Montana Lidar Plan

Troy Blandford

Montana State Library

Measure Distance

Think sonar . . .

Think radar . . .

Think rangefinder . . .

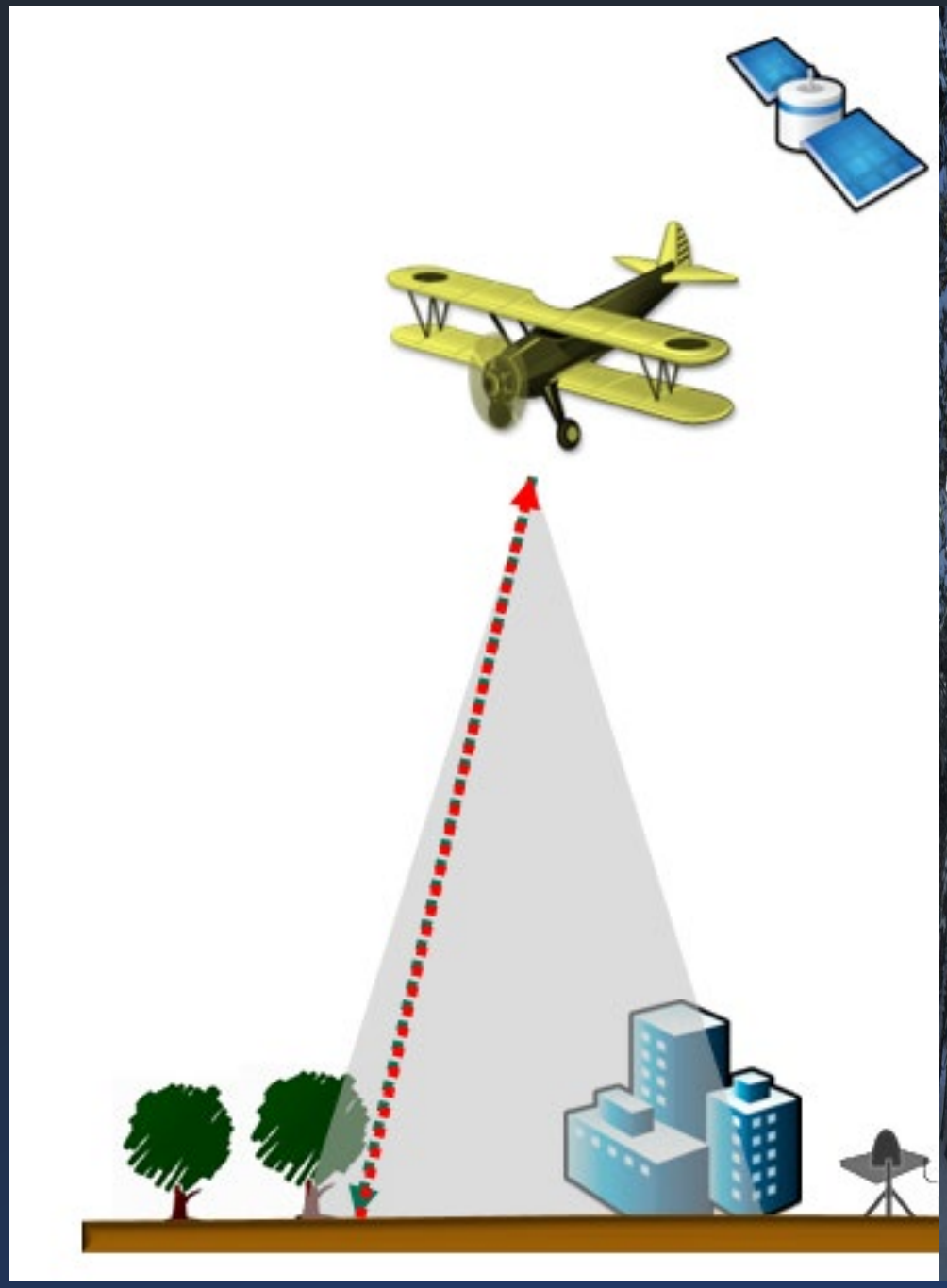
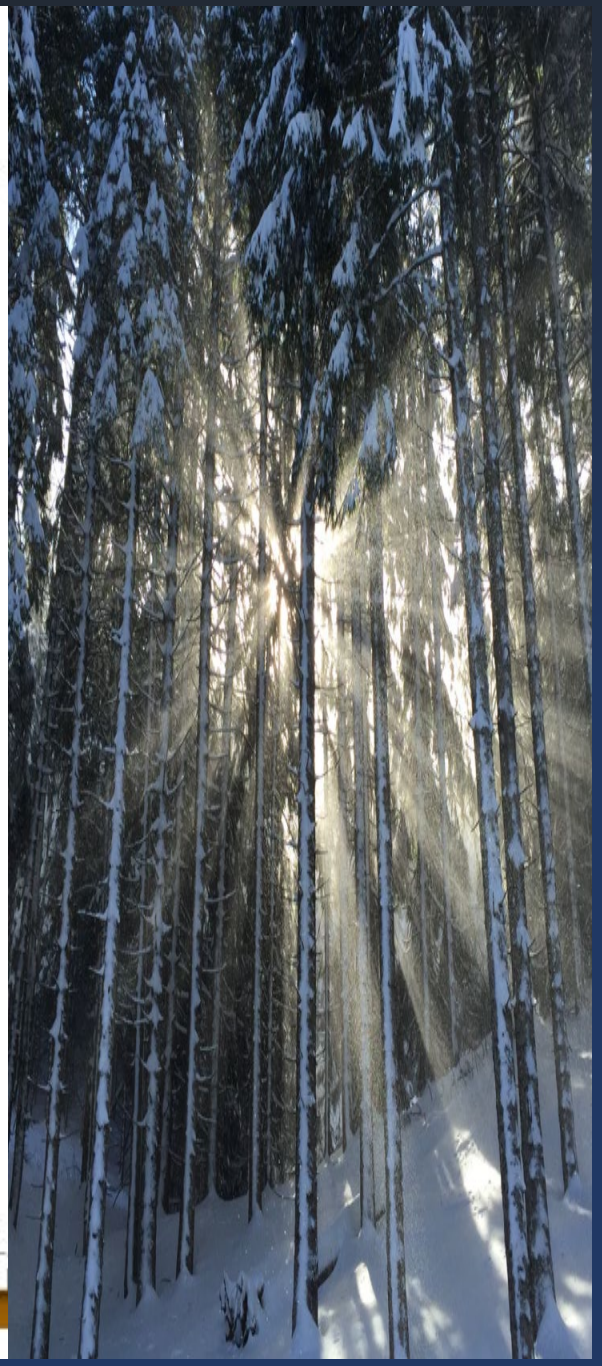
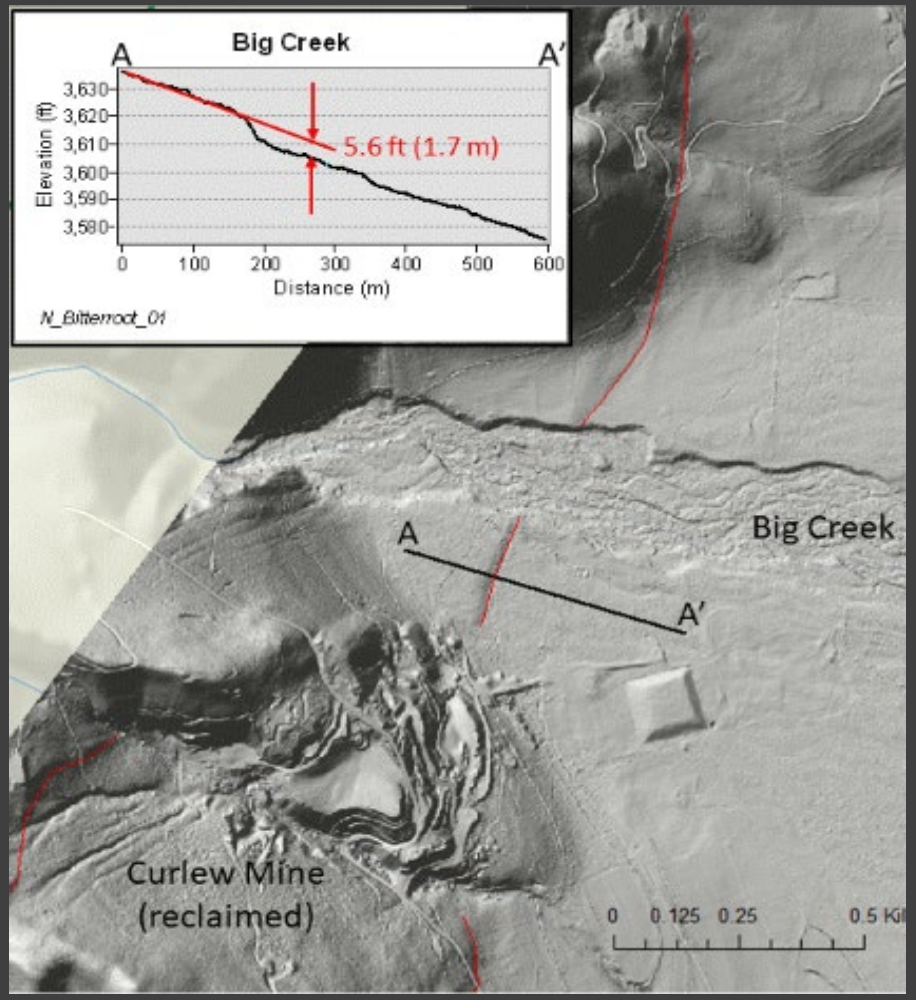
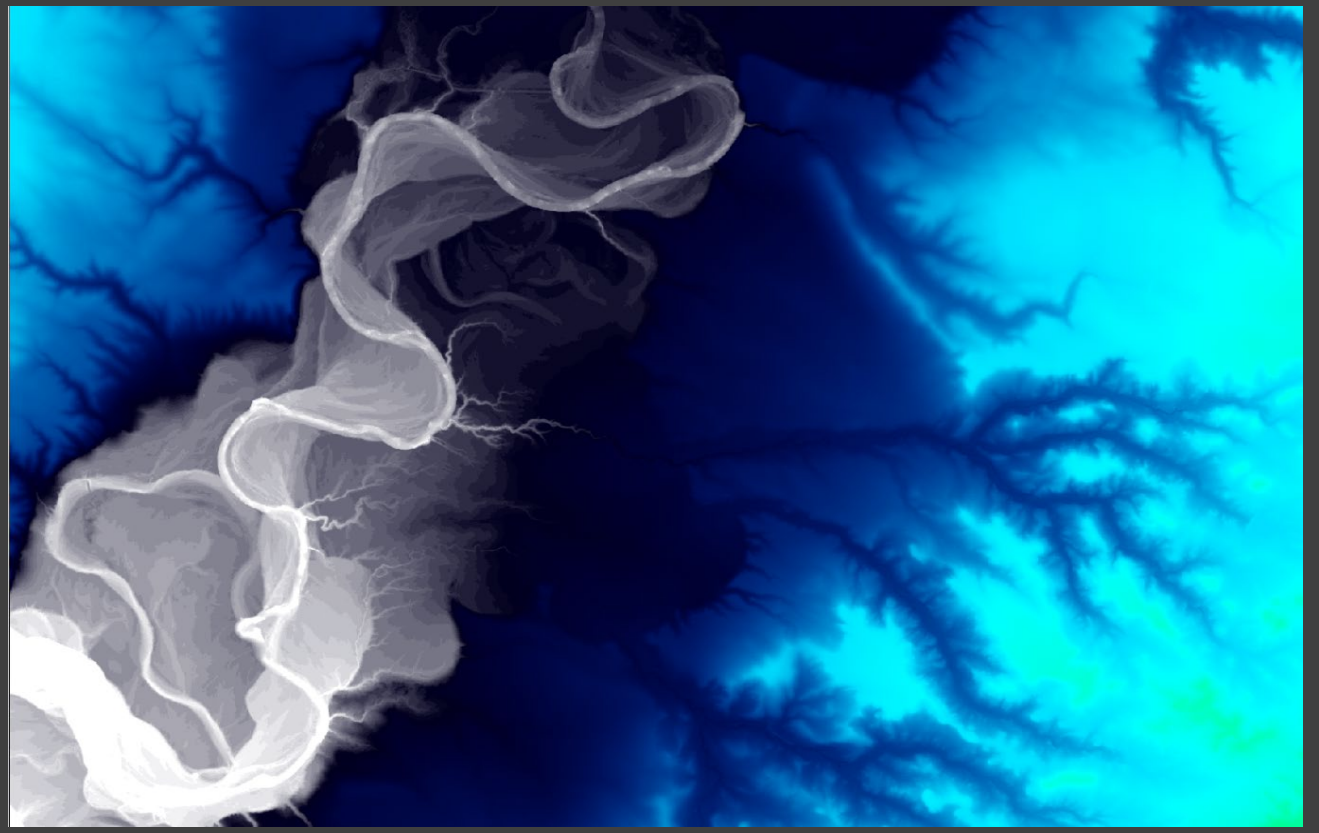
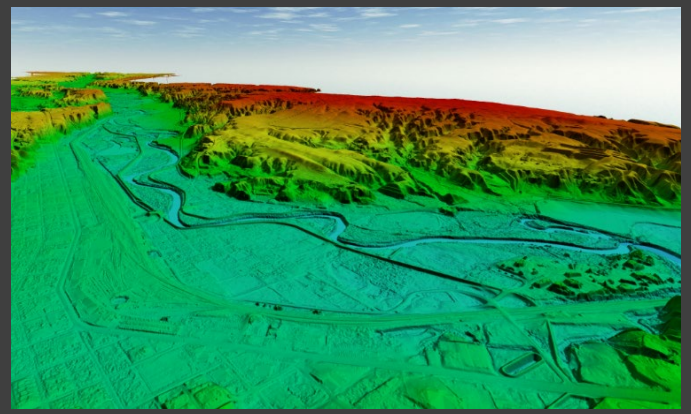


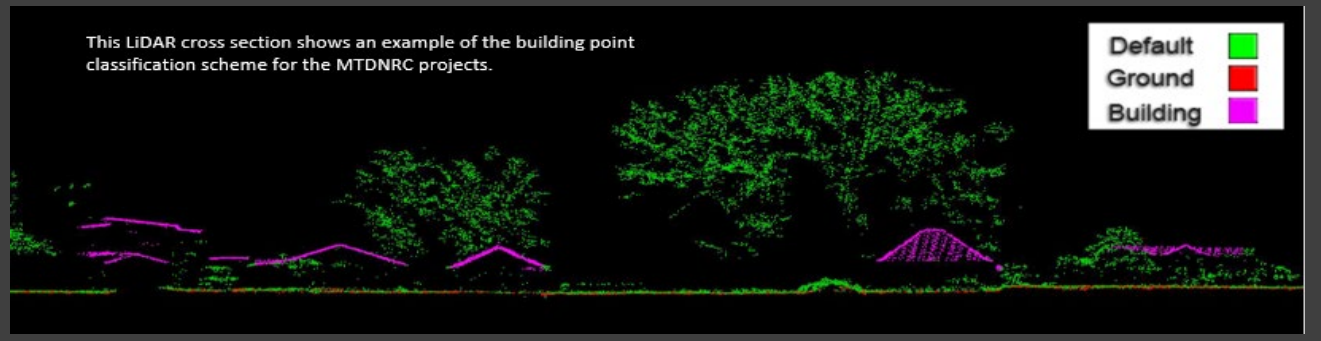
Image from ESRI ArcGIS Desktop Help

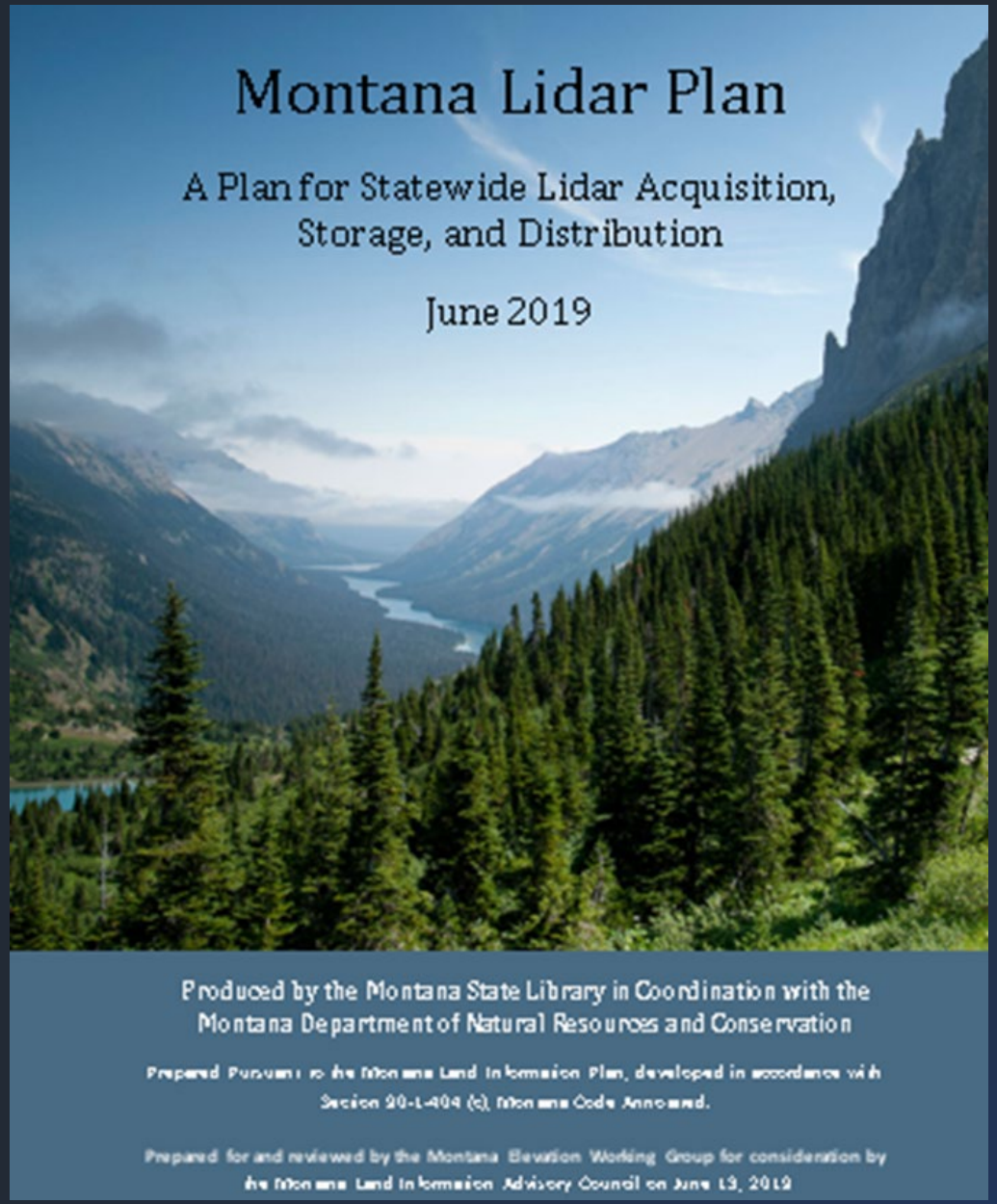



Big Creek
A
A'
3,630
3,620
3,610
3,600
3,590
3,580
Elevation (ft)
5.6 ft (1.7 m)
0
100
200
300
400
500
600
Distance (m)
N_Bitterroot_01
A
A'
Big Creek
Curlew Mine
(reclaimed)
0
0.125
0.25
0.5 Ki






This LiDAR cross section shows an example of the building point classification scheme for the MTDNRC projects.
Default
Ground
Building



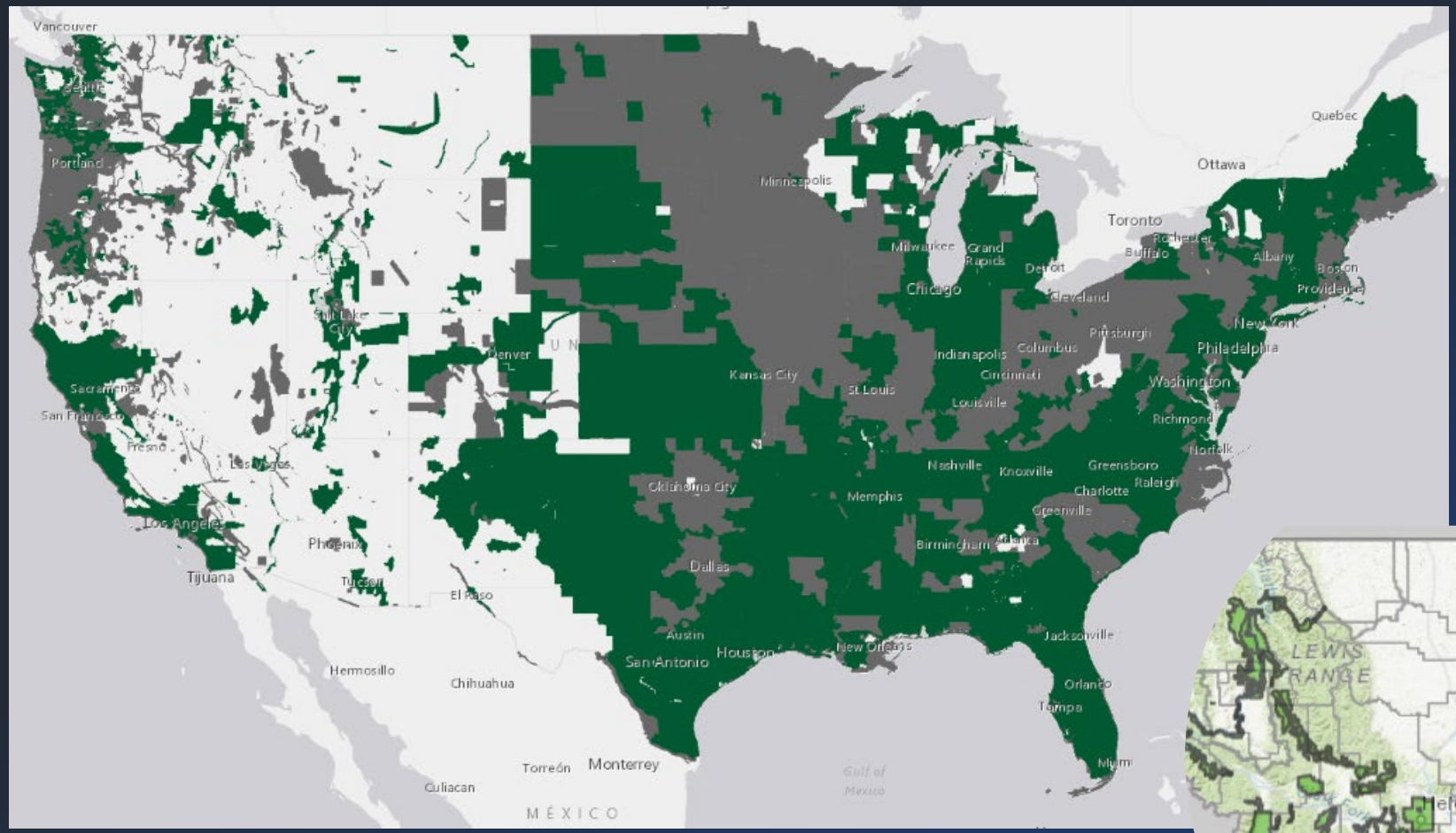
PURPOSE

Provide recommendations for the collection, maintenance, and dissemination of lidar data in Montana. The goal of the plan is statewide lidar coverage by the end of 2023.

States with a plan are in the best position to leverage funding opportunities and achieve statewide lidar coverage.

PROBLEM STATEMENT

- Lidar coverage is woefully incomplete in the West.



Gray = lidar of any quality

Green = lidar meeting USGS Specs.

Montana Lidar Coverage

Description	Square Miles	Percent of MT Total Area
Existing lidar coverage, any quality and any collection date	47,000	32%
Existing lidar coverage meeting USGS baseline specifications (QL2 or better)	42,000	28%
Existing lidar coverage that has become dated (more than 10 years old, 2008)	500	< 1%
Overlapping acquisitions	2,000	< 1%
Lidar needed to reach the goal of the Montana Lidar Plan (complete coverage)	100,000	68%

MONTANA STAKEHOLDER LIDAR USES

1. terrain modeling, ski slopes, new ski areas
2. snow avalanche hazard mapping
3. flood risk mapping
4. better contour maps needed
5. transportation and sidewalk design
6. building footprints
7. locating/preserving cultural resources
8. hydrologic modeling
9. public works
10. inundation mapping during
11. geologic and natural hazards mapping
12. seismic analysis/risk mapping
13. modeling for groundwater development
14. water resources investigations and modeling
15. mapping surface water structures database
16. control point database
17. education and training
18. earth sciences research
19. geophysical engineering
20. landslides
21. water quality modeling
22. engineering and design
23. remediation
24. mining and reclamation
25. landfill and waste management
26. archeology and cultural resources
27. superfund sites
28. stormwater modeling
29. wetland mapping
30. disaster response
33. mapping of riverine areas
34. dam and levee safety
35. state forest health
36. fire risk/fuels
37. natural resources damage r
38 geophysical properties to su
39 transportation and infrastru
40 bridge design and construct
41 stormwater modeling
42 cut and fill analysis
43 fish and wildlife habitat ma
44 land cover mapping
45 Tribal resiliency planning
46 storm water infrastructure
47 tribal transportation planni
48 surveying
49 energy siting *(assumed use)*
50 tree assessment/removal *(a*
51 vegetation structure mappi
52 watershed boundary deline
53 conservation planning
54 water resources manageme
55 infrastructure design, const
56 survey and ground modelin
57 water supply: municipal, ru
58 renewable energy – wind
59 height, shape, and height to
60 wildlife movement corridors

NOT AN EXHAUSTIVE LIST

STAKEHOLDERS AND COORDINATION

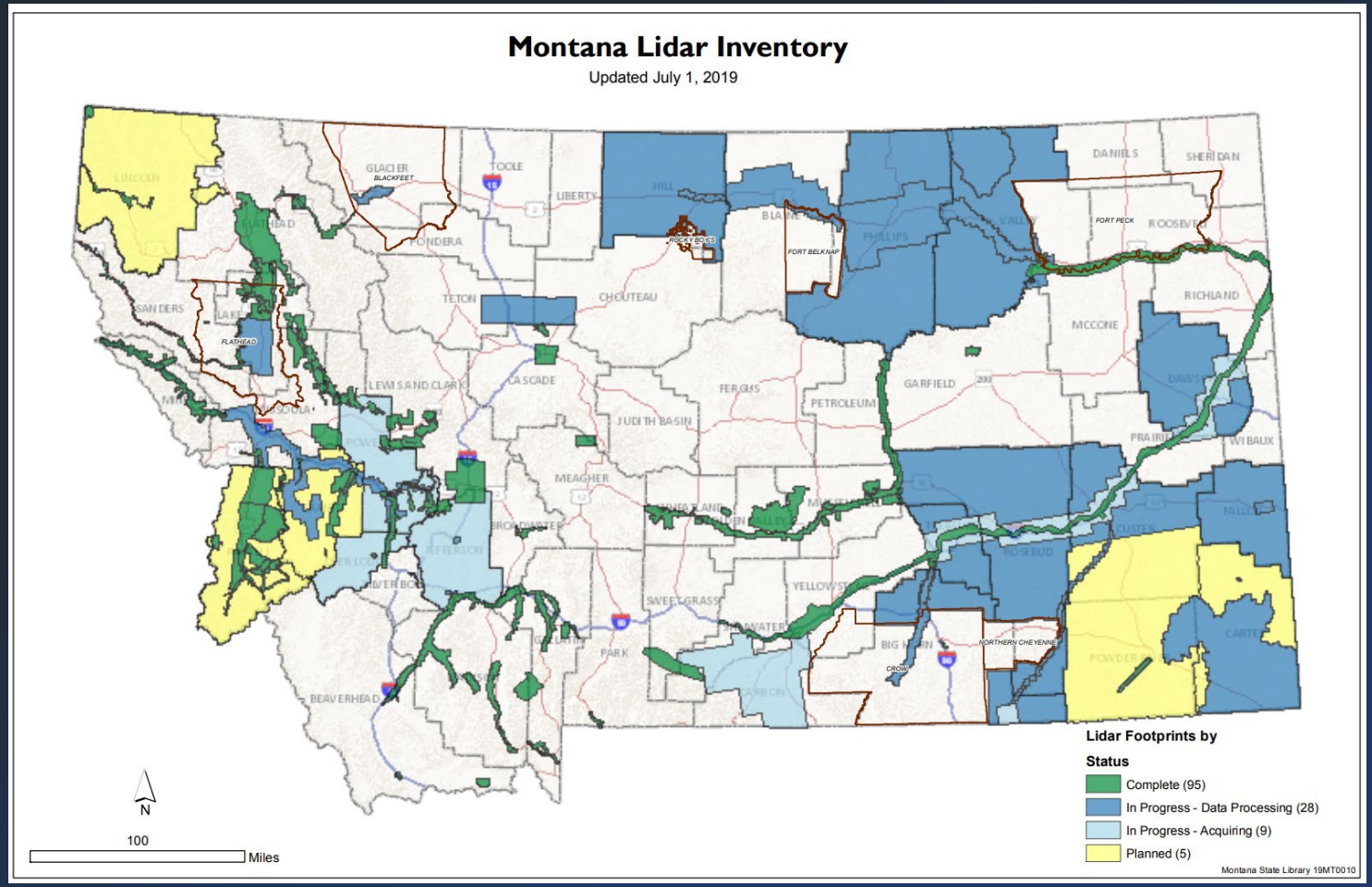
The Montana Elevation Working Group is the coordination and communication foundation necessary to execute the Montana Lidar Plan.

Montana Elevation Working Group

- Federal, State, County, local, private participants

Montana Lidar Inventory

1. Completed/in-progress acquisitions
2. Planned lidar acquisitions
3. Priority areas of interest for future acquisitions



http://msl.mt.gov/gis/lidarinventory

Montana Lidar Inventory

A Story Map

Introduction | 1. Acquisition Status Map | 2. Request Data | 3. Collaborate - Submit Areas of Interest | 4. Download | 5. Submit missing acquisitions | 6. Explore more and set filters

Discover where lidar data has been collected in Montana and identify opportunities to collaborate on future acquisitions

The Montana Lidar Inventory is a GIS database with accompanying maps depicting where lidar data has been or will be collected. The inventory provides:

Tab 1. A map of completed, in-progress, and planned lidar acquisitions.

Tab 2. A form for requesting lidar data from the Montana State Library.

Tab 3. A map that allows users to draw priority areas of interest for future lidar acquisition collaboration and planning.

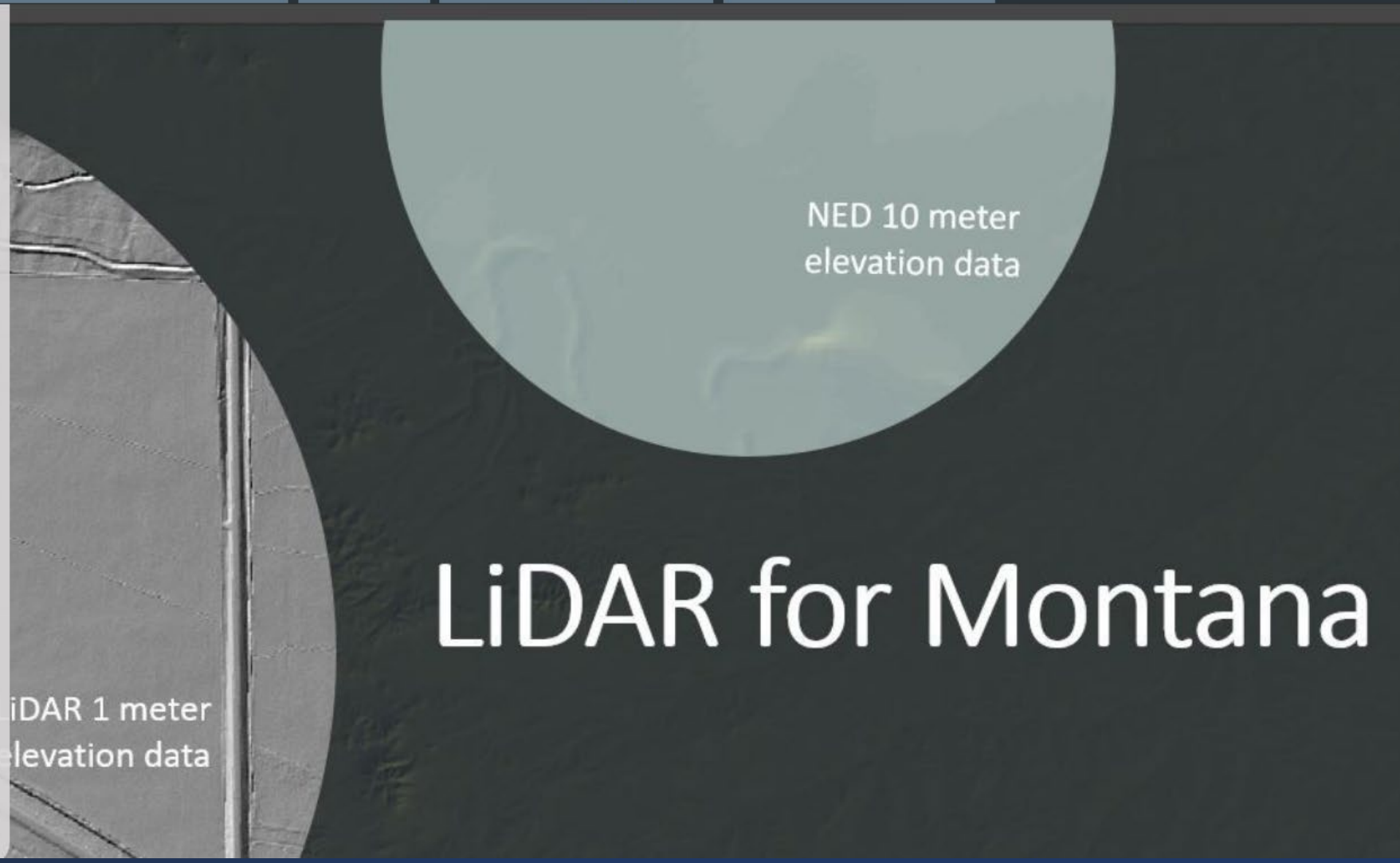
Tab 4. Links to download maps and GIS data.

Tab 5. A form for submitting acquisitions that are missing from the current inventory.

Tab 6. An interactive map providing additional functionality, such as viewing the data categorized in various ways, exploring the data as a table, and setting filters.

The Lidar Inventory is a discovery tool for learning where high-resolution elevation data has been collected. It also functions as a collaboration tool for prioritizing areas for future lidar acquisitions. Any organization acquiring lidar data should first check the inventory to see what data is already available or planned for acquisition, then identify potential partners with mutual priority areas of interest. Ideally, organizations should partner, pool available funds, and apply for a USGS 3DEP award to maximize the areal extent that can be collected. The Montana Elevation Working Group led by the Montana State Library can assist with coordination. Contact geoinfo@mt.gov for additional information.

Learn more! Click here to read the Montana Lidar Plan.



Montana Lidar Inventory

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Lidar Acquisition Status

This map depicts completed, in-progress, and planned lidar acquisitions. "Completed" means the flights to acquire the lidar data are complete, and the data has been processed and delivered. "In-progress" means lidar is currently being collected or the data is being processed. "Planned" means the area is expected to be collected soon. If you are interested in an area planned for collection or an area nearby, you should contact the organization listed about potentially partnering. There may be opportunities to work with the lidar vendor to maximize the areal extent that can be collected

Much of the available data can be obtained by contacting the Montana State Library. The USDA Montana NRCS and the Montana State Library are currently collaborating on a prototype data distribution system for downloading lidar data (*in development*). In the meantime, submit requests for lidar data using "Tab 5. Request Data."

Click on a project area to view information about it, such as project name, agency name, collection dates, and more.

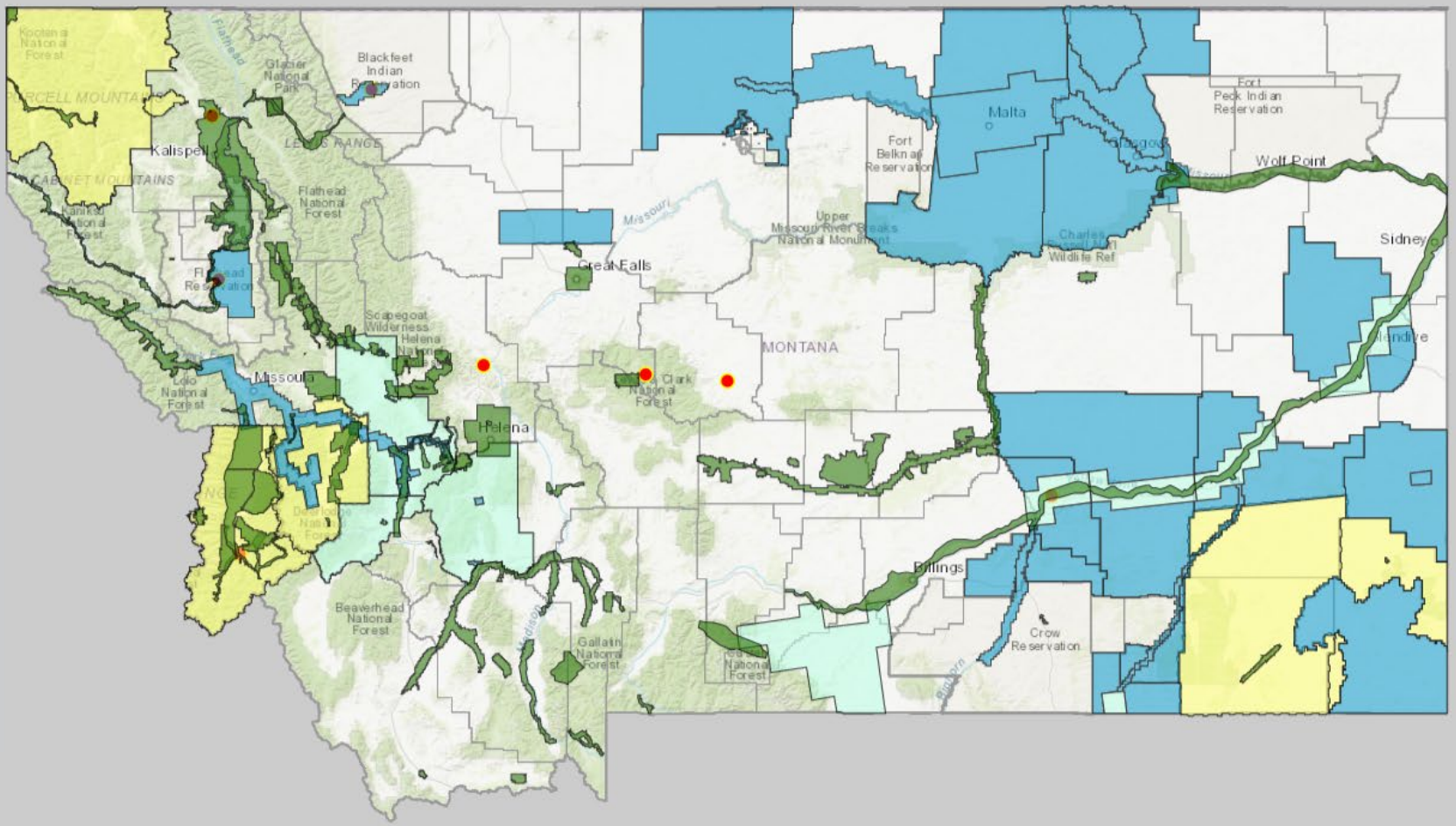
Last Update: July 1, 2019

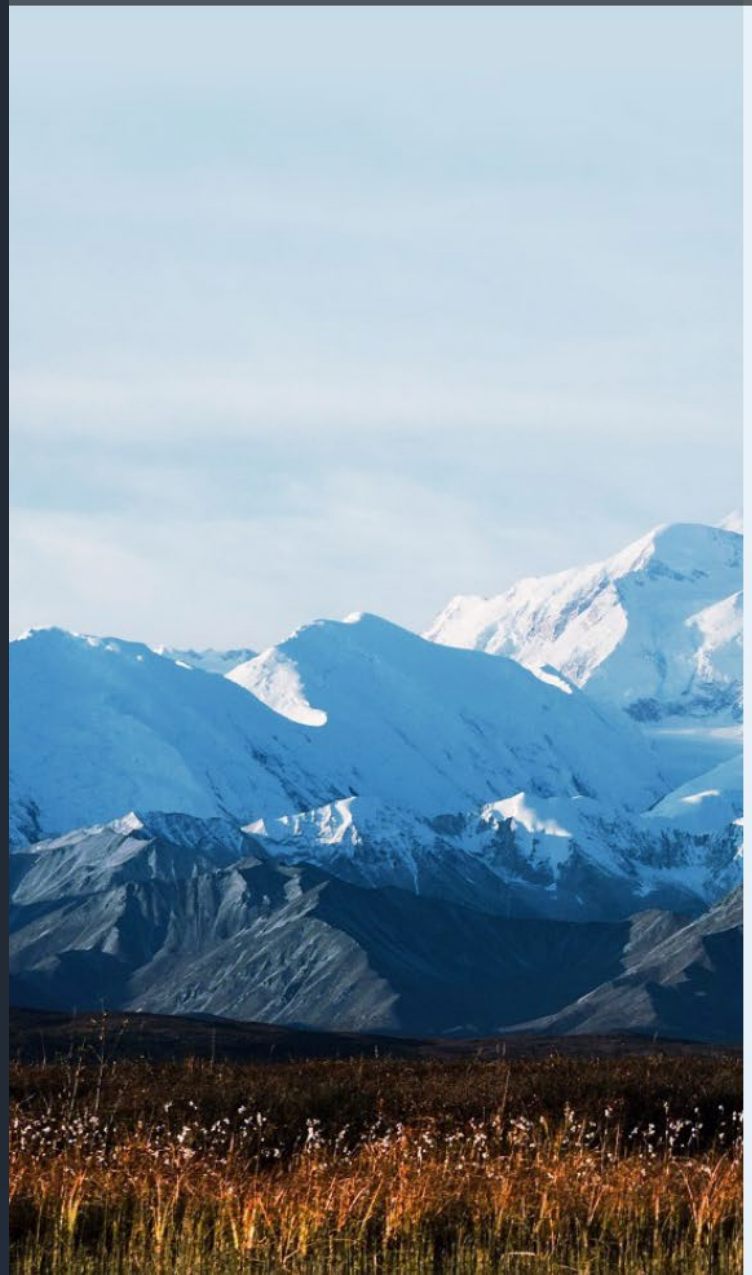
Completed Lidar Collection

In-Progress Lidar Collection

- In Progress - Data Processing
- In Progress - Acquiring

Planned Lidar Collection



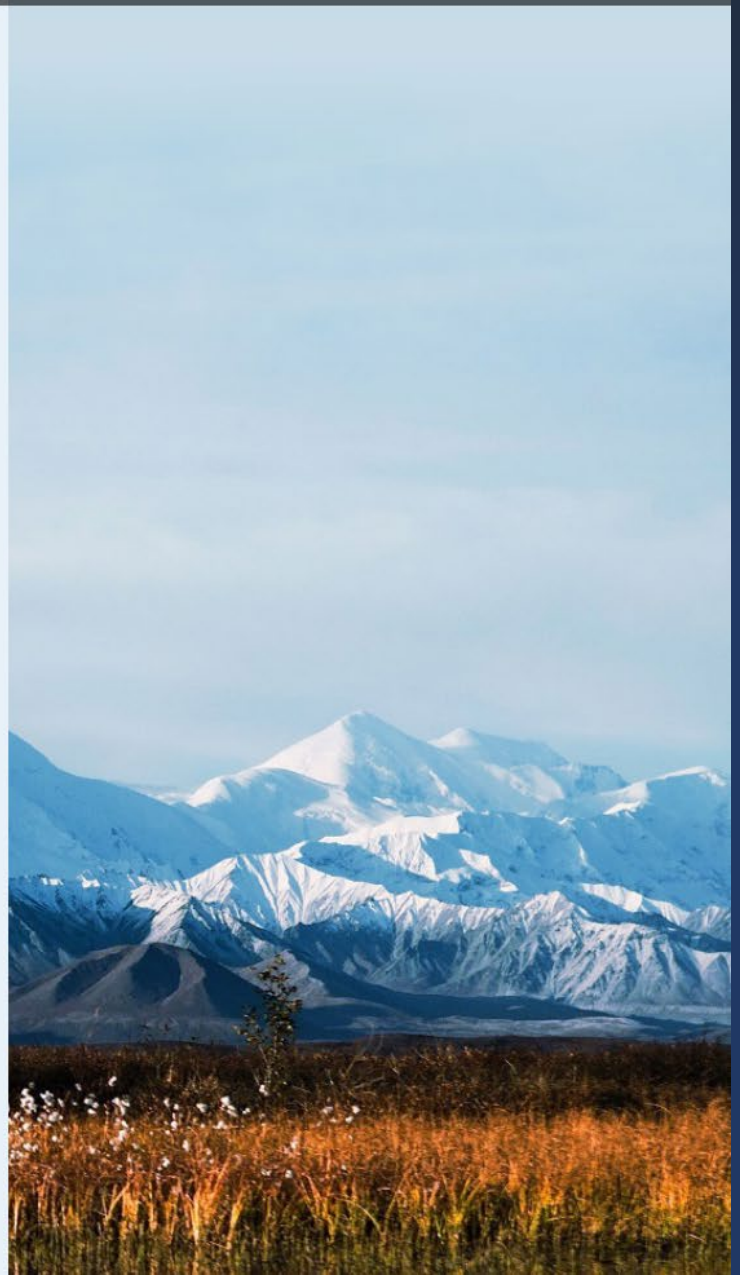


What products do you need?*

Due to the data volume of lidar, please limit your request to only the products you need.

- [ ] LAS (point cloud)
- [ ] Bare-earth Digital Elevation Model
- [ ] First-return Digital Elevation Model (e.g, surface, includes trees)
- [ ] Project extent footprint/tiles (vector)
- [ ] Lidar acquisition report
- [ ] Breaklines
- [ ] Intensity image
- [ ] Contours (not availble for all projects)
- [ ] Original delivery (all available products)
- [ ] Other (please specify)

What are your preferred file formats?*



Montana Lidar Inventory

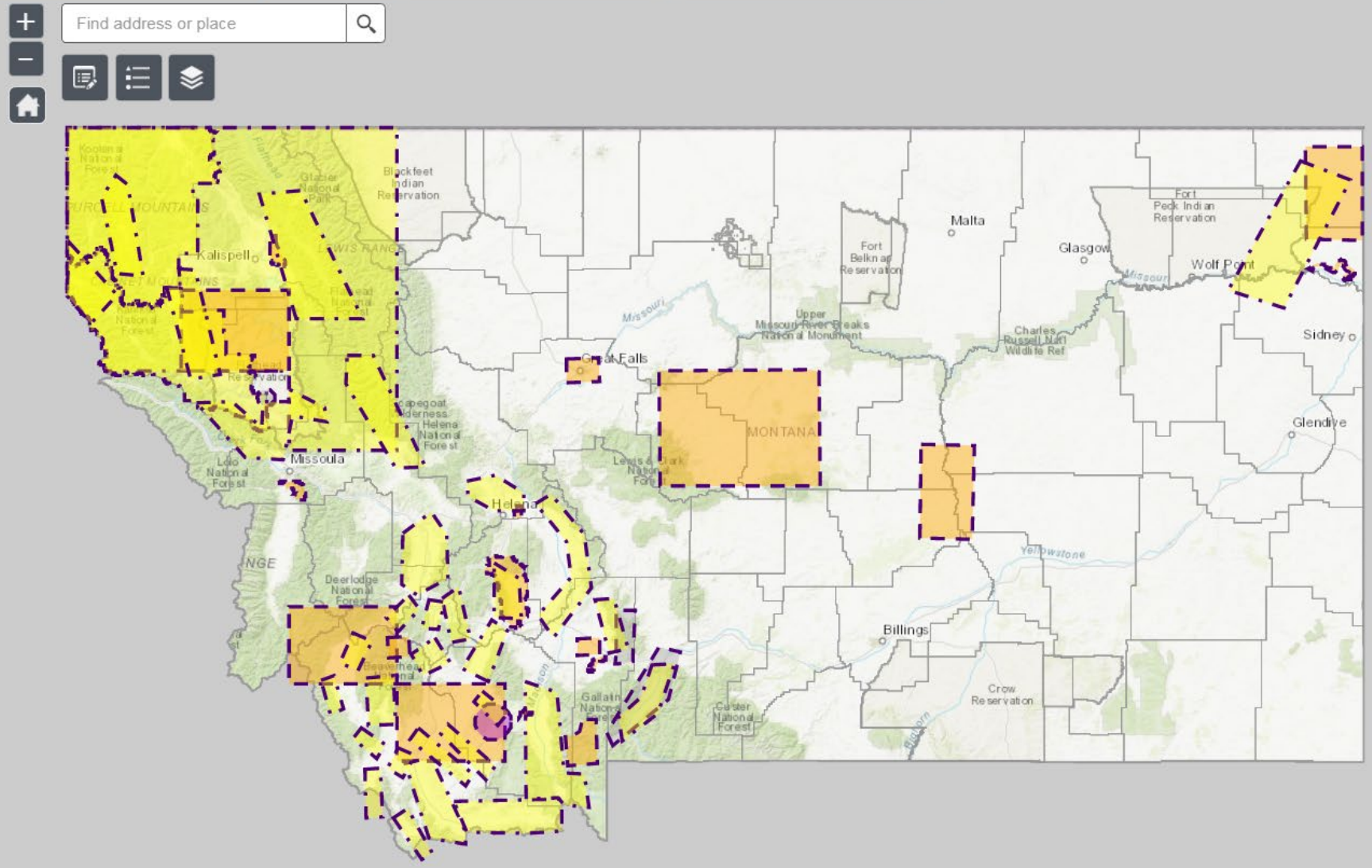
A Story Map

Collaborate - Priority Areas of Interest for Future Lidar Acquisitions

The purpose of this map is to promote collaboration among organizations interested in acquiring lidar. Shapes can be drawn on the map to let others know where you would like lidar collected, what it will be used for, potential funding that may be available, and the urgency for the collection. Ideally, organizations should partner and apply for a federal grant, such as USGS 3DEP funds. The Montana Elevation Working Group led by the Montana State Library can assist with coordination. Contact: geoinfo@mt.gov.

Instructions:

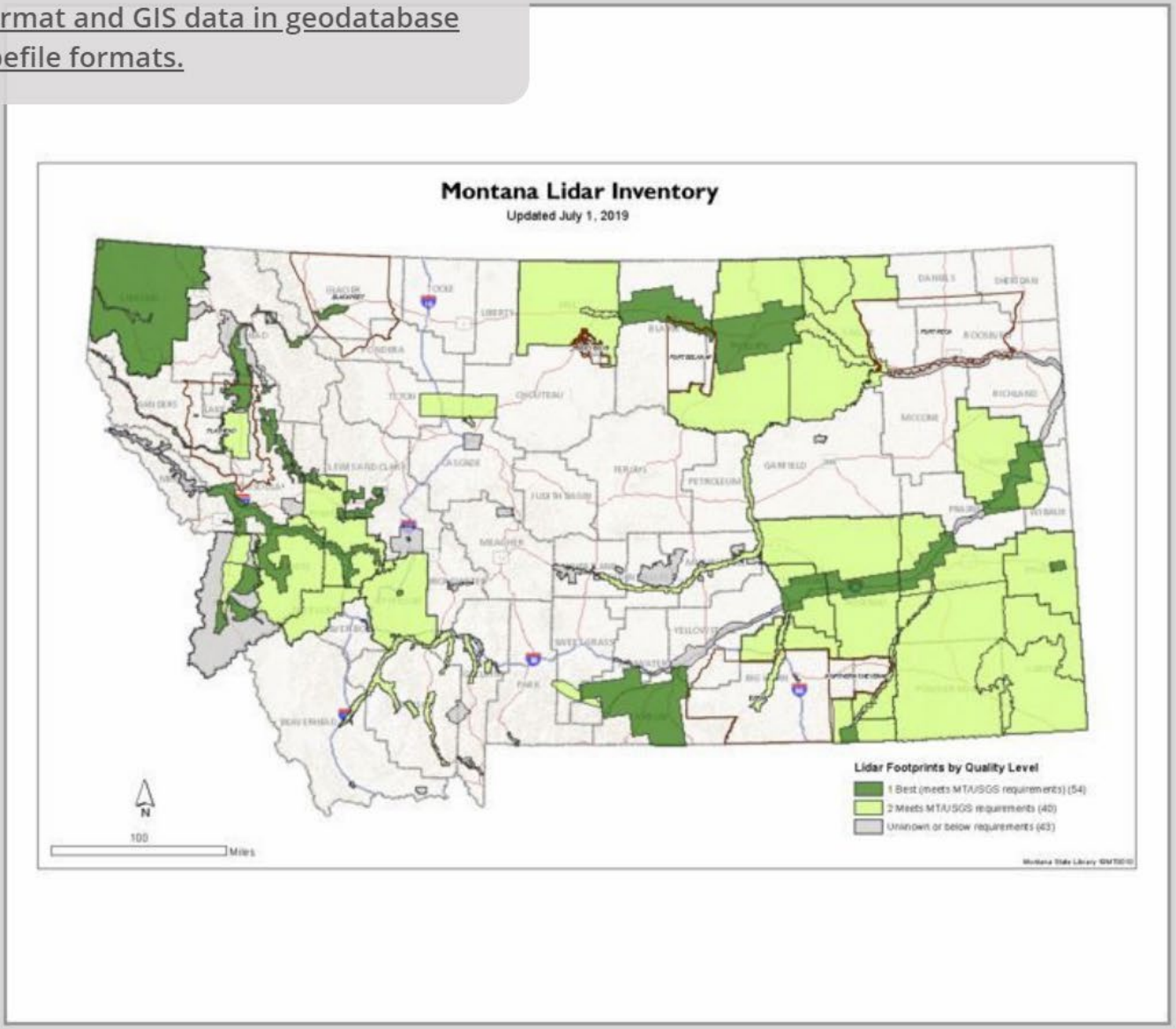
1. Familiarize yourself with the Legend (the icon looks like a bulleted list). By default, only priority areas are shown on the map. Planned and completed lidar acquisitions can be turned on through the Layer List (the icon looks like a stack of layers).
2. Zoom and pan the map to the general location of your area of interest. Alternatively, use the Search box to quickly zoom to a town or place.
3. Click the Edit Tool located in the top left corner of the map (the icon looks like a notepad and pen)
4. Choose the template color (purple <1 year; orange 1-2 years, yellow 2-5 years, grey unknown) that best describes the priority of your area of interest.
5. Click to start drawing a polygon around your area of interest. Double-click to finish.
6. Fill out the popup box as best as possible to describe your lidar data needs.
7. The polygon and text is automatically saved. Clicking on the polygon allows you to reshape it or modify the text. Additional tools are available on the Edit Tool, such as undo, redo, and a drop down for drawing various shapes.

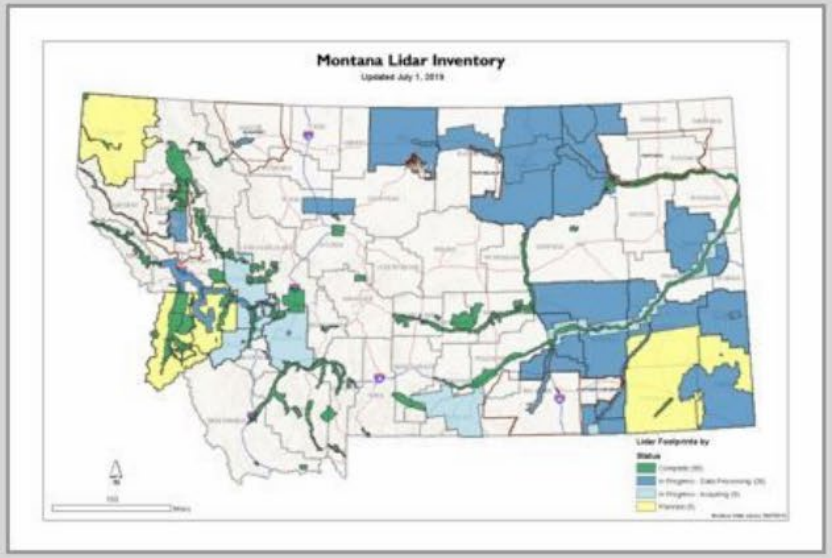


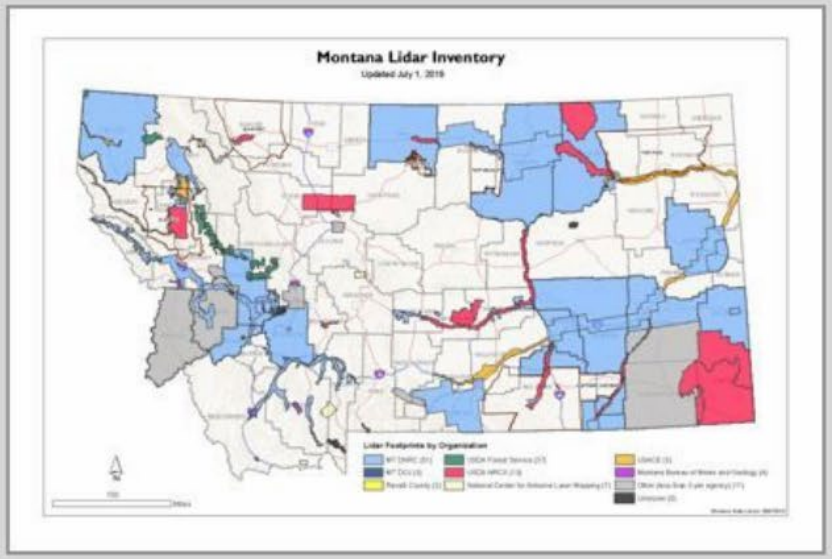
Montana Lidar Inventory

A Story Map

Click here to download maps
in PDF format and GIS data in geodatabase and shapefile formats.







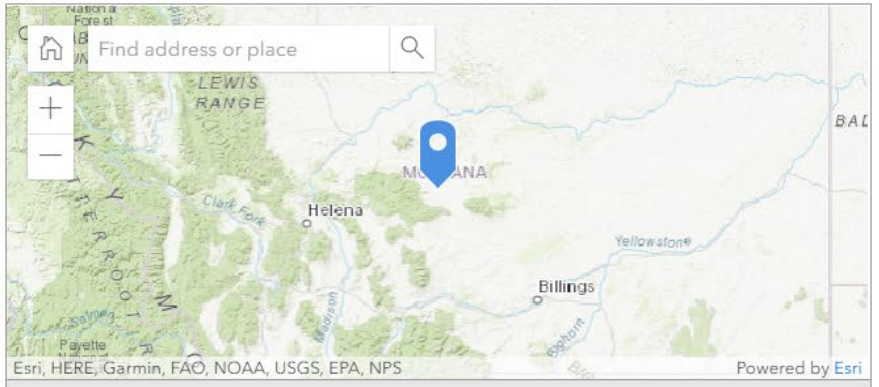
LiDAR Project Name

example: 2012 Little Buffalo Creek, Jefferson County

Short Description of Project Area

example: Appoximate 5 mile buffer of Smith Creek to its confluence with Joe River

Please zoom and pan the map to place a marker at the approximate location of the LiDAR study*



Lat: 46.92026 Lon: -110.03906

Submit

Montana Lidar Inventory

A Story Map

Introduction | 1. Acquisition Status Map | 2. Request Data | 3. Collaborate - Submit Areas of Interest | 4. Download | 5. Submit missing acquisitions | 6. Explore more and set filters

Home ▾ Lidar Inventory Web Map (completed, in progress, planned)

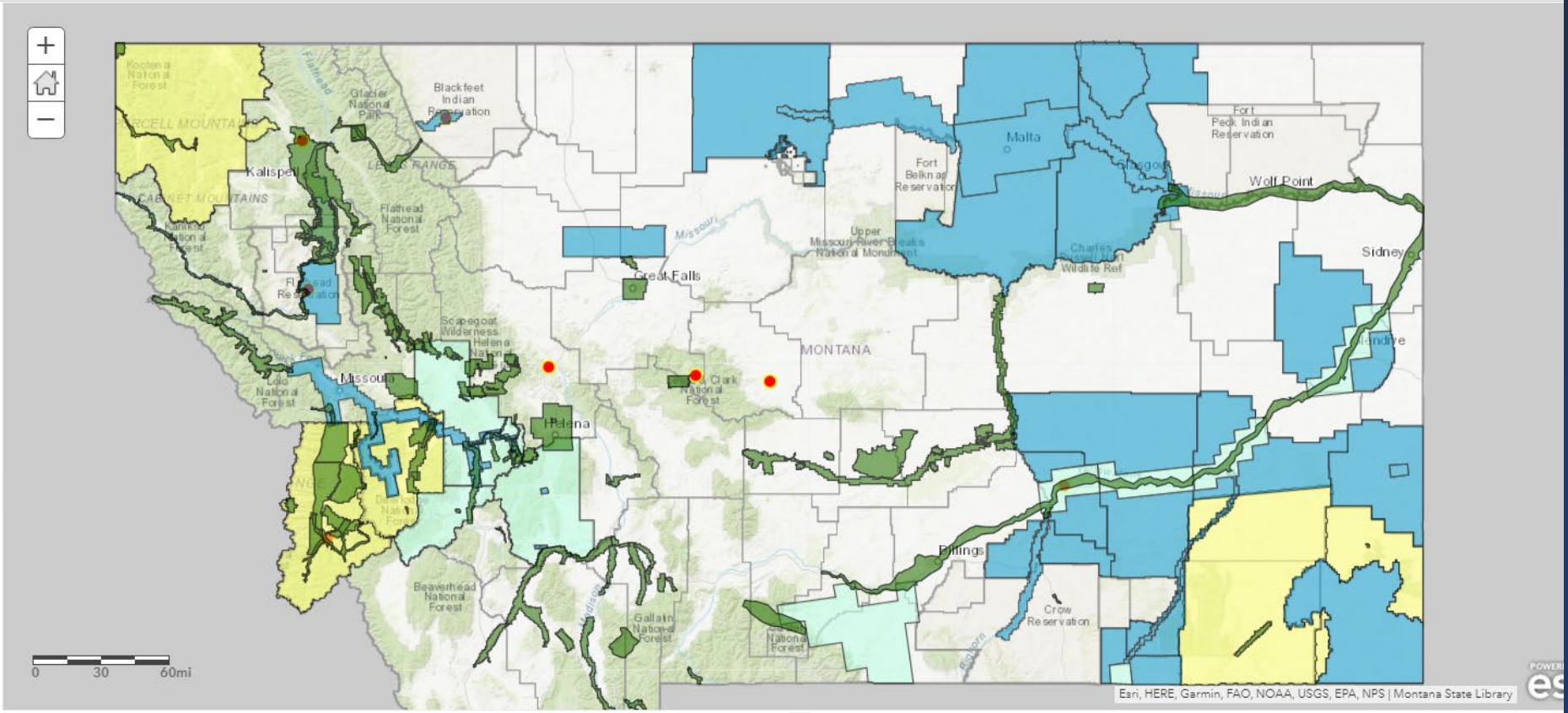
Modify Map Sig

Details | Edit | Basemap | Share | Print ▾ | Measure

About | Content | Legend

Contents

- [x] Completed Lidar Collection
- [x] In-Progress Lidar Collection
- [x] Planned Lidar Collection
- [ ] MT Lidar Inventory (all)
- [x] Lidar acquisitions known to be missing from the inventory (more information needed)
- [x] County
- [x] Indian Reservations
- [ ] Watershed Boundaries
- [ ] Hydrography
- [x] Montana Mask
- [ ] Topographic
- survey123 2a864737f1cb4c299162705108a4aff1 - metadata



Completed Lidar Collection (Features: 95, Selected: 0)

ProjectNam	SourceData	Restrictio	Horizontal	Horizont_1	VerticalAc	VerticalDa	Notes	ProductsAv
2012 Yellowstone River Confluence Lidar	Lidar-Topobathy	Government Only	NAD83	0.6 m	18.5 cm RMSE	NAVD88	Confluence with the Missouri River Upstream to Stillwater County state line (Lidar/Topo). Confluence with the Missouri River upstream 121 river miles. Includes hydrographic surveys	Points, DEM, 2 ft contours, hydrographic surveys

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Technical Specification

Recommended
Quality Level 1

Required
Quality Level 2

Recommended:

Quality Level 1	DEM Cell Size	Aggregate Nominal Pulse Spacing	Aggregate Nominal Pulse Density	Absolute Vertical Accuracy $RMSE_z$ (nonvegetated)	Relative Vertical Accuracy (repeatability) $RMSD_z$
Topo Lidar	1 m (3 foot) 0.5 m (1.5 foot) DEM possible	0.35 m	8 pls/m^2	0.1 m	0.06 m

Table 5. Montana's recommended lidar quality level.

Required:

Quality Level 2	DEM Cell Size	Aggregate Nominal Pulse Spacing	Aggregate Nominal Pulse Density	Absolute Vertical Accuracy $RMSE_z$ (nonvegetated)	Relative Vertical Accuracy (repeatability) $RMSD_z$
Topo Lidar	1 m (3 foot)	0.71 m	2 pls/m^2	0.1 m	0.06 m

Table 6. Montana's required lidar quality level.

COST

Description	Square Miles	Percent of MT Total Area	Cost based on $350/mi^2
Lidar needed to reach the goal of the Montana Lidar Plan (complete coverage, with all new lidar acquired at QL1).	100,000	68	$35 million
Largest sized Montana county (Beaverhead)	5,573	3.8	$2 million
Median sized Montana county (Dawson)	2,384	1.6	$835,000
Smallest sized Montana county (Silver Bow)	718	0.5	$250,000

Based on $350 per SM for QL1

Montana Lidar Plan, page 27

Funding Approach

Identify partnership opportunities and leverage the USGS 3D Elevation Program for cost-share.

Total Estimated Project Cost *(from previous page)*:		$937,500.00	
Funding Partner(s)			**% Cost Share for 3DEP Base Data**
Name(s)	**Type**	**Proposed Contribution for Lidar Data Acquisition, Processing, QA/QC**	
Montana DNRC Floodplain Management Program (provided by FEMA)	Nonfederal	$250000.00	
Montana Bureau of Mines and Geology	Nonfederal	$1500.00	
NRCS (Montana office)	Federal	$250000.00	
Montana State Library	Nonfederal	$1500.00	
USDA Forest Service (Montana office)	Federal	$50000.00	
Missoula County	Nonfederal	$10000.00	
Trout Unlimited	Nonfederal	$1500.00	
Montana Department of Environmental Quality	Nonfederal	$15000.00	
	Choose One	$	
	Choose One	$	
Funding Partner Totals *(from above)*		$579,500.00	62%
Funds Requested from 3DEP		$358,000.00	38%

Hypothetical funding scenario

Take Home Messages

1. Join the Elevation Working Group

2. Let the Montana State Library know how you will use lidar and what organizations may be potential funding partners

3. Submit priority areas of interest

4. If you are planning a lidar acquisition, the State Library can help. Refer to the Montana Lidar Plan for specifications and deliverables. Think big – we want to collect entire counties.

5. Need lidar data? The State Library intends to be the Montana repository for lidar data. We have much of the data already.

THANK YOU

QUESTIONS/COMMENTS PLEASE.

tblandford@mt.gov

http://msl.mt.gov/gis/lidarinventory