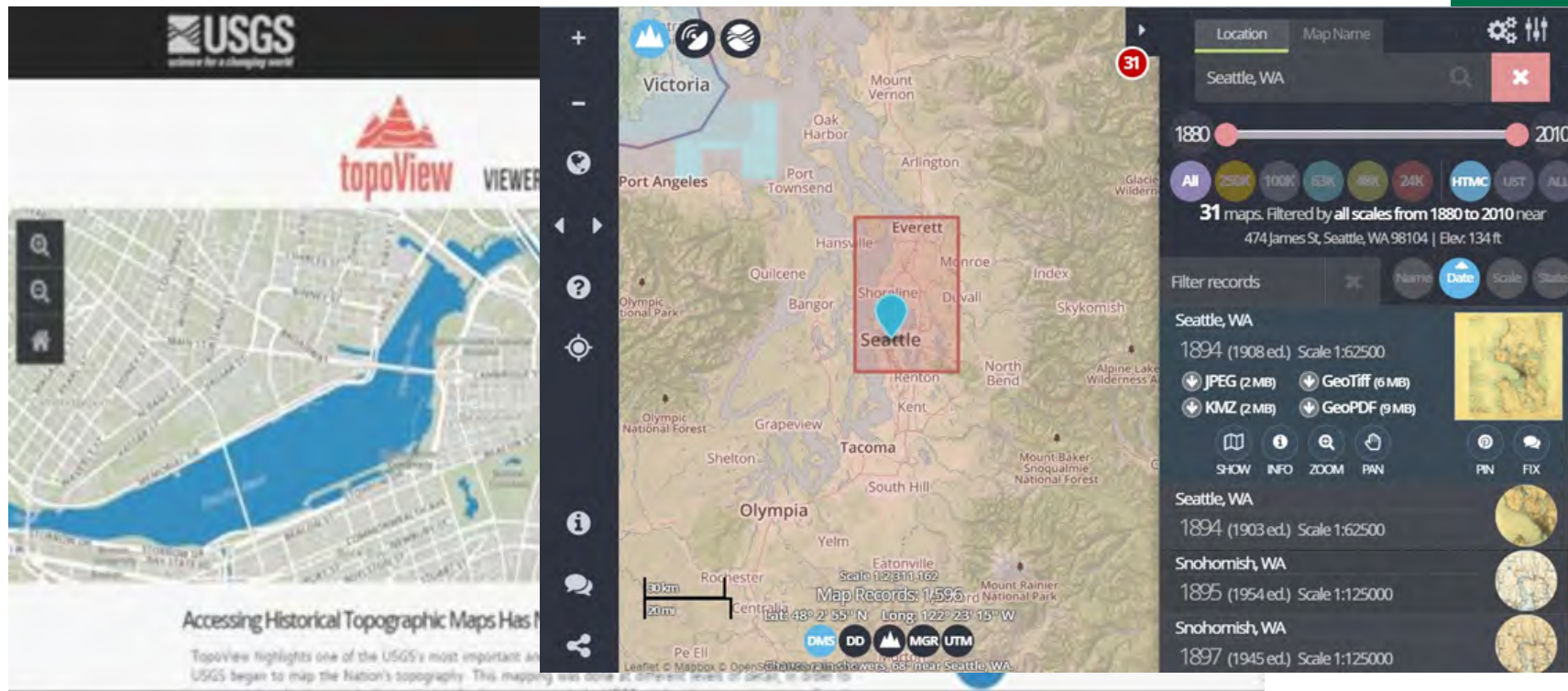
23



+ Topo View

Exploring our Historical Topo Map Collection

24



+ New Elevation Services for FY18

25

- Dynamic Elevation Services for:
 - Hillshade
 - Slope
 - Aspect
 - Contours and more..

<https://apps.nationalmap.gov/3depdem/>



+ Lidar Visualization

26

<http://prd-tnm.s3.amazonaws.com/test/LidarExplorer/index.html>

The screenshot displays the USGS 3DEP Lidar Explorer web application. At the top, the USGS logo and 'The National Map' branding are visible. The main heading is 'Lidar Visualization Projects'. Below this, there is a search bar and a list of project entries, each with a location and year (e.g., 'TX VICTORIA 2006', 'TX JEFFERSON 2006', 'VA WV SHENANDOAH VALLEY 2011'). A detailed view of the 'VA WV SHENANDOAH VALLEY 2011' project is shown, including a map of the region and a 3D visualization of the terrain. The 3D visualization shows a river valley with a bridge, rendered in a color-coded elevation scheme (blue for low, green/yellow for higher). The interface also includes a 'Data Filter' section with a 'Date Filter' dropdown. The footer contains the USGS logo and the text 'Your Source for Topographic Information'.

USGS science for a changing world The National Map

3DEP Lidar Explorer

Lidar Visualization Projects

Filter Project filter

- TX VICTORIA 2006
- TX JEFFERSON 2006
- VA WV SHENANDOAH VALLEY 2011

View in: Placio or Netras (pdf)
Download: [Client] [FTP] [Cloud]
Coordinates: 261.0000 - 261.0000 Date: 2012-03-17
County: WY
District: WY-THOMAS (2012-03-17)
City: WY-THOMAS (2012-03-17)

- ARRA-TX CA HUINCO 2010
- TX SAN PATRICK 2006
- TX GALVESTON 2006
- FL MIAMI DADE CO 2007
- IL ILLINOIS KEYS 2008

Zoom to Select Z
Date Filter entry date

USGS Department of the Interior | U.S. Geological Survey
science for a changing world Your Source for Topographic Information

Where We Are

- Download Mentality

- We show users where data exists. (WMS & API)
- We offer visualization of the data through services. (WMS)
- We package data into products of various formats and extents for download.
- We provide limited direct access to data through services. (WFS, WCS)

- Impractical with Big Data

- Packaged products can't be used directly without unzipping.
- TBs of data aren't easily processed on Desktops.
- Existing standard services address some, but not all, needs.
- Many use cases are still undefined and require custom workflows.



Where We Want To Be

- Download as Last Resort Mentality
 - Store data in unzipped, optimal formats ready for direct processing by standard services or custom processes.
 - Provide basic visualization, analysis and extraction functions through services on an open platform.
 - The platform additionally provides the potential processing capacity for building unforeseen custom workflows and processes against big data.



Lidar and Cloud Hosting Activities

+ Question...

30

How do we make lots of data...
available to multiple users....
as quickly as possible?

+ Cloud Strategy

31

- Store ready-to-use data in Cloud
- Access can be instantaneous
- Cloud provides processing infrastructure
- Costs can be deferred to users

Theoretical, until these two events.

~22,000 square miles; ~1.2 TB



~40,000 square miles; ~4.0 TB (Florida only)



+ Summary

- Lidar available via the Cloud can provide users with immediate access.
- The Cloud environment allows nearly limitless processing without downloading.
- Entwine/Greyhound services provide a fast way to visualize, interrogate and extract data.



Questions & Discussion

