

# 3DGeo Stakeholder Coordination: Minnesota Lidar Plan

## *Metro LAB - USGS 3DEP Grant Application Discussion*

November 17, 2020 2:00-3:30

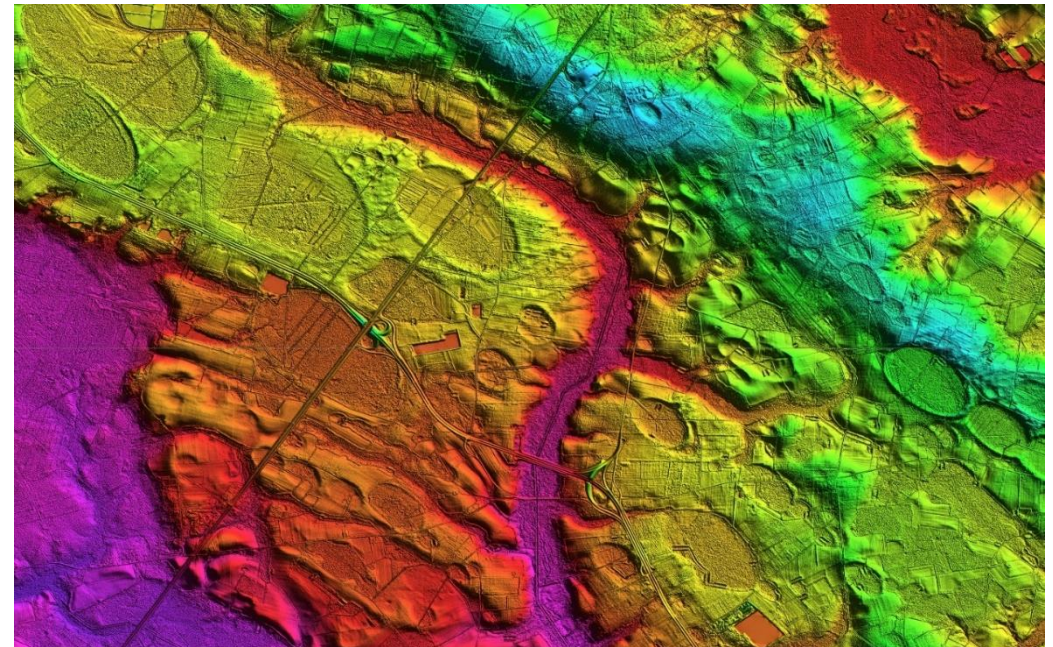
Hosted by the Geospatial Advisory Council (GAC) 3D Geomatics Committee's Data Acquisition Workgroup

**Please stand by, we will be starting at 2:05 after others join...**

# Welcome!

## Thank you for joining us today!

- We are excited to meet with you today to discuss lidar acquisition planning efforts in Minnesota.
- Members of the 3D Geomatics Committee Lidar Acquisition Workgroup will be introducing 3DGeo, sharing updates, and information about lidar collects for Minnesota.
- We welcome your input today and going forward.



# Meeting Housekeeping

- Please **mute** your microphone if you're not speaking
- Type in questions anytime into the **chat window**, and we'll address them during the Q&A section
  - Feel free to use your microphone during Q&A session
- Slides will be shared after the meeting



# Agenda

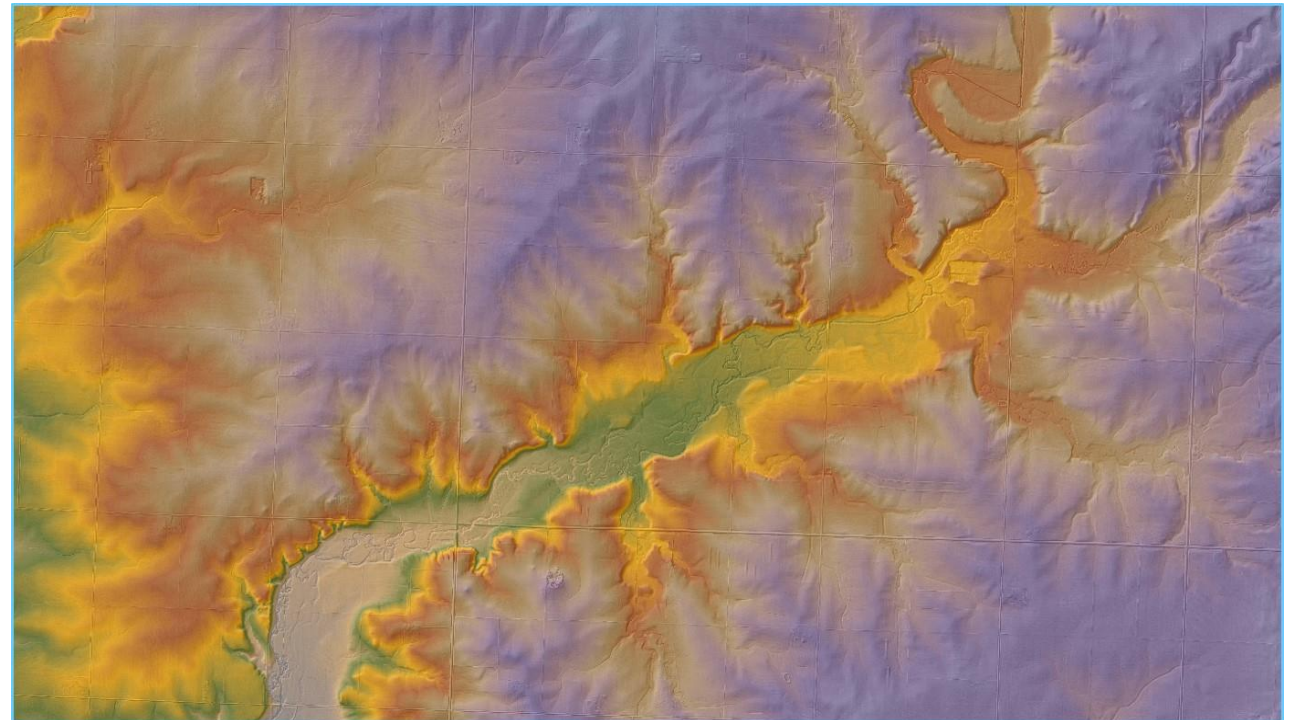
2:05 - 2:15 (10 min)	Welcome, Introduction and agenda overview	<b>Joe Sapletal</b> Dakota County IT Department, Office of GIS   Sr. GIS Specialist
2:15 - 2:40 (25 min)	Intro to 3DGeo, Minnesota Lidar Plan & National 3DEP program, Hydro Examples.	<b>Sean Vaughn</b> GIS Hydrologist & LiDAR Data Steward   MNIT serving EWR Hydrography Data Stewardship
2:40 - 3:05 (25 min)	Forestry Applications, Progress on lidar acquisition planning statewide, and how you can get involved	<b>Jennifer Corcoran</b> DNR Forestry, Remote Sensing Program Consultant   Resource Assessment
3:05 - 3:30 (25 min)	Information Sharing and Q & A	Sean Vaughn, Jennifer Corcoran, Joe Sapletal, Gerry Sjerven, Alison Slaats & other attending 3DGeo Acquisition Team members.

**Alison Slaats** - Running the slide show.  
**Gerry Sjerven** - Monitoring Chat

**Note:** *If you have questions during the presentation, please submit them to the chat window during the meeting and we will review them during the discussion session.*

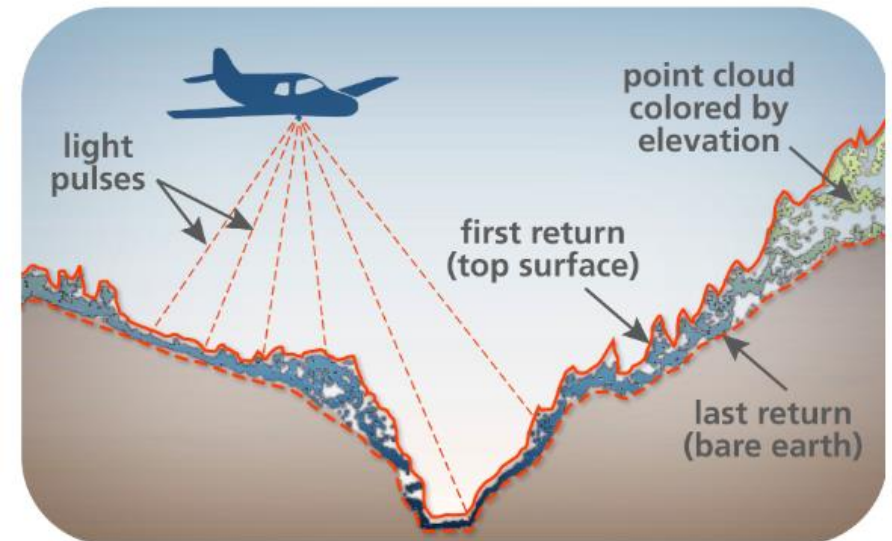
# Goals for today

- Who is 3D Geomatics (3DGeo)?
- What is this partnership and plan all about?
- What is Lidar in 2020 and beyond?
- What do we get for the money we can contribute?
- When do we get our deliverables?
- What's the next steps after this meeting?

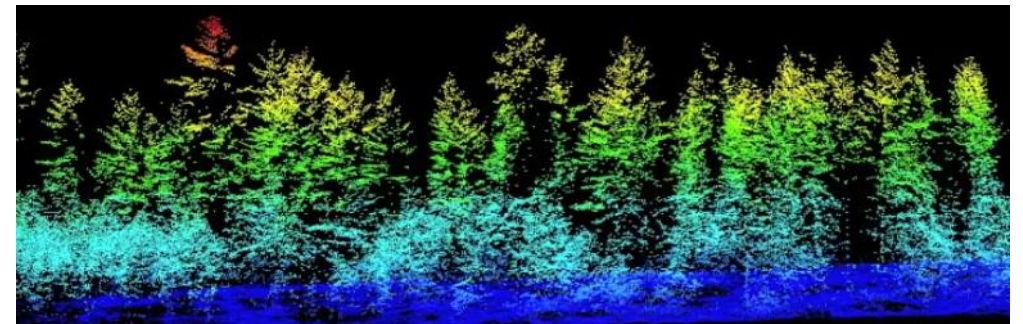


# What is lidar?

- **Lidar** stands for **light detection and ranging**
- It is a **mapping technology** that uses a pulsed laser to measure the time it takes for emitted light to travel from a sensor to the ground or other objects and back.
- The sensor can **pulse** a laser beam hundreds of thousands of times per second, millions of returns ("**points**") are captured, resulting in a "point cloud" of three-dimensional measurements.



*Image from the Washington Geological Survey*



# What is Lidar?

## To Some Lidar Is:

- A 3D Point Cloud

## To Some:

- 2-ft Contours
- Digital Elevation Model (DEM)

Note: The two most downloaded authoritative lidar-derived products from MnTOPO are the 2-ft Contours and the DEM.

## To Some:

- Hydro-modified DEM & Hydrography
- 1-ft contour Dataset
- Vegetation and Buildings
- Intensity Imagery
- Digital Surface Model (DSM)
- And Many other products

Regardless what lidar is to you and your business needs, “lidar” begins with collection of the data as part of a data procurement project within a 3D Geomatics lidar acquisition area.





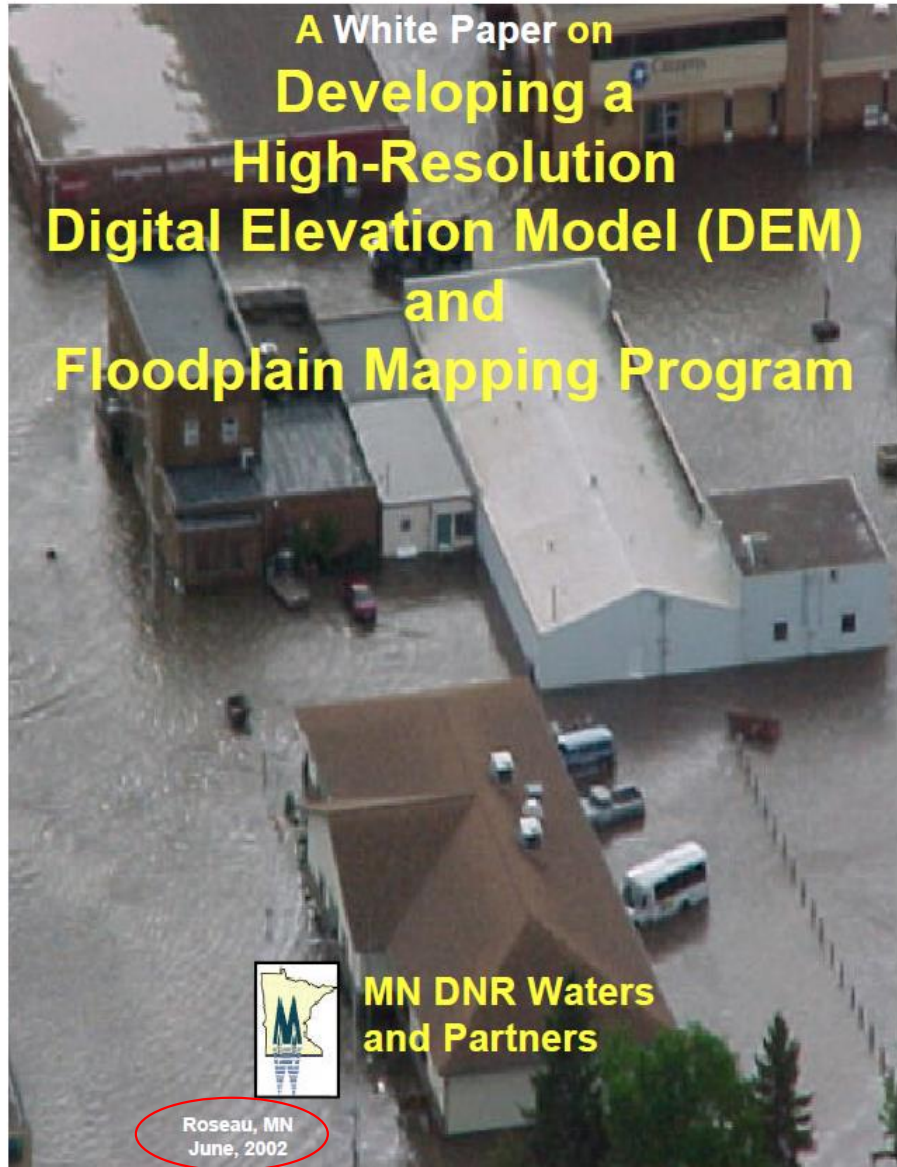
## 2002 Need for a DEM


- “...need to develop a high-resolution DEM and floodplain mapping program”.
- “...correctly identify and map flood hazard areas...”
- “...efficiently and effectively manage land and water resources as well as infrastructure”.

### \$80 Million

- \$41M – DEM
- \$27M – Floodplain Mapping
- \$12M –IT Infrastructure

A White Paper on  
**Developing a High-Resolution Digital Elevation Model (DEM) and Floodplain Mapping Program**




 **MN DNR Waters and Partners**

Roseau, MN  
June, 2002

**STATEMENT of NEED**

...of the attendees strongly expressed resolution DEM m. The State North Carolina, program of f and er to ard areas re and tively l as



Furthermore, counties, cities, townships, private firms, the DNR, and the Minnesota Department of Transportation (MnDOT) spend millions of dollars every year to collect high-resolution elevation data in order to plan and implement programs mandated by state and federal agencies. Most data collection is done by traditional methods which is extremely expensive and comparatively slow.

The current estimated cost of developing a DEM and floodplain mapping program in Minnesota is about \$80 million. Two thirds (\$53 million) of cost is for the DEM development and one third (\$27 million) is for floodplain mapping. The current estimated cost of developing a DEM and floodplain mapping program as discussed below.

...s floodplain management program will obtain a total of \$15-20 million in the 2003, 2004, and 2005 federal budget. The legislature authorizes a high-resolution and floodplain mapping program as a window of opportunity for Minnesota to potentially be \$25-30 million. North Carolina's experience of 34 percent. In addition, the cost is reduced by 35% for development and hydraulic analysis.

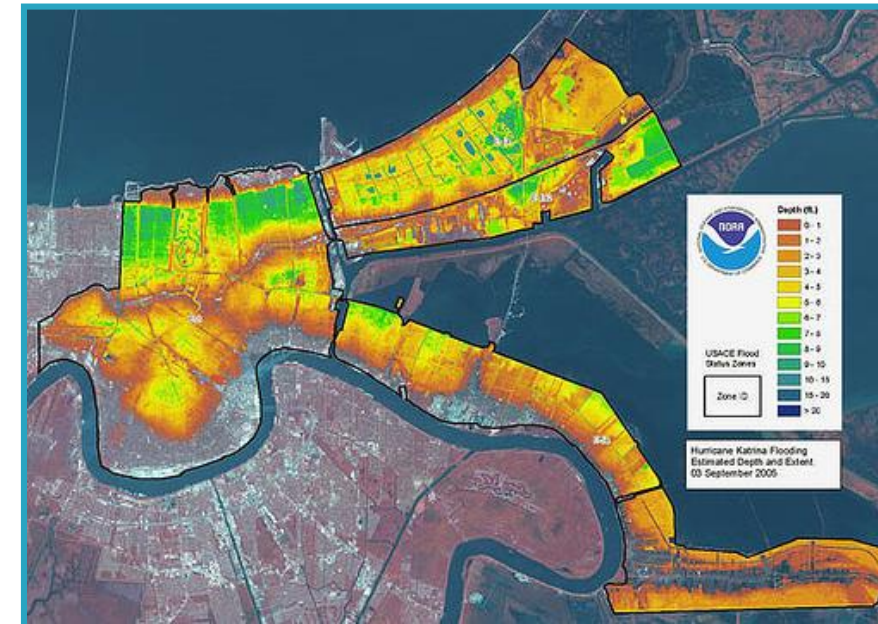
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## 2002 - Reactive Approach

- “In 1993 and 1997, flooding caused \$1.7 billion and \$1.5 billion in damages, respectively...”

- “Focusing on 1997, a total of \$830 million, about half of the total estimated damage, was spent thereafter by state, federal and private agencies towards recovery”.



# Geospatial Advisory Council (GAC) - 3D Geomatics Committee

## Geospatial Advisory Council (GAC)

- **Coordinating body** for the Minnesota geospatial community.
- **Cross-section of organizations** that include counties, cities, universities, business, nonprofit organizations, federal and state agencies, tribal government, and other stakeholder groups.

## 3D Geomatics Committee (3DGeo)

- Committee **under the GAC**
- Works to identify and promote the need for planning, funding, acquisition, and management of three-dimensional geomatic data and derived products.
- Lidar acquisition led by a team with **dedicated time** working to bring new high-definition lidar to Minnesota.



GAC Rank	Project or Initiative Name
1	All public geospatial data in MN to be free and open to everyone
2	Updated and aligned boundary data from authoritative sources
3	The implementation of an archive for Minnesota geospatial data
4	Statewide publicly available parcel data
5	Improvements to the MnGeo Imagery Service, such as Web Mercator support, tiling, and complementary options such as "composite of latest leaf off imagery", and downloading options
6	Accurate hydro-DEMs (hDEM) that serve modern flood modeling and hydro-terrain analysis tools, and the development of more accurate watercourses and watersheds
7	Statewide publicly available road centerline data
8	New LiDAR data acquisition across Minnesota for use in developing new derived products guided by committee developed standards
9	An emergency management damage assessment data standard to provide an accepted specification to support a request for State or Federal assistance after a disaster
10	Statewide publicly available address points data
11	Maps, procedures, templates and other materials to help all levels of government implement the U.S. National Grid
12	A parks and trails data standard
13	A forum (committee, workgroup, etc.) for MN geospatial professionals to discuss and share best practices, standards, lessons learned, etc. for implementing and supporting the geospatial components of NG9-1-1

# 3DGeo Workgroups

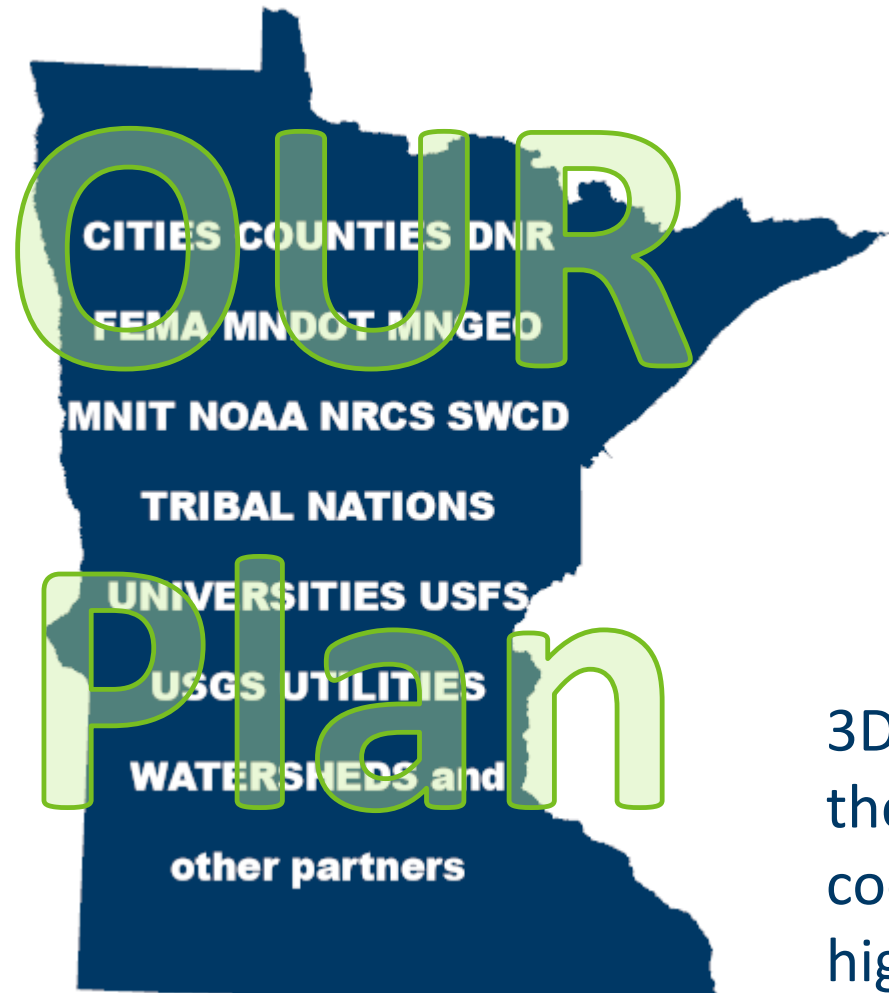
## 3DGeo Executive Steering Team

### ■ Workgroups/Subgroups

- Hydrogeomorphology
  1. Data Catalog
  2. Foundational Hydrography Data Stewards
  3. DEM Hydro-modification
- Vegetation
- Education
- Human Infrastructure
- Data Acquisition



# Minnesota Lidar Plan - Our Plan – Your Plan – One Plan



## The Minnesota Lidar Plan

- **One** plan for Minnesota
- **Committee** led plan, not a state agency plan
- **Collaboration** of the geospatial community
- **Coordination** of lidar acquisition in Minnesota leverages federal match dollars

3DEP grant success is built on a guiding plan that pulls the community together to foster collaboration and coordinate funding to achieve the common goal of high density lidar acquisition across Minnesota

# Background

- Lidar acquisitions are coordinated by the GAC's **3DGeo Committee**
- Minnesota's Lidar Plan divides up the state into **lidar acquisition areas (LAA)** based on political (county) and watershed boundaries
- Grant **funds** are available from USGS for lidar acquisition because there is a national need for a nationwide elevation layer
- 3DGeo is working to organize lidar acquisition so that Minnesota can take advantage of this **USGS federal funding opportunity**
- **Economies of scale** are achieved
  - The bigger the collection footprint, the lower the cost

# 3DGeo - Data Acquisition Workgroup

## Mission:

- The Data Acquisition Workgroup promotes procurement of foundational 3D data for Minnesota.

## Co-Chairs

- Sean Vaughn, Alison Slaats, and Gerry Sjerven

## Lidar Acquisition Subgroup:

- Alison Slaats (MnGeo), Jennifer Corcoran (DNR), Colin Lee (MnDOT), Sean Vaughn (MNIT DNR), Gerry Sjerven (MN Power), Dan Ross (MnGeo), Matt Baltes (NRCS), Joel Nelson (U of MN), Joe Sapletal (Dakota Co), Andra Mathews (MnDOT), and Brandon Krumwiede (NOAA), Jeff Weiss (DNR).





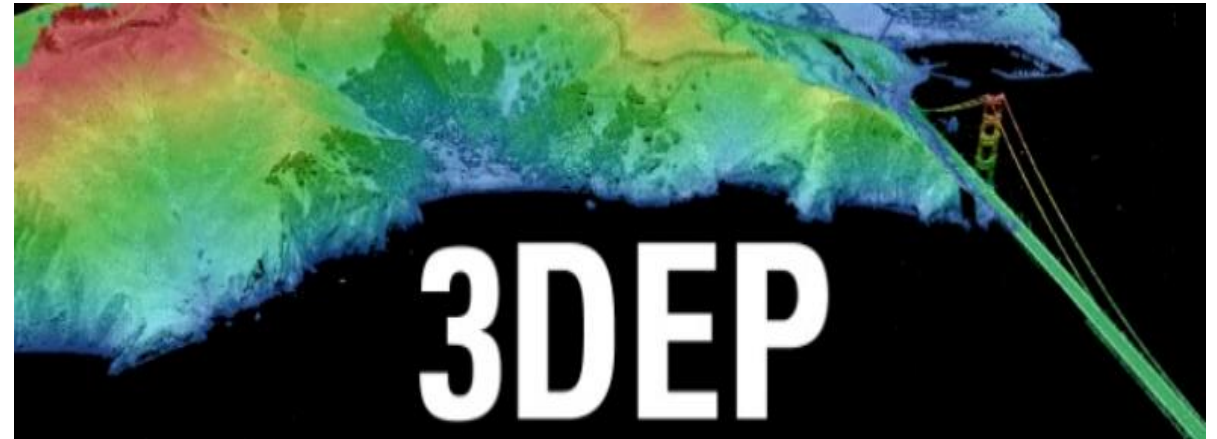
*What:*  
3DEP



# USGS 3D Elevation Program (3DEP)

## 3D Elevation Program (3DEP)

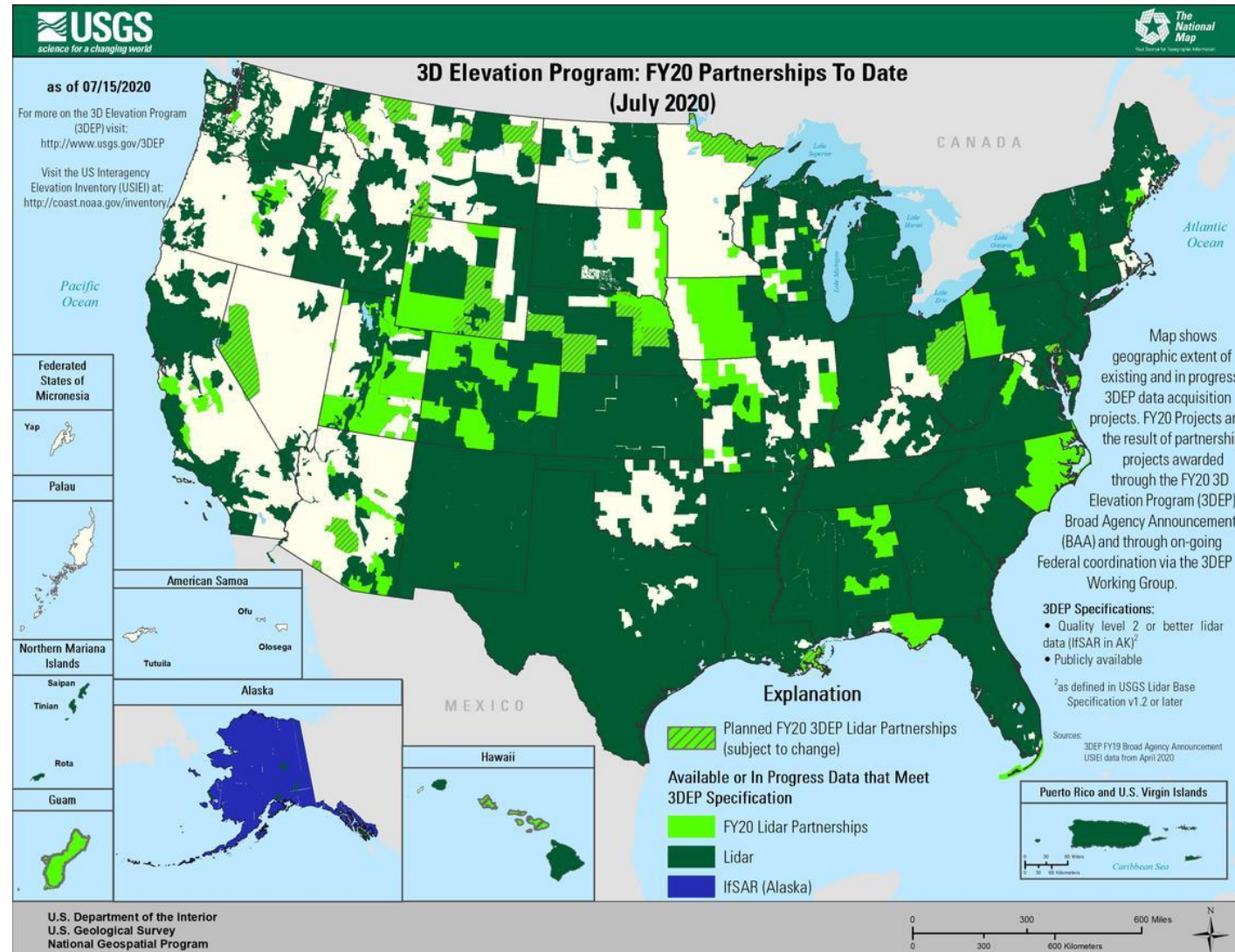
- **Systematically** guiding the collection of 3D elevation data in the form lidar data for the United States, and the U.S. territories
- Goal: elevation dataset for the nation **by 2023**
- Acquisition contracts are under two managerial mechanisms
  - GPSC
  - COOP




# USGS 3D Elevation Program (3DEP)

## Broad Agency Announcement (BAA)

- Grant coordinating mechanism 3DEP
- Guides **partnerships** between the USGS and other Federal agencies with other public and private entities seeking high-quality 3D lidar elevation data acquisition.
- USGS is **cost-sharing** via grant funds for QL2 or greater
- Grants through “BAA” process – **deadlines** are every fall (Oct/Nov)



An aerial photograph of a dense forest with a road and a lake. The forest is rendered in a reddish-brown color, likely due to a color map or filter. A road runs through the forest, and a lake is visible on the left side. A large blue circle is overlaid on the right side of the image, containing the text "What is: High-density Lidar".

*What is:*  
High-density  
Lidar

# Need for High-density Lidar

- Higher-resolution, higher-quality, and higher density lidar dramatically **improves** our ability to analyze the landscape in Minnesota, map assets, and assess resources
- Provides the foundation for development of authoritative **derived products** use to analyze and plan for current and future scenarios, and make better informed decisions
- Enables practitioners, managers, and researchers to be more **proactive** than reactive.



Lidar Point Cloud Colorized by Photo

# What is High Density Lidar?

High-Density lidar is defined by **two measures:**

1. Pulse Spacing
2. Pulse Density

3DGeo Committee Minimum

USGS & FEMA Base Specification Minimum

Current Minnesota Data Holdings

LiDAR BASE SPECIFICATION (LBS)	LBS Table 1 Minimum Net Pulse Density and Spacing for a Single lidar Collection Mission	
	Aggregate Nominal Pulse Spacing (ANPS) [m]	Aggregate Nominal Pulse Density (ANPD) [pulse/m <sup>2</sup> ]
QL-0	≤ 0.35	≥ 8.0
QL-1	≤ 0.35	≥ 8.0
QL-2	4X ≤ 0.71	16X ≥ 2.0
QL-3	≤ 1.41	≥ 0.5

These two HD technical measures relate to flight mission planning and they **affect** the **subsequent:**

1. Point Density of the lidar Point Cloud
2. Derived Products

## Improved Density = Improved Detail

- QL1 = 8+ pulses per 1 square meter
- QL3 = 1 pulse per 2 square meters

That's 16+ QL1 pulses per the same 2m area of QL3

# HD Lidar – Derived Products

## Lidar Quality Levels Define Deliverable Specifications

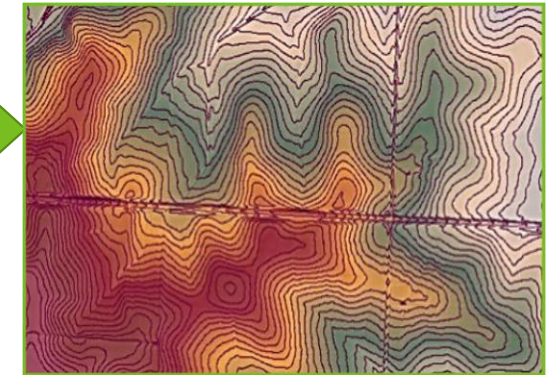
- Minimum **DEM** Cell Size
- Minimum **Contour** Interval

3DGeo Committee Minimum →

**USGS & FEMA** Base Specification Minimum →

Current Minnesota Data Holdings →

LiDAR BASE SPECIFICATION (LBS)	LBS Table 6 Minimum DEM Cell Size		Supported Contour Interval Accuracy [ft]
	Minimum Cell Size [m]	Minimum Cell Size [ft]	
QL-0	0.5	1.0	0.5
QL-1	0.5	1.0	1.0
QL-2	1.0	2.0	1.0
QL-3	2.0	5.0	2.0



**A High-density Pulse = High Density of Points = Highly Detailed Derived Products**

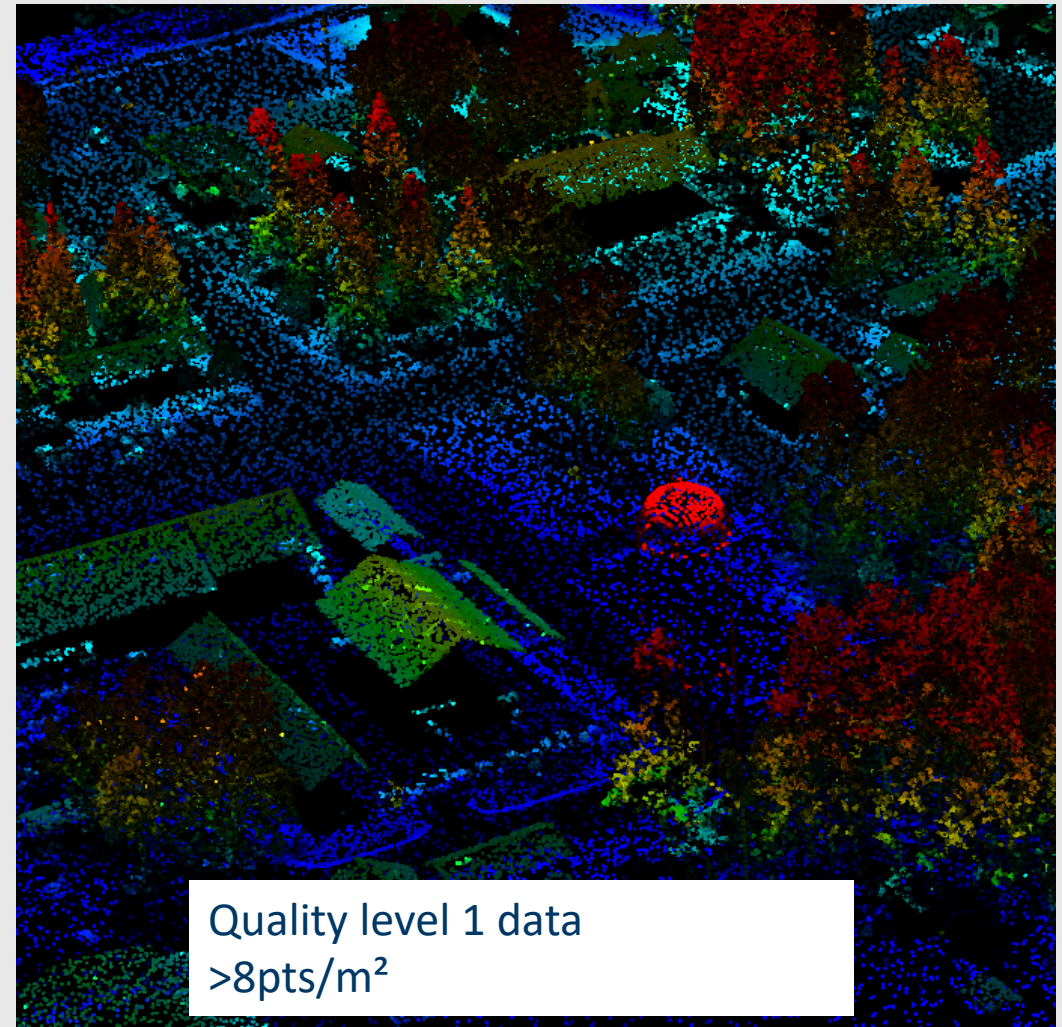
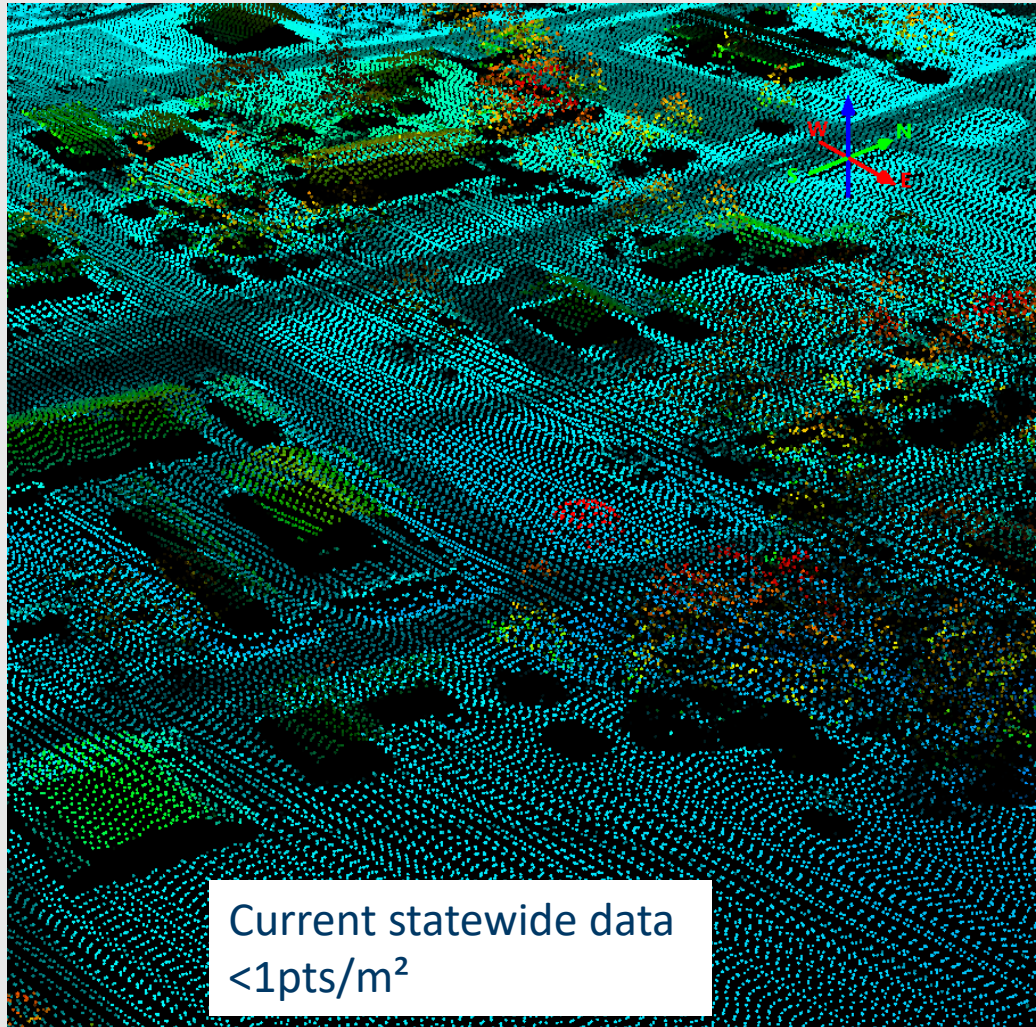
QL1 = 16 grid cells per one QL3 cell  
 QL1 = 2 additional contour lines for every one 2-foot contour

16X

2X

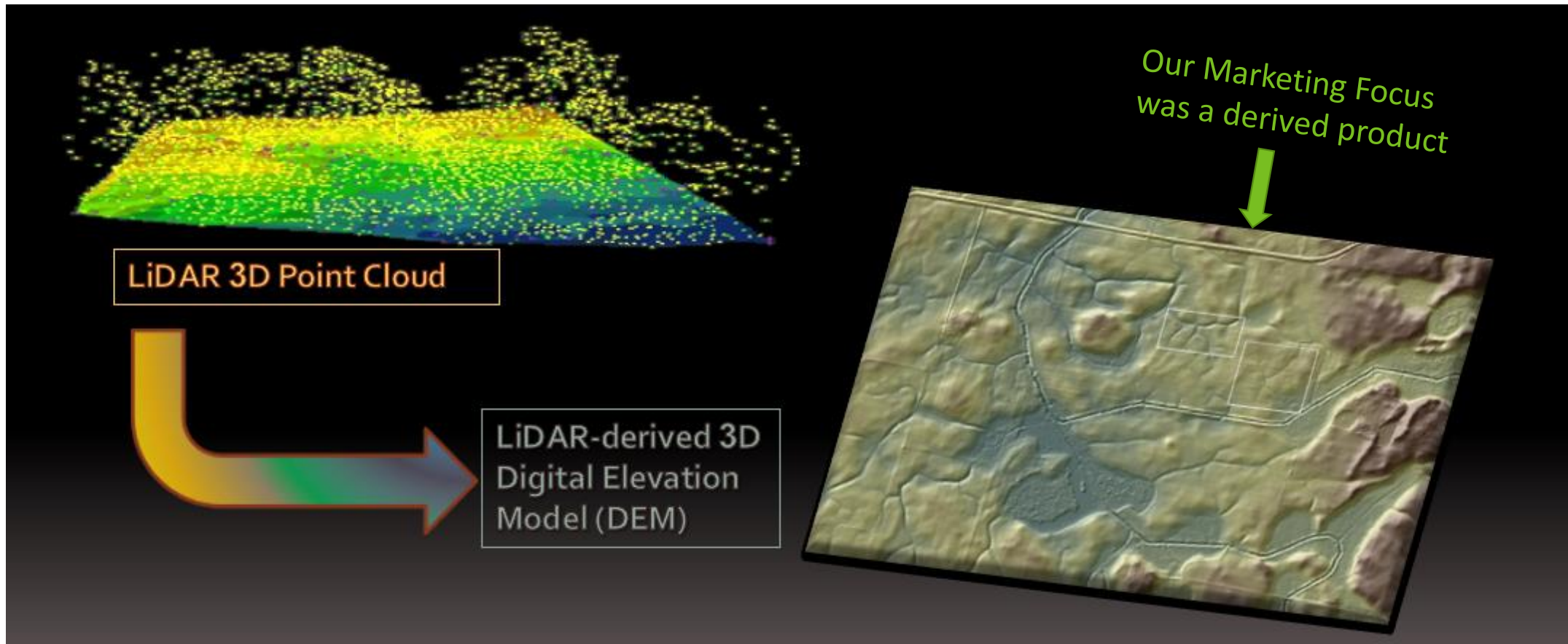
# “...but you already have Lidar”

## *Quality Matters*



# HD Lidar – Derived Products

## DIGITAL ELEVATION – The Catalyst for Minnesota’s Initial Lidar





# HD Lidar – Derived Products - Hydrology Example

## WATER CONVEYANCE LANDFORMS

Mapping the Unmapped



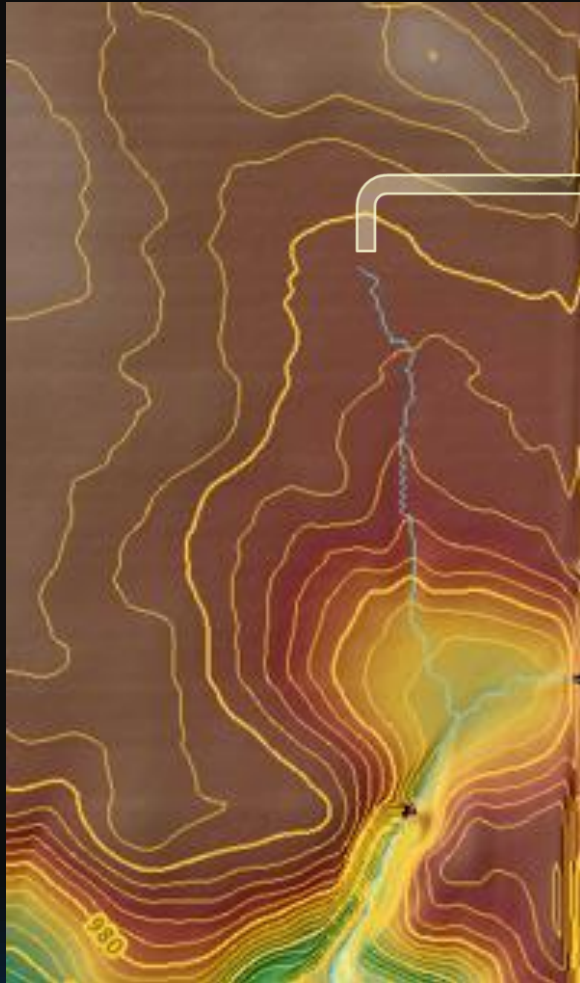
- Features of hydrologic Significance.

- Nickpoint
- Fluvial Processes
- Soil Degradation

- Where does the watercourse begin ?

- Where concentrated flow begins. LiDAR captures these landform.

We Model this with DEMs



■ Features of hydrologic Significance.

- Nickpoint
- Water Conveyance Landform

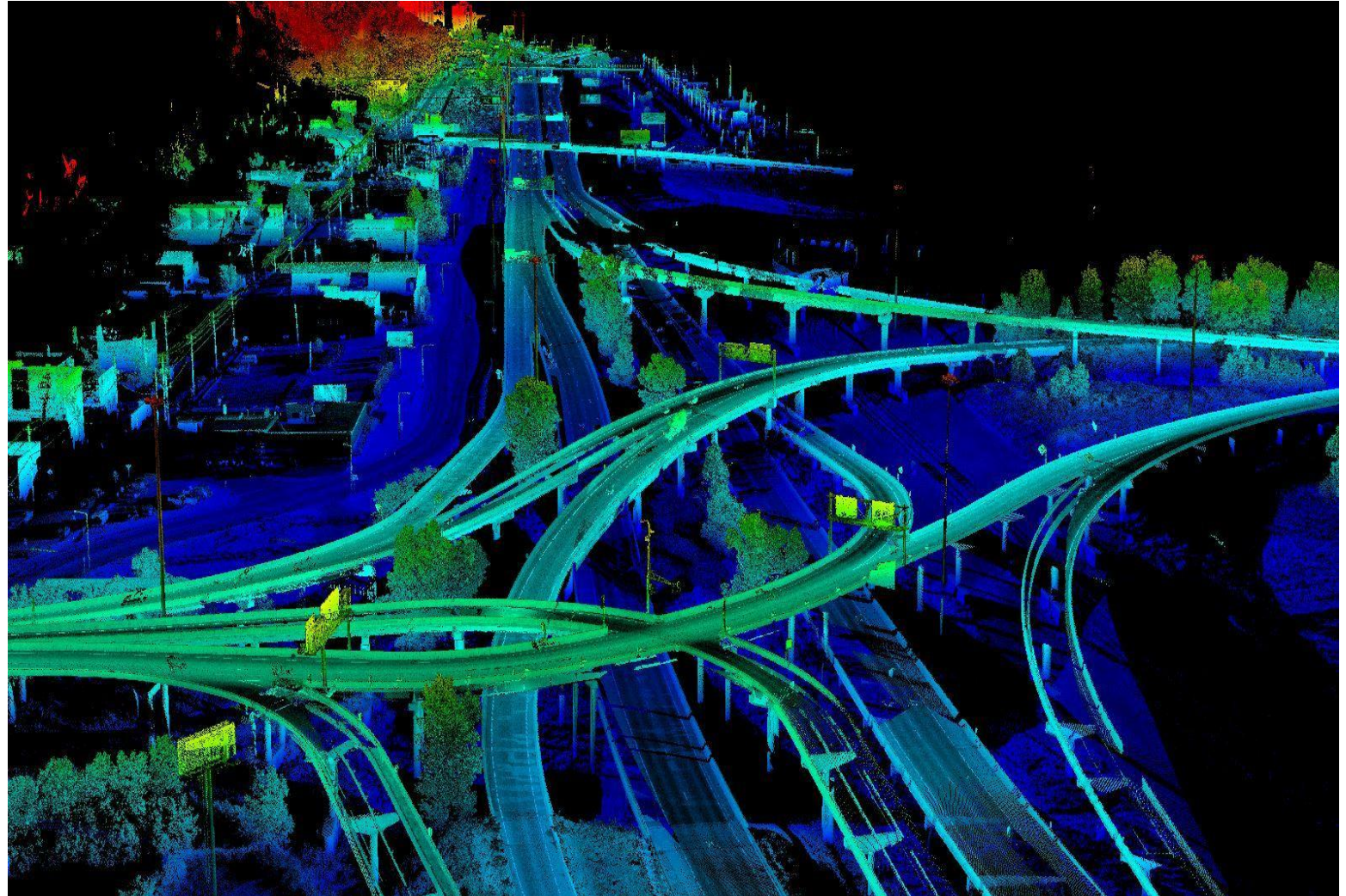
■ Where does the watercourse begin ?

- Where concentrated flow begins. LiDAR captures these landforms.

We Do this with Digital Elevation Models (DEM)

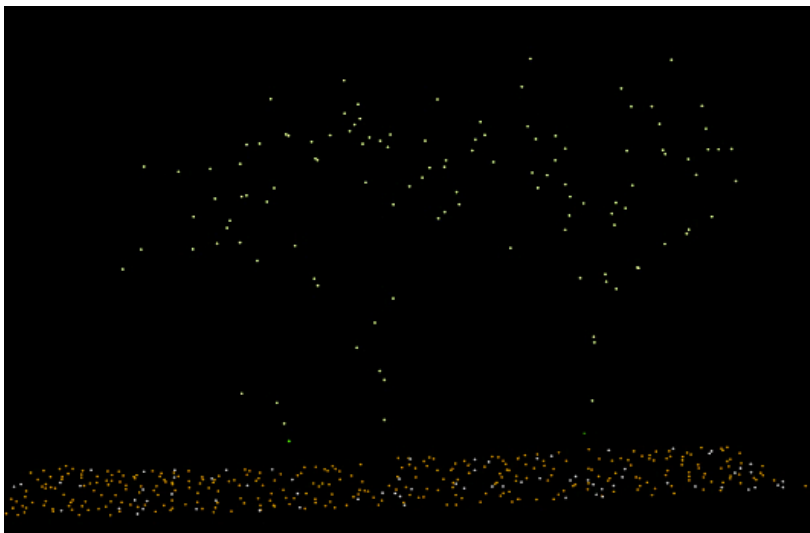
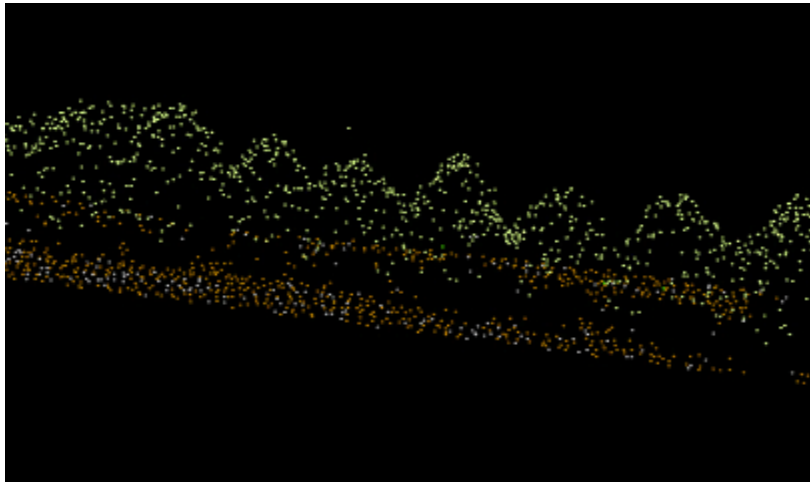
# HD Lidar Examples: Infrastructure

- Transportation
  - 3d Design
  - Traffic operations
  - Signing and striping
  - Highway safety
  - Maintenance
  - Asset management
- Energy
  - Traditional
  - Renewable/Alternative
- Cultural/Historical Resources

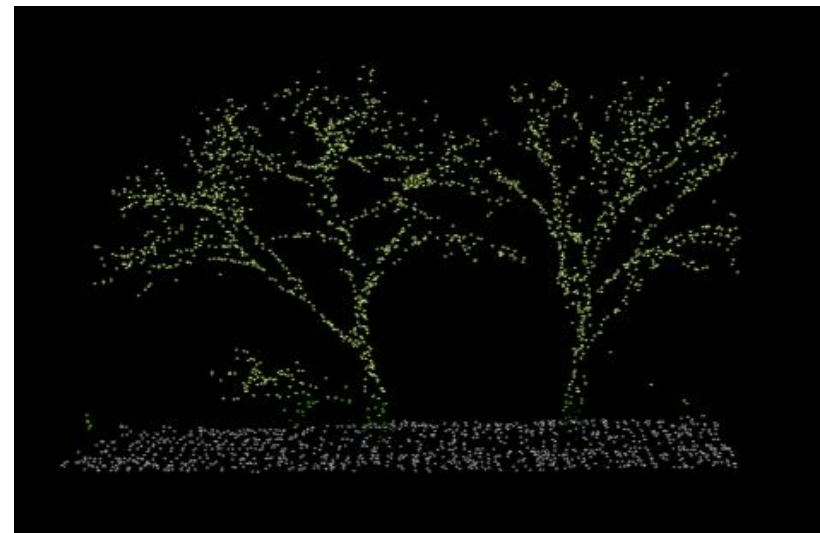
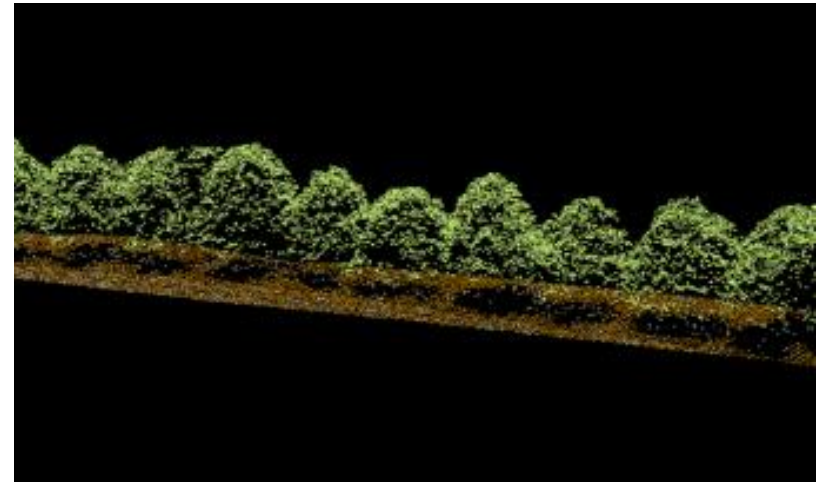


# HD Lidar Examples: Vegetation Mapping

Low Density (QL3, 1ppm)

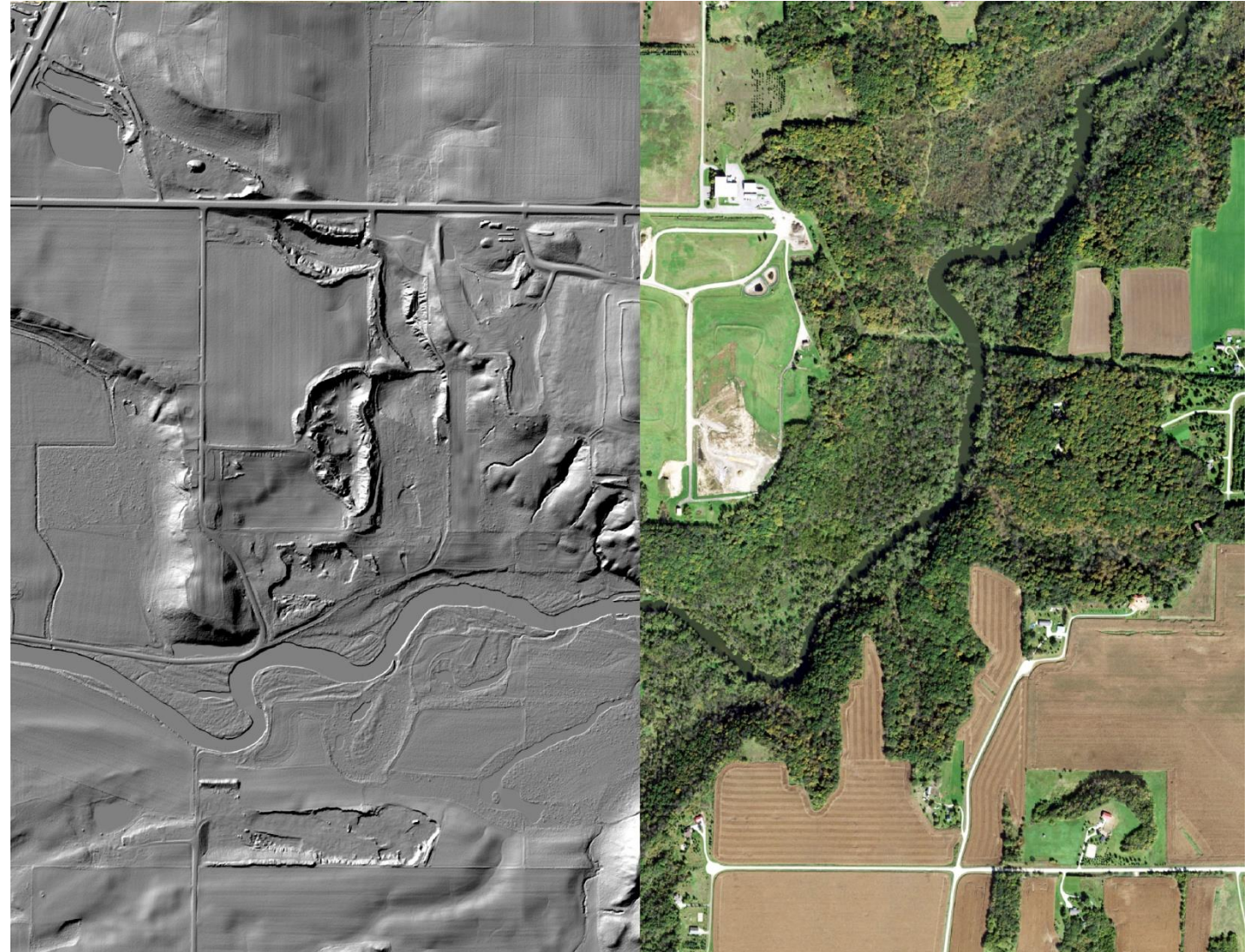


High Density (QL1, 8+ppm)



# HD Lidar Examples: Soil and Water

- Model **movement of water** on the landscape
- Key **building block** of modeling processes
- Identification of best management practices (**BMP**)
- Wetland and vegetation management



# HD Lidar Examples: Floodplain Mapping

## 2020 - Progressive Approach

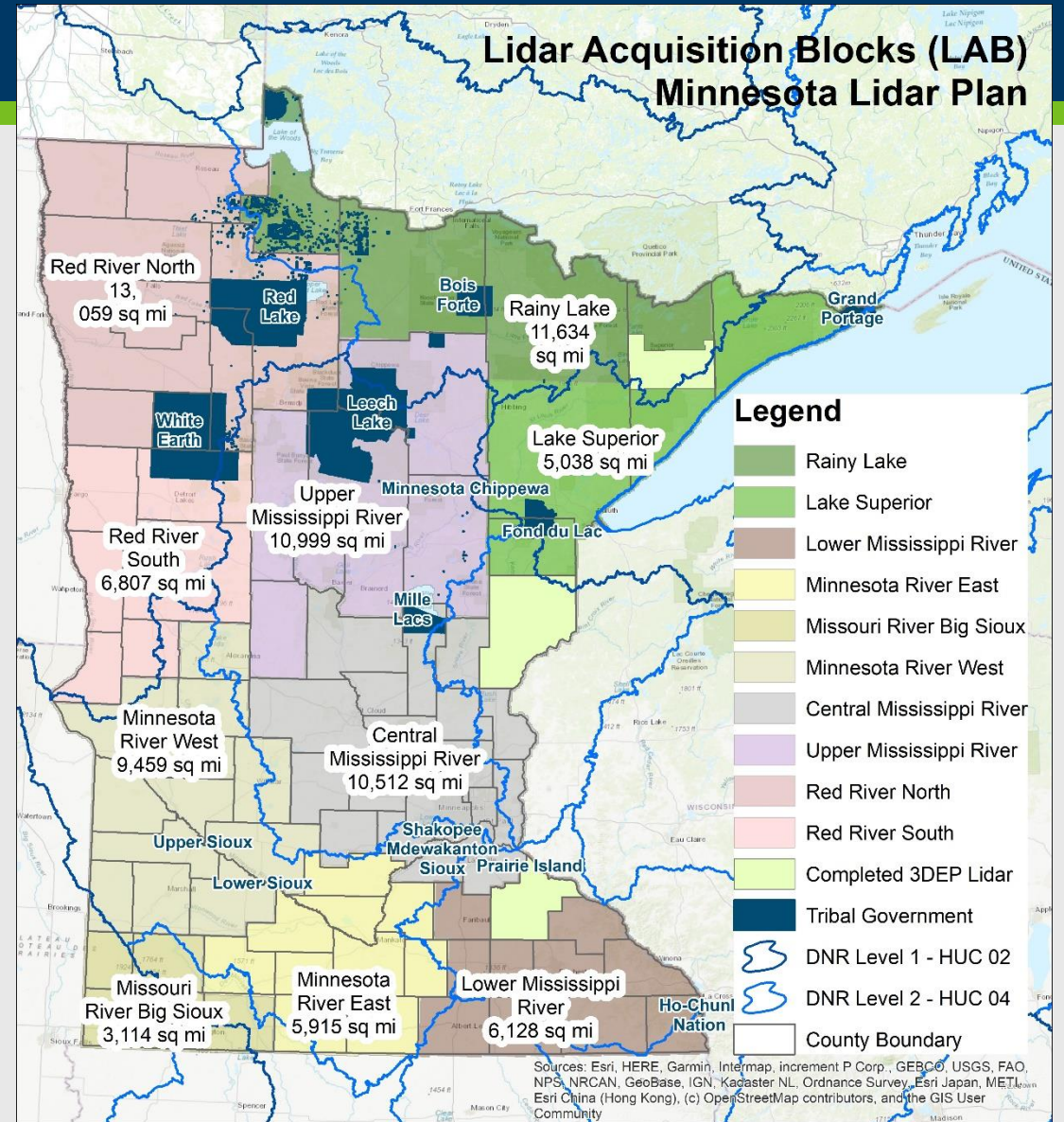
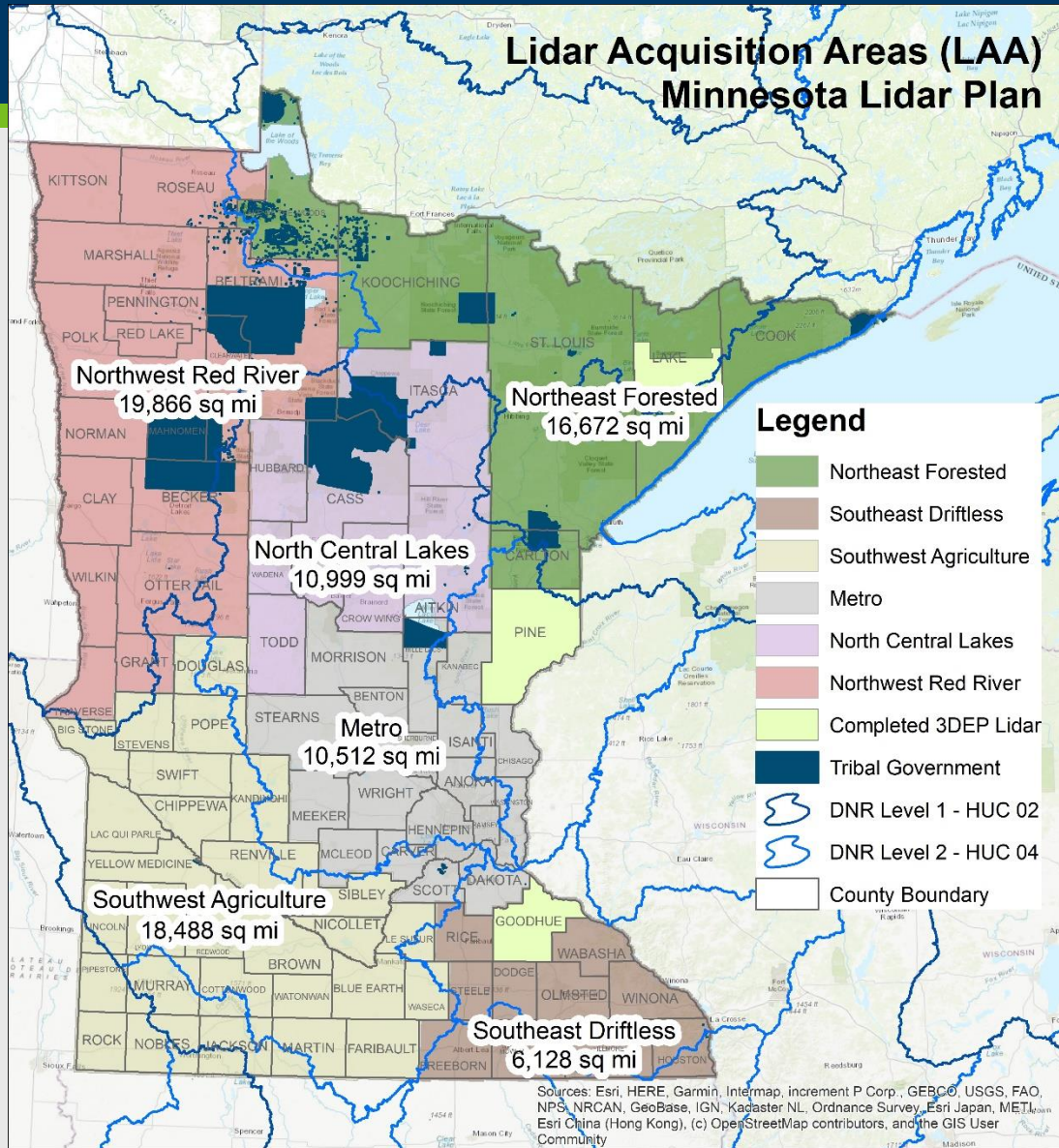
- We have an opportunity to be **proactive** and map this entire scene.
- New high density lidar not only maps this area of flood inundation but it **maps all the infrastructure assets** in the image.





*Where:*  
Next Lidar  
Collect

# Lidar Acquisition Areas and Blocks of Interest



Tribal boundaries data source:  
MnDOT, US Census Data Sept 2019



Map Date: Nov 16, 2020

Tribal boundaries data source:  
MnDOT, US Census Data Sept 2019



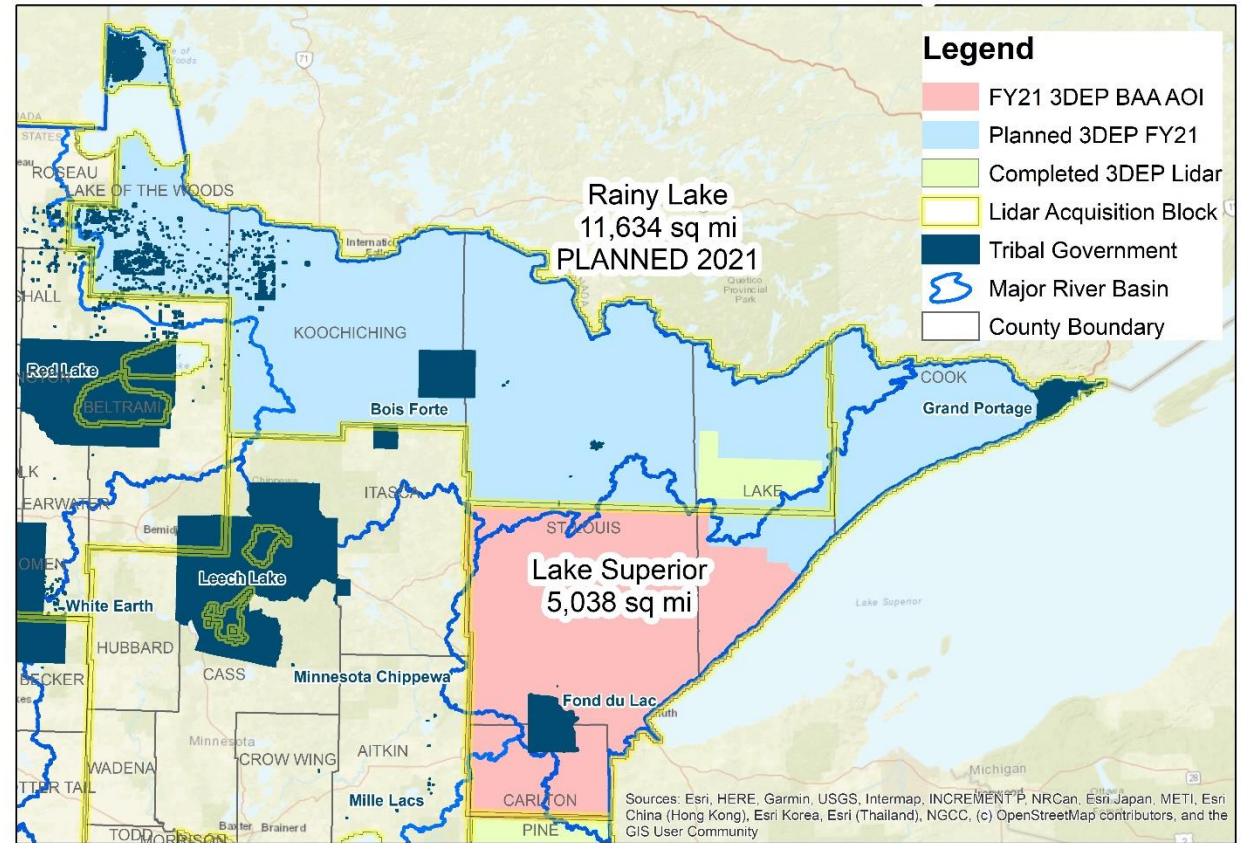
Map Date: Nov 16, 2020



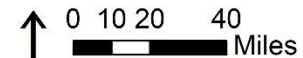
# What is happening now?

- Rainy Lake is funded!!
  - QL1 Lidar to be flown Spring 2021
- Lake Superior application was just submitted for Spring 2021 as well, with the following partners:
  - USGS, NRCS State and Federal Offices, MN DNR, MnDOT, MnGeo, Lake and St Louis Counties

Northeast MN - FY21 PROPOSED USGS 3DEP Lidar Acquisition Blocks



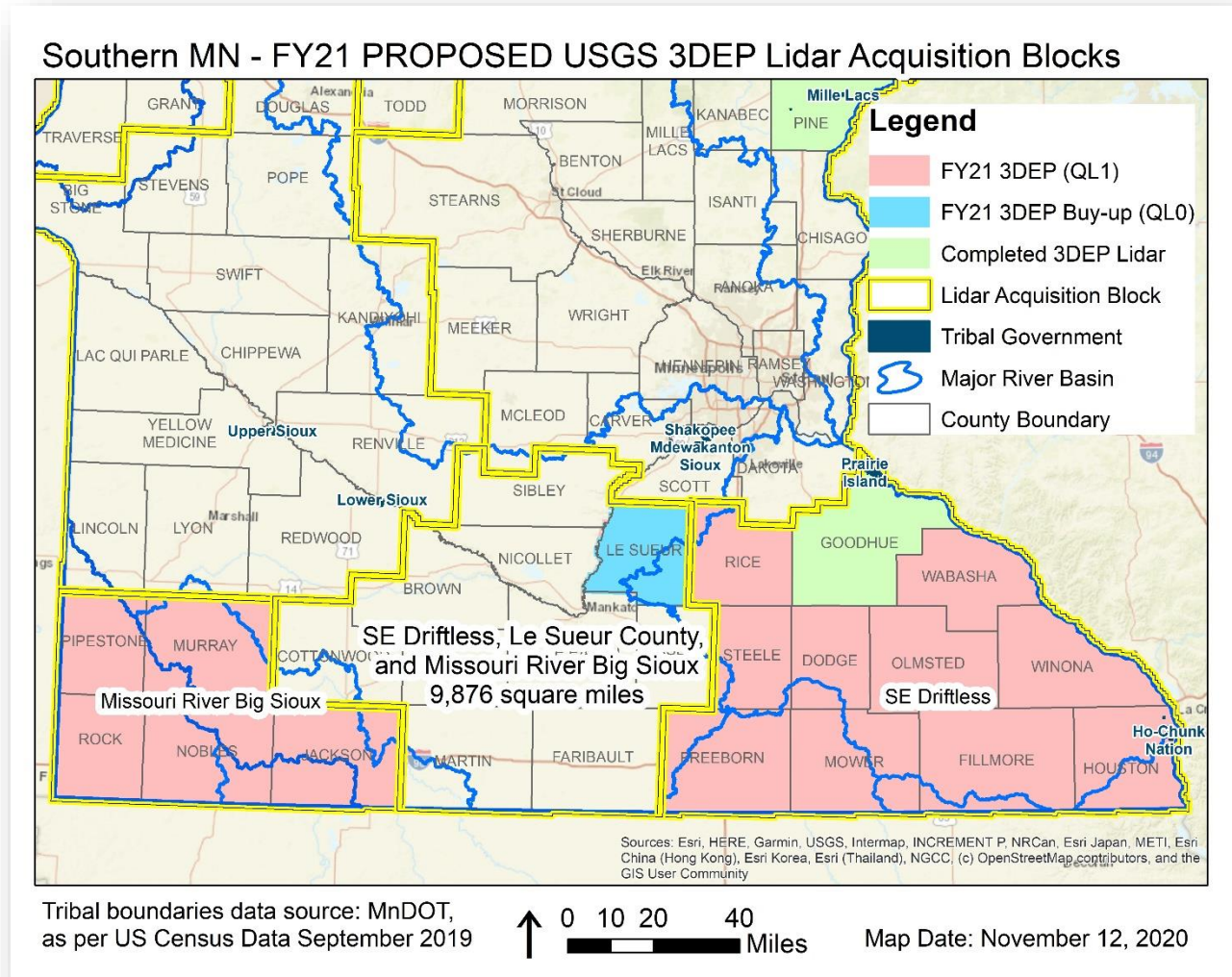
Tribal boundaries data source: MnDOT, as per US Census Data September 2019



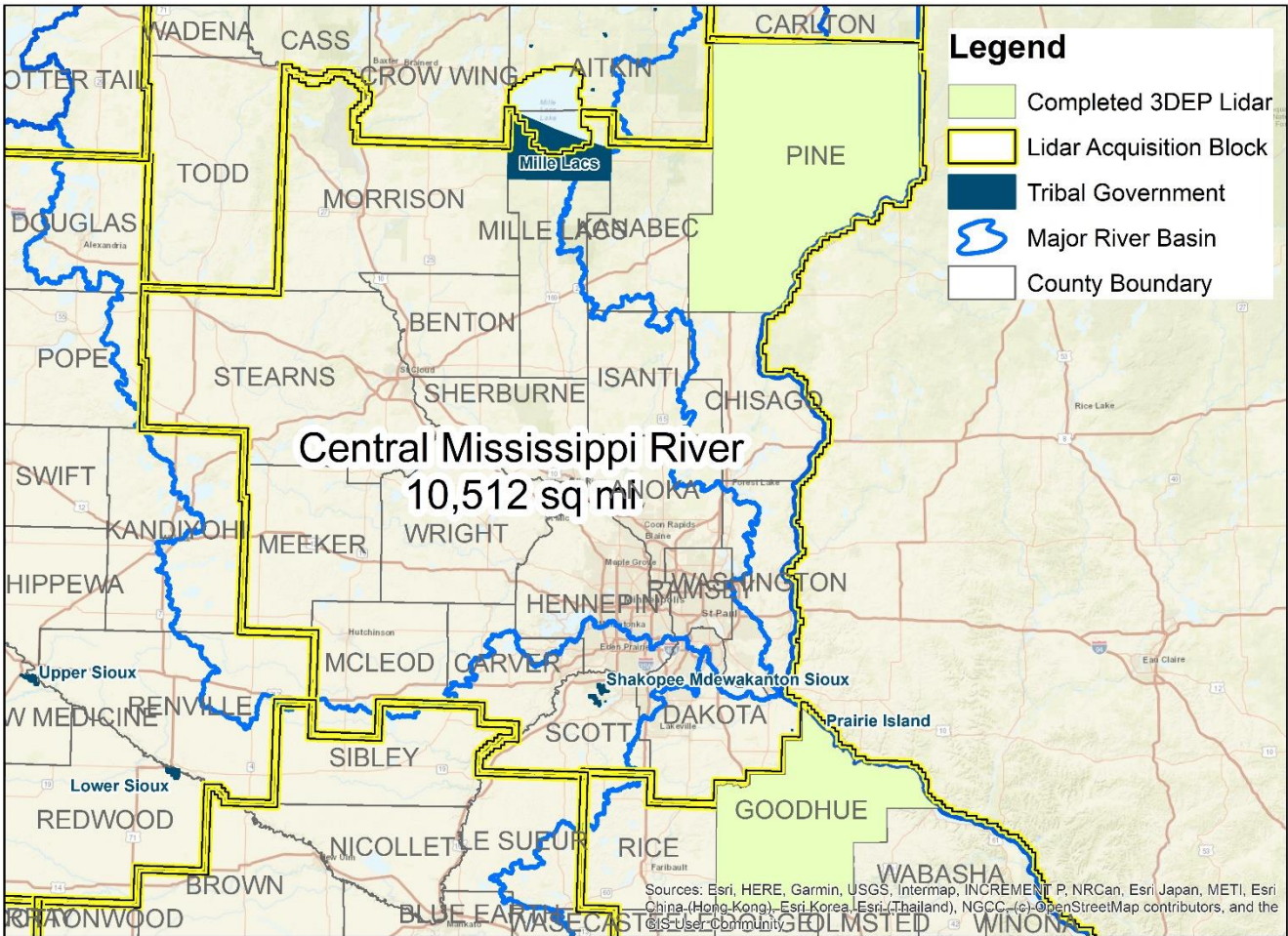
Map Date: November 12, 2020

# What is happening now?

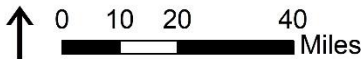
- Goodhue County successfully collected QL0 in Spring 2020!
- Pine County also has 3DEP lidar, QL2
- The SE Driftless, Le Sueur, and Missouri River Big Sioux block applications were submitted for Spring 2021, with the following partners:
  - USGS, NRCS State and Federal Offices, MnDOT, MnGeo, and Nobles, Le Sueur, Winona, and other partners



# Partners and Funds Needed: Central Mississippi River Lidar Acquisition Block



Tribal boundaries data source: MnDOT, as per US Census Data September 2019



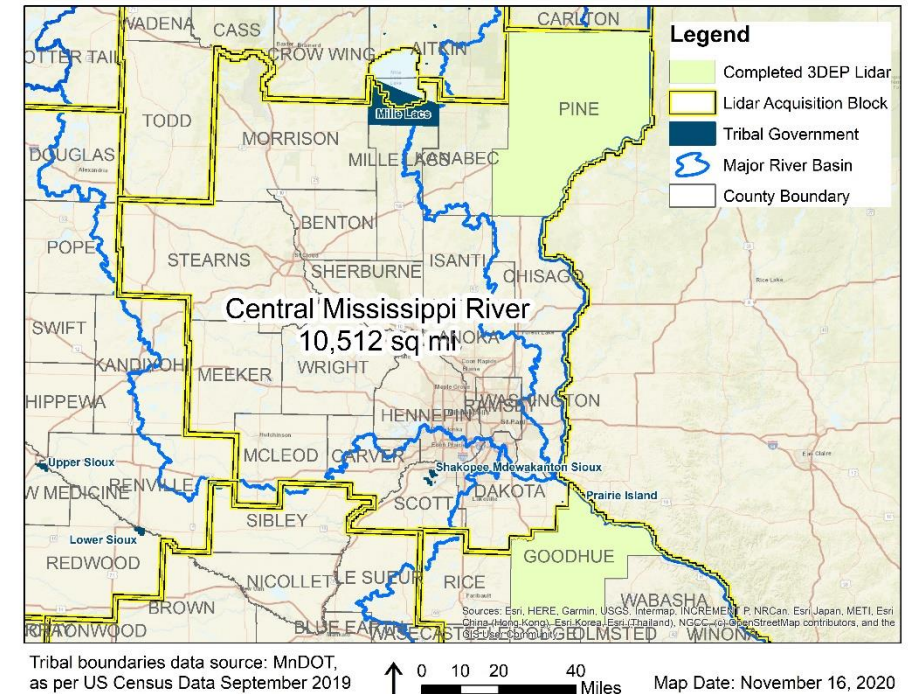
Map Date: November 16, 2020

Estimated USGS 3DEP Contribution		Total Partner Contributions Needed	
%	\$	%	\$
40%	\$1,362,355	60%	\$2,043,533
10,512 square miles at \$324 per square mile =			
<b>\$3,405,888 TOTAL</b>			

# Partners and Funds Needed: Central Mississippi River Lidar Acquisition Block

- TOTAL Est Funds Needed: \$ 3,405,888
- Estimated using \$324 per square mile for QL1
- 18 Counties\* - 10,512 square miles

Contributors	%	Average Per County	\$
USGS	40		1,362,355
Partners	60		2,043,533
LAB Counties	~ 30**	\$\$56,765	1,021,766
All Others	~ 30**		1,021,766
<b>Grand TOTAL</b>	<b>100</b>		<b>3,405,888</b>



\*Anoka, Benton, Carver, Chisago, Dakota, Hennepin, Isanti, Kanabec, McLeod, Meeker, Mille Lacs, Morrison, Ramsey, Scott, Sherburne, Stearns, Washington, Wright

\*\*This is an estimate, up to 30% of the TOTAL, and dependent on the Lidar Acquisition Block

A top-down view of a group of people's hands stacked in a circle, symbolizing teamwork and support. The hands are of various skin tones and are wearing different colored sleeves (beige, plaid, yellow, blue, light blue). One person is wearing a gold watch and several black beaded bracelets. The background is a wooden floor. A large, semi-transparent blue circle is overlaid on the right side of the image, containing the text.

*How:*  
You can Help

# 3DGeo & 3DEP – *Estimated* Timelines

## Phase 1 – Planning & Grant Application

- Outreach and Planning (ongoing) – now - Summer
- Plan Revisions, 3DEP Webinar – August
- BAA application preparation – September
- BAA application due – October/November
- BAA announcement – December/January

...continues on the next column (the next year)...

## Phase 2 – Data Acquisition & Delivery

- Funding Agreements, Statements of Work – Feb/March
- Survey in the field – March/April
- Acquisition – April/May (leaf off, snow free)
- Initial QA/QC – April/May
- Data Calibration and processing – 3-6 months
- Data QA/QC & Data distribution – 3-7 months

Total turnaround for an AOI = 20–26 months (from planning phase to data in-hand)  
PHASE 3 = derived products!

# Potential costs of lidar in Minnesota

Quality Level (QL)	Average Cost per mi2	Average Cost for Minnesota [millions]
QL-0	\$445	\$38.2
QL-1	\$340	\$29.4
QL-2	\$200	\$17.2
QL-3	\$175	\$13.9

# 3DEP Program - Lidar Products

## 3DEP (USGS Funded) Standard Deliverables

- QL1 Classified Point Cloud (minimum classification level)
- Digital Elevation Model (DEM/Bare-Earth Surface Raster)
- Lidar Swath Polygon
- Hydro-breaklines

- Metadata

- ✓ Collection Report
- ✓ Survey Report - of all ground survey data
- ✓ Flight Mission Report
- ✓ Processing Report – Calibration & Classification
- ✓ QA/QC Report – accuracy assessment
- ✓ Georeferenced polygon swaths
- ✓ Georeferenced polygon extents



# 3DEP Program - Lidar Products

## Possible Added Deliverables

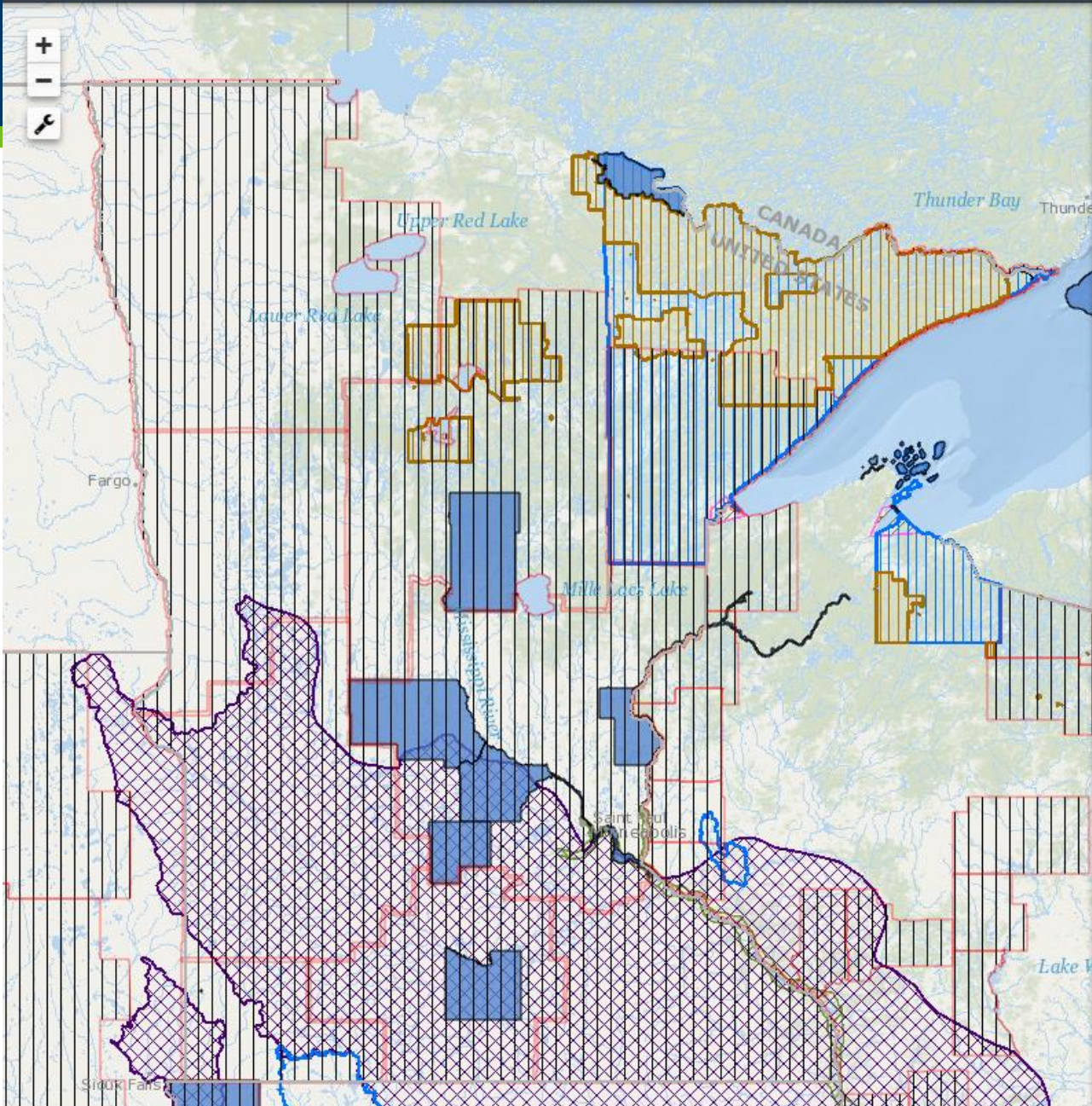
**Note: Not 3DEP funded deliverables but can be part of the 3DEP contract as a buy-ups with the 3DEP contract vendor**

- QLO Point Cloud
- Improved hydrographic products
  - ✓ Advanced hydro-modified DEM (Conditioned)
- Bare Earth point cloud
- Classification of high vegetation and buildings
- Intensity imagery, GeoTIFF

## State Agency Derived Products

**Publicly available data served as authoritative products for state agency distribution portals**

- 1-ft contour dataset
- Hillshaded DEM



Data Layers My Plans Participate

Data Layers Basemap Legend & Ordering

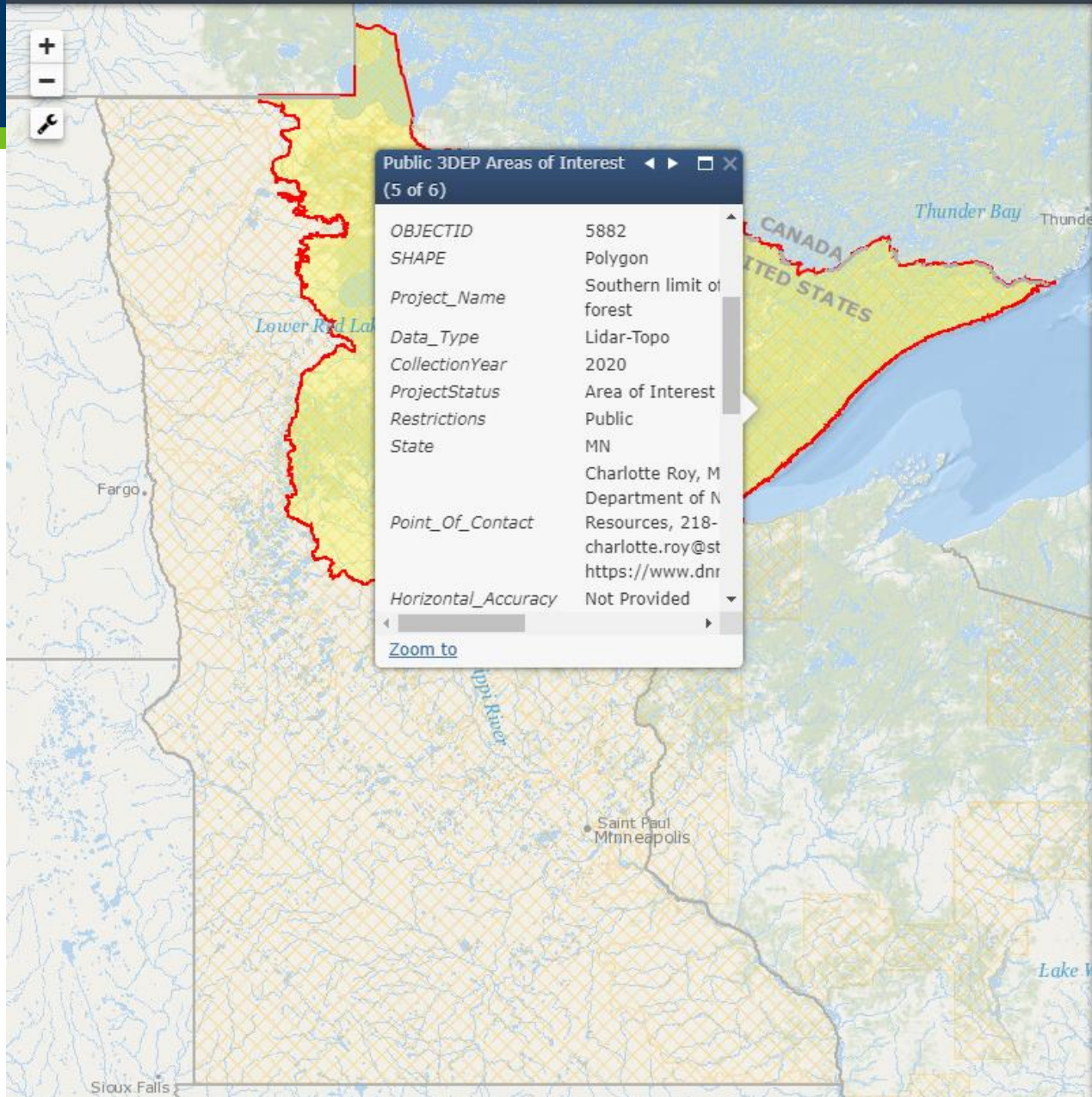
Search layers by name or keyword

Mapping Priorities: Proposed

- Topographic Lidar 3DEP Areas of Interest
  - Federal 3DEP Interests (1-3 yrs)
    - FWS 3DEP Areas of Interest
    - FEMA 3DEP Areas of Interest
    - NPS 3DEP Areas of Interest 2018
    - NRCS 3DEP Areas of Interest
    - NOAA Elevation Priorities 2020 Jun 2020
    - USACE 3DEP Areas of Interest FY20
    - USDAARS 3DEP Areas of Interest
    - USFS 3DEP Areas of Interest Jul 2020
    - USGS 3DEP Areas of Interest
  - State/Local/Academic/Other 3DEP Interests (1-3 yrs)
    - 3DEP Mapping Areas of Interest
    - Minnesota GAC Priorities May 2020
      - Minnesota GAC Southwest Agriculture Area May 2020
      - Minnesota GAC Southeast Driftless Area May 2020
      - Minnesota GAC Rainy Lake Block May 2020
      - Minnesota GAC Northwest Red River Basin Area May 2020
      - Minnesota GAC North Central Lakes Area May 2020
      - Minnesota GAC Metro Area May 2020
      - Minnesota GAC Lake Superior Block May 2020
  - Topobathymetric Lidar Areas of Interest
  - Acoustic/Sonar (bathy, etc.) Areas of Interest
  - Digital Imagery (Airborne/Satellite)
  - Other (eg. HTEM, DEM, CSCAP, EPA NCCA)

Mapping Projects: Planned (Funded) and Ongoing

- Topographic Lidar
  - FEMA Planned and Ongoing LiDAR Projects
  - NOAA OCM Maui County and Oahu AOlE FY20 Jan 2020



Data Layers

My Plans

Participate

Data Layers

Basemap

Legend & Ordering

Search layers by name or keyword

Mapping Priorities: Proposed

- Topographic Lidar 3DEP Areas of Interest
  - Federal 3DEP Interests (1-3 yrs)
    - FWS 3DEP Areas of Interest
    - FEMA 3DEP Areas of Interest
    - NPS 3DEP Areas of Interest 2018
    - NRCS 3DEP Areas of Interest
    - NOAA Elevation Priorities 2020 Jun 2020
    - USACE 3DEP Areas of Interest FY20
    - USFS 3DEP Areas of Interest Jun 2020
    - USDAARS 3DEP Areas of Interest
    - USGS 3DEP Areas of Interest
  - State/Local/Academic/Other 3DEP Interests (1-3 yrs)
    - 3DEP Mapping Areas of Interest
      - Minnesota GAC Priorities May 2020
        - Minnesota GAC Southwest Agriculture Area May 2020
        - Minnesota GAC Southeast Driftless Area May 2020
        - Minnesota GAC Rainy Lake Block May 2020
        - Minnesota GAC Northwest Red River Basin Area May 2020
      - Minnesota GAC North Central Lakes Area May 2020
      - Minnesota GAC Metro Area May 2020
      - Minnesota GAC Lake Superior Block May 2020
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- Digital Imagery (Airborne/Satellite)
- Other (eg. HTEM, DEM, CSCAP, EPA NCCA)

Mapping Projects: Planned (Funded) and Ongoing

- Topographic Lidar
- Topobathymetric Lidar

# Outreach and educational materials



## The 3D Elevation Program—Summary for Minnesota

### Introduction

Elevation data are essential to a broad range of applications, including forest resources management, wildlife and habitat management, national security, recreation, and many others. For the State of Minnesota, elevation data are critical for agriculture and precision farming, natural resources conservation, flood risk management, infrastructure and construction management, water supply and quality, coastal zone management, and other business uses. Today, high-quality light detection and ranging (lidar) data are the sources for creating elevation models and other elevation datasets. Federal, State, and local agencies work in partnership to (1) replace data, on a national basis, that are (on average) 30 years old and of lower quality and (2) provide coverage where publicly accessible data do not exist. A joint goal of State and Federal partners is to acquire consistent, statewide coverage to support existing and emerging applications enabled by lidar data. The new 3D Elevation Program (3DEP) initiative (Snyder, 2012a,b), managed by the U.S. Geological Survey (USGS), responds to the growing need for high-quality topographic data and a wide range of other three-dimensional representations of the Nation's natural and constructed features.

### 3D Elevation Program Benefits for Minnesota

The top 10 Minnesota business uses for 3D elevation data, which are based on the estimated annual benefits of the 3DEP initiative, are shown in table 1. National Enhanced Elevation Assessment (NEEA; Dewberry, 2011) survey respondents in the State of Minnesota estimated that

**3DEP in Minnesota by the Numbers**  
 Expected annual benefits \$13.64 million  
 Estimated total cost \$28.15 million  
 Payback 2.1 years  
 Quality level 1 buy-up \$17.91 million estimate

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

Rank	Business use	Annual benefits (\$ millions)
1	Agriculture and precision farming	56.90
2	Natural resources conservation	3.38
3	Flood risk management	1.10
4	Infrastructure and construction management	0.64
5	Water supply and quality	0.47
6	Coastal zone management	0.41
7	Forest resources management	0.33
8	Geologic resource assessment and hazard mitigation	0.15
9	Aviation navigation and safety	0.14
10	Renewable energy resources	0.07
	Other	0.03
	Total	13.62

U.S. Geological Survey  
 2280 Woodale Drive  
 Mounds View, MN 55112  
 Email: rvsned@usgs.gov  
<http://nationalmap.gov/3DEP/>

By William J. Carswell, Jr.



**Figure 1.** Map of Minnesota showing the areal extent and quality levels of planned and existing publicly available light detection and ranging (lidar) data in November 2012. No lidar data that meet 3DEP requirements for quality level 2 or better are publicly available for Minnesota. See Table 2 for quality levels.

the national 3DEP initiative would result in at least \$13 million in new benefits annually to the State. The cost for such a program in Minnesota is approximately \$28 million, resulting in a payback period of 2.1 years and a benefit-to-cost ratio of 3.9 to 1 over an 8-year period. Because monetary estimates were not provided for all reported benefits, the total benefits of the 3DEP to Minnesota are likely much higher. On the basis of the NEEA survey results, all levels of government and many organizations in Minnesota could benefit from access to statewide high-resolution elevation data.

The NEEA evaluated multiple data-collection programs to determine the optimal data quality and data replacement cycle relative to cost to meet the stated needs. For Minnesota, approximately 76 percent of the total benefits are realized in agriculture and precision farming and natural resources conservation uses alone, as shown in table 1. The status of publicly available lidar data in Minnesota is shown in figure 1. By enhancing coordination between the 3DEP and the various government and private organizations in Minnesota, it may be possible to meet a higher percentage of the needs.

### 3D Elevation Program

3DEP is a national program managed by the USGS to acquire high-resolution elevation data. The initiative is backed by a comprehensive assessment of requirements (Dewberry, 2011) and is in the early stages of implementation. 3DEP will improve data accuracy and provide more current data than is available in the National Elevation Dataset (NED). The goal of this high-priority cooperative program is to be operational by January 2015 and to have complete coverage of the United States by 2022, depending on funding and partnerships. The new program has the potential to generate \$13 billion/year in new benefits through improved government services, reductions in crop and homeowner losses resulting from floods, more efficient routing of vehicles, and a host of other government, corporate, and citizen activities (Dewberry, 2011).

### Benefits of a Funded National Program

- Economy of scale—Acquisition of data covering larger areas reduces costs by 25 percent.
- A systematic plan—Acquisition of data at a higher quality level reduces the cost of “buying up” to the highest levels needed by State and local governments.
- Higher quality data and national coverage—Ensure consistency for applications that span State and watershed boundaries and meet more needs, which results in increased benefits to citizens.
- Increase in Federal agency contributions—Reduces State and local partner contributions.
- Acquisition assistance—Provided through readily available contracts and published acquisition specifications.

Fact Sheet 2013-208  
 September 2013



## Minnesota Lidar Acquisition Plan Fact Sheet

### Background

The 3D Geomatics Committee (3DGeo) of the Minnesota Geospatial Advisory Council (GAC) is working closely with the Minnesota Geospatial Information Office (MnGeo) under Minnesota IT Services (MNIT) to engage the geospatial community in developing, promoting, and funding a statewide high-density (HD) lidar acquisition plan for Minnesota. Higher-density and higher-quality lidar will dramatically improve our ability to analyze the landscape in Minnesota, inventory public and private infrastructure and assets, and plan for current and future scenarios, in support of better decision making for our natural, cultural, and built environments.

- This will be a 5 year or longer effort with a grant request to the federal government each year.
- The plan covers acquisition of all lands within the state boundary - 86,943 square miles
- We are engaging partners in ,state, federal, regional, and local government, tribal nations, academia, non-profit, and private sectors to contribute to the plan and funding.
- We will be seeking funding from the federal government through a US Geological Survey (USGS) grant program called a broad agency announcement (BAA) managed under the USGS 3D Elevation Program (3DEP).
  - Federal cost share averages about 38% of the cost but can cover as much as 75% depending on needs of federal agencies
- MNIT/MnGeo is the principal for this year's grant application and would likely be the aggregator and distributor for the data products generated over the course of this project and beyond.

- Additional resources that can provide more information about upcoming plans for lidar in Minnesota:
- [Minnesota State Lidar Plan](#)
  - [Story Map](#) about the Minnesota State Lidar Plan

### Benefits

Expected annual benefits are \$13.64 million. Based on an estimated total acquisition cost of \$34.8 million for quality level 1 data, the payback would be 2.6 years. The top 10 Minnesota business uses for 3D elevation data, which are based on the estimated annual benefits of the 3DEP initiative, are shown in the table-1 below.

Rank	Business use	Annual benefits (\$ millions)
1	Agriculture and precision farming	56.90
2	Natural resources conservation	3.38
3	Flood risk management	1.10
4	Infrastructure and construction management	0.64
5	Water supply and quality	0.47
6	Coastal zone management	0.41
7	Forest resources management	0.33
8	Geologic resource assessment and hazard mitigation	0.15
9	Aviation navigation and safety	0.14
10	Renewable energy resources	0.07
	Other	0.03
	Total	13.62

Table 1 - Estimated Annual Benefits of Lidar, Source: National Enhanced Elevation Assessment for Minnesota (Dewberry, 2011)

### Identified

#### Natural Res

- Fish
- Wet
- Nat
- Wild
- Fish
- Wild

#### Agriculture

- Prec
- Run

#### Transport

- 3D
- Tra
- Sign
- High
- Mar
- Bos

#### Water Resou

- Wat
- Riv
- Coa
- Flo
- Sea
- Cuk
- Hyd

#### Recreation

- Tra
- Lan

#### Risks

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As customers of government agencies, citizens expect spatial data mapping of building placement, flood modeling, and water features are in harmony with the imagery on their phone. When agency data is out of date and at lesser resolution the bond of trust between the citizen and the agency providing services is broken.



## Minnesota State Lidar Plan – Announcement



**Overview**  
 The Minnesota 3D Geomatics Committee and the State Geospatial Information Office, MnGeo, have developed a draft Lidar Plan for the State of Minnesota that will help guide the acquisition of new statewide lidar data over the next five years.

**Need for Lidar**  
 Lidar data pro making for ass to save costs in infrastructure, forestry. Lidar a multitude of

**Call to Action**  
 Please contact us for more on the State Lidar Plan.  
 • Identify and share requirements and business use cases  
 • Provide your desired areas of interest and product needs  
 • Let us know if you can help provide matching funds  
 • Check out the draft State Lidar Plan and StoryMap on the web

**Get Involved!**  
 • Let us know if you can help  
 • Share requirements and business use cases  
 • Provide areas of interest and product needs

**The Draft Minnesota State Lidar Plan**  
 An introduction to lidar, how it is used in Minnesota, and the Minnesota State Lidar Plan.

<http://bit.ly/MnLidarPlanStoryMap>



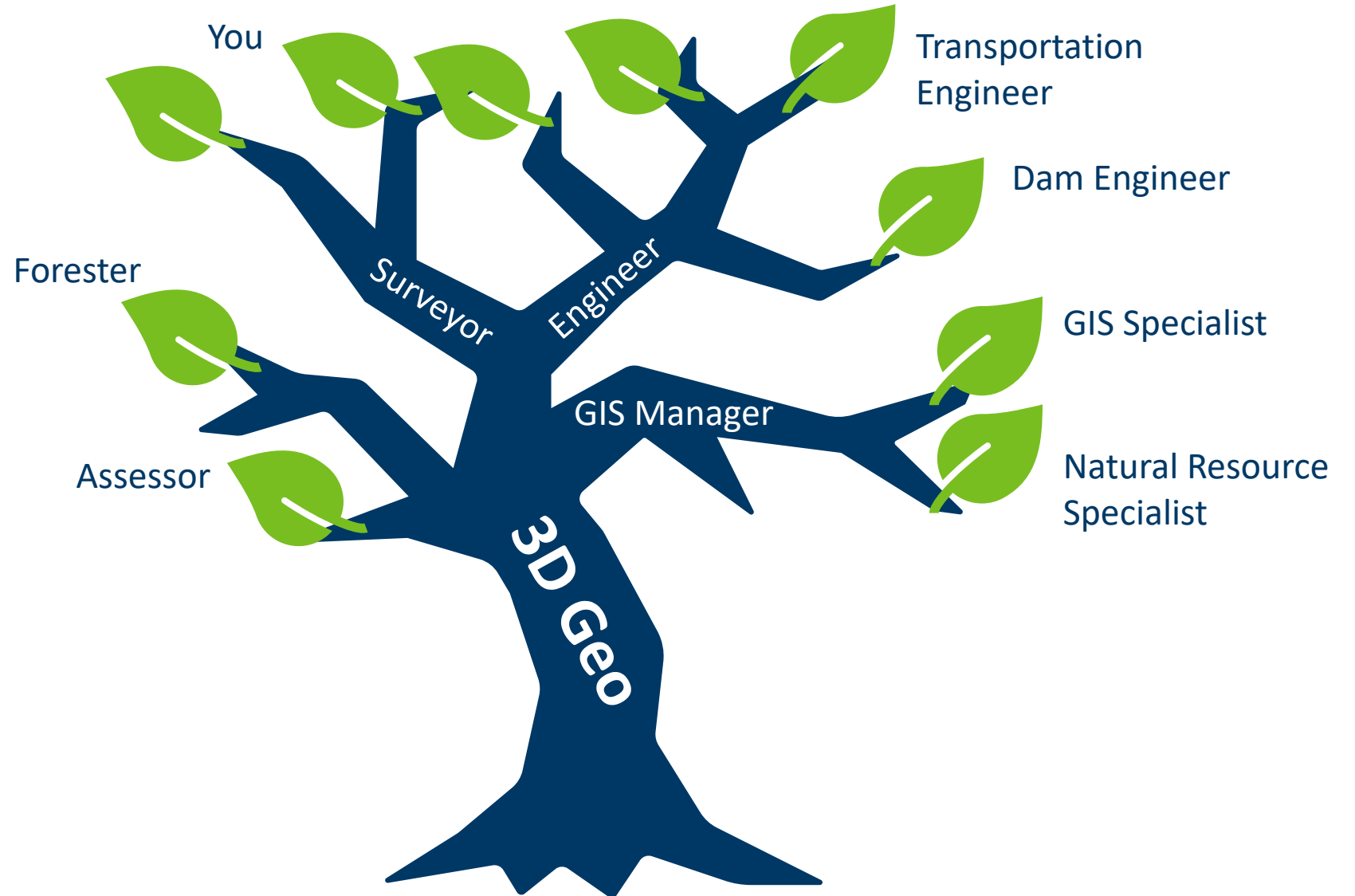
Get Involved! Contact <https://www.mngeo.state.mn.us/committee/3dgeo/>

# Next steps

You don't have to have money or be a decision maker to be a stakeholder . . .

You can be a voice of support . . .

A collaborator



## We need partners to help fund lidar acquisition!

- Check out the Minnesota Plan & StoryMap
- Stay in touch
  - Get on the Minnesota GIS News GovDelivery list
    - <https://www.mngeo.state.mn.us/newsletter.html>
  - Email 3DGeo
    - [lidar@state.mn.us](mailto:lidar@state.mn.us)
- Openly discuss the need for new lidar with managers and decision makers.



# Additional Resources



## Minnesota Lidar Plan

[https://www.mngeo.state.mn.us/committee/3dgeo/acquisition/Minnesota\\_State\\_Lidar\\_Plan.pdf](https://www.mngeo.state.mn.us/committee/3dgeo/acquisition/Minnesota_State_Lidar_Plan.pdf)

## Story Map about the Minnesota Lidar Plan

<http://bit.ly/MnLidarPlanStoryMap>



*Questions &  
Discussion*