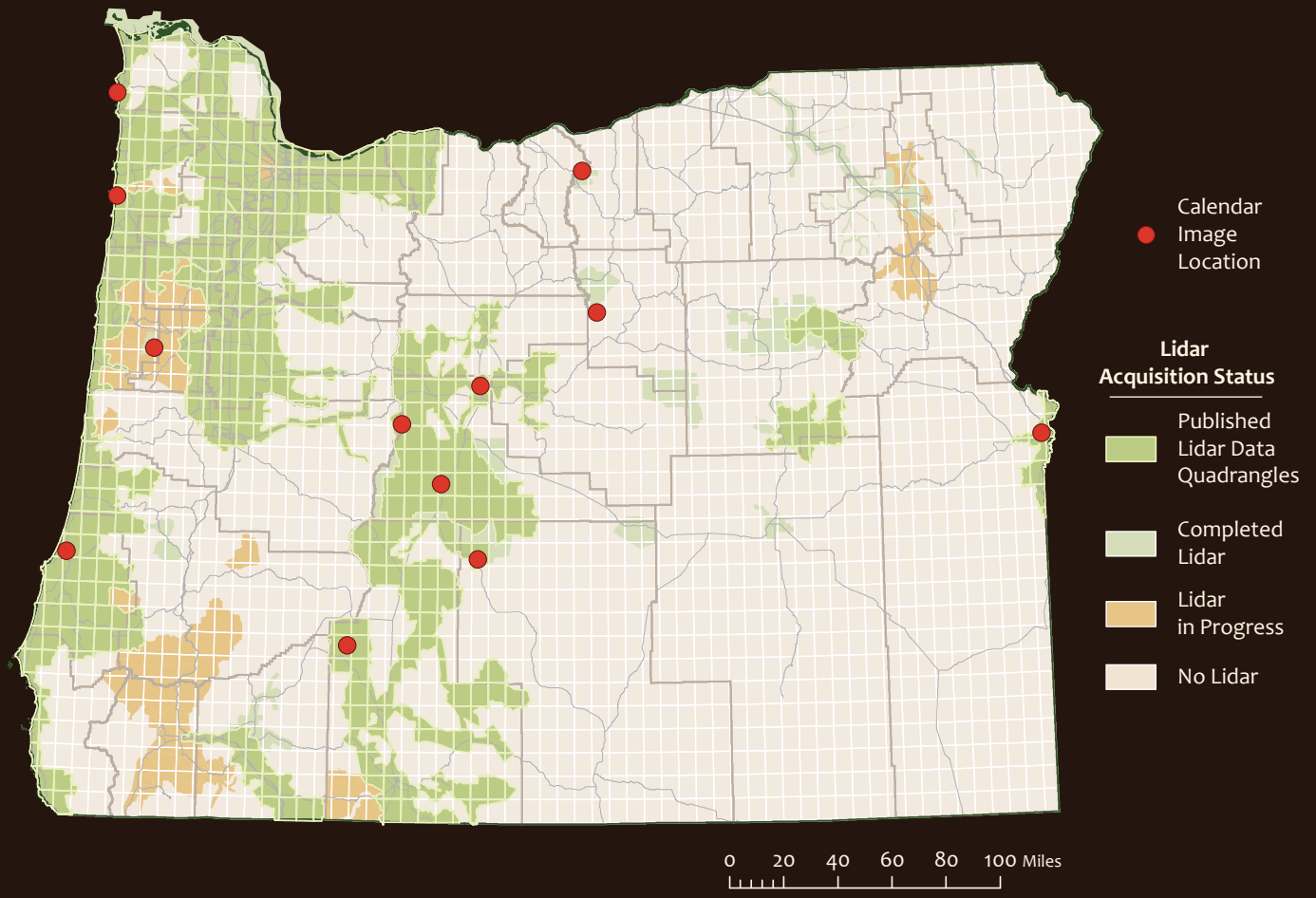
Lidar Illuminated 2013 Calendar

Oregon Department of Geology and Mineral Industries

Lidar in Oregon

Lidar (light detection and ranging) is a remote sensing technique similar to radar that uses light pulses instead of radio waves. Lidar is typically "flown" or collected from planes and rapidly produces a large collection of very dense and accurate elevation points (up to 500,000 per second) over a large area. The product can be used to generate three-dimensional representations of the Earth's surface and its features.

The Oregon Department of Geology and Mineral Industries (DOGAMI) uses lidar to create new-generation maps that are more accurate and comprehensive than any in the past. DOGAMI, via the Oregon Lidar Consortium, is continually acquiring new lidar data throughout Oregon.



DOGAMI applications for high-resolution lidar

•*Resource Mapping*
Base maps
Geologic mapping
Shoreline monitoring
Aggregate monitoring & permitting
Mine site reclamation
Mineral exploration
Geothermal development

•*Asset Mapping*
Building extraction
State-owned facilities
Essential & critical facilities
Utilities & energy site development
Population distribution
Transportation corridors

•*Natural Hazard Mapping & Modeling*
Landslides
Debris avalanches
Fault displacement
Channel migration
Volcanic flows
Coastal erosion
Climate change
Tsunami inundation
River & coastal flooding
Volcanic lahar deposits
Evacuation planning

How can DOGAMI help you? Contact us to find out!

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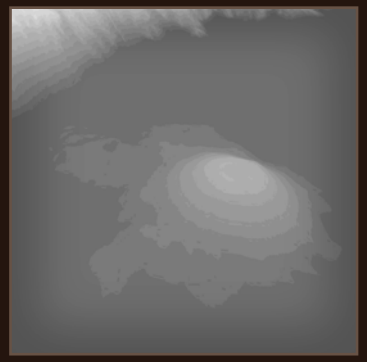
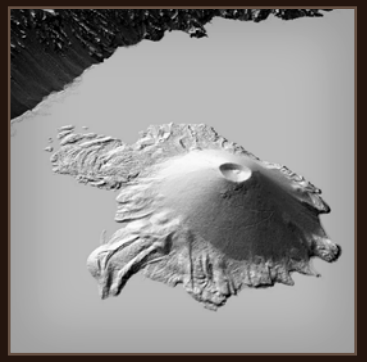
How are lidar images made?

Lidar systems produce a mass of points known as a point cloud. Complex algorithms classify points on the basis of relative point-to-point and absolute geometries. These classification methods allow lidar points representing returns off the ground surface to be discriminated. Ground points are interpolated to produce a digital elevation model (DEM) typically referred to as a "bare-earth DEM." The entire mass of points (ground and other points) is interpolated to a DEM using the highest point at a given location. This produces a "highest-hit" surface model. This model includes ground, trees, buildings, and all other above-ground features.



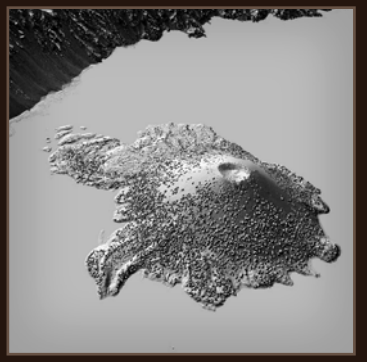
Bare-Earth DEM

Shades from dark gray to light gray represent elevation change from lowest to highest in the last-return, or bare-earth, lidar data.



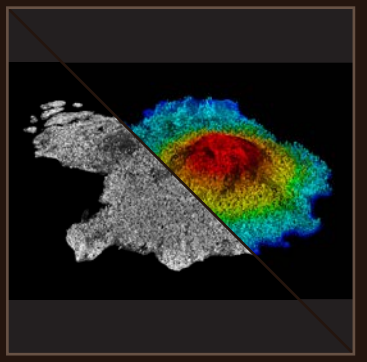
Bare-Earth Hillshade

Lighting effects can be added to a DEM to better simulate topography.



Highest-Hit Hillshade

Lighting effects can also be added to first-return, or highest-hit, lidar data to simulate the effect of topography with tree cover.



Lidar Point Cloud — black and white intensity (bottom), with elevation color ramp (top)

Lidar point data can be rotated to provide 3-D perspective and enhanced with color ramps that represent elevation change.

Bare-Earth Slopeshade

Change in slope can be emphasized to help visualize the shape of the landscape.

Black and White Canopy Model (bottom), Colorized Canopy Model (top).

A simple canopy model can be made by subtracting the bare-earth DEM from the highest-hit DEM. This results in a digital map of the height above ground of trees and structures.

Colorized Canopy Model over Highest-Hit Hillshade

Combining layers, such as these, adds to the richness of the image

Final Image

When shading, color, and rotation are added to combinations of these data sets, the result can be an almost "photographic" image that also contains highly accurate elevation data.

Please note: The lidar-derived images in this calendar are for illustrative purposes only and are not to be used for site-specific studies or emergency planning.

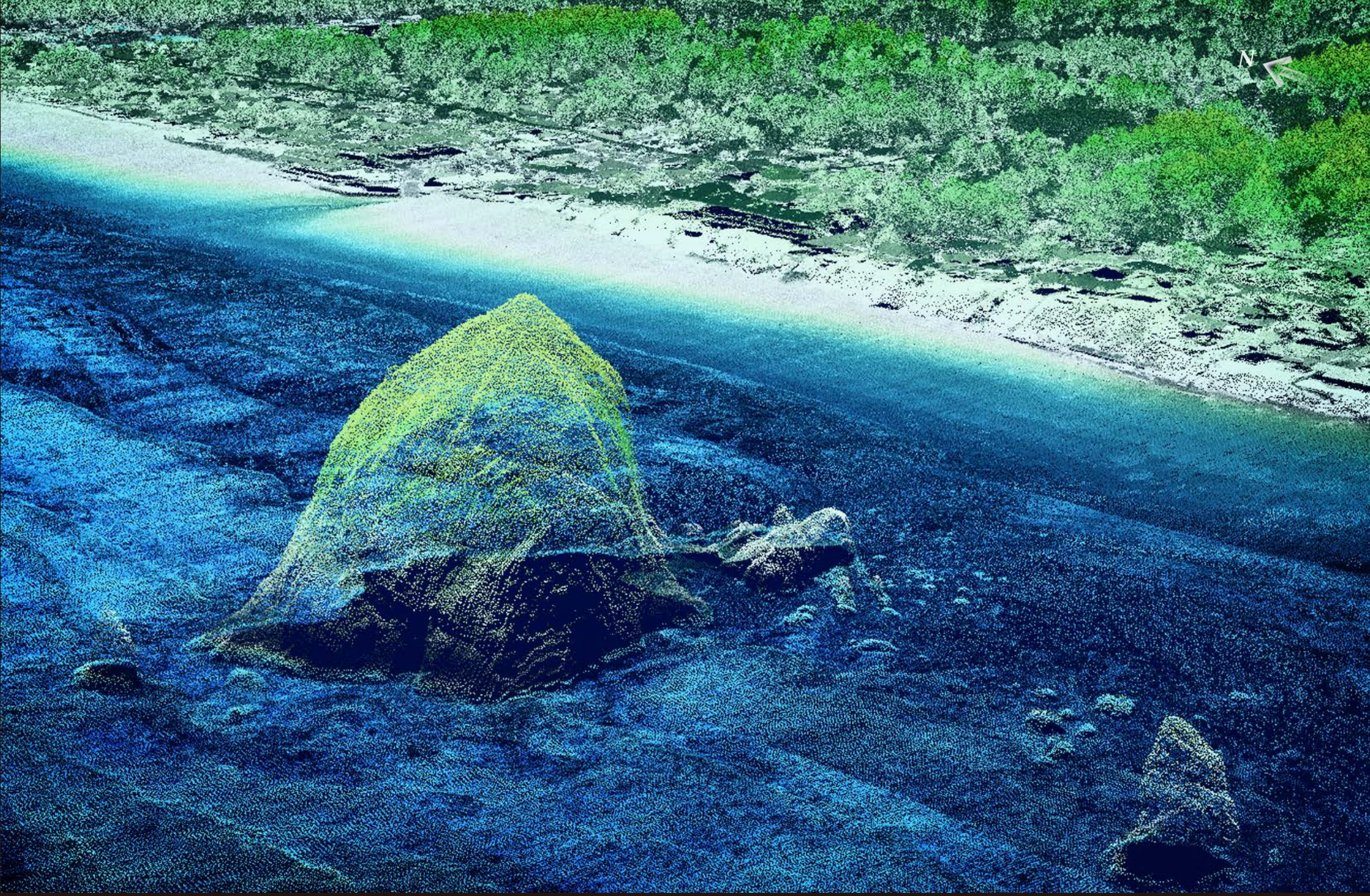


Image: Daniel E. Coe

Haystack Rock, Cannon Beach, Oregon

Haystack Rock in Cannon Beach is one of Oregon's most recognizable geologic landmarks. The 235-foot-high sea stack is composed of Grande Ronde basalt and is connected to the adjacent beach at low tide by a rocky isthmus. OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

December 2012

S	M	T	W	T	F	S
25	26	27	28	29	30	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

January 2013

February 2013

S	M	T	W	T	F	S
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	1	2

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
30	31	1 New Year's Day	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21 Martin Luther King Jr.'s Birthday	22	23	24	25	26
27	28	29	30	31	1	2

Image: Daniel E. Coe

Little Deschutes River, Near Sunriver, Oregon

The Little Deschutes River in central Oregon originates in the High Cascades of Klamath County. The image above, located south of Sunriver, has been enhanced to reveal the river's myriad of abandoned channels. OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

January 2013

S	M	T	W	T	F	S
30	31	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2

February 2013

March 2013

S	M	T	W	T	F	S
24	25	26	27	28	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
27	28	29	30	31	1	2 Groundhog Day
3	4	5	6	7	8	9
10	11	12 Lincoln's Birthday	13	14 Valentine's Day	15	16
17	18 President's Day	19	20	21	22 Washington's Birthday	23
24	25	26	27	28	1	2

Image: Daniel E. Coe

John Day River, Future Site of Cottonwood Canyon State Park, Oregon

At 281 miles, the John Day River is the longest free-flowing river in the state of Oregon. Most of the area shown above will become part of Oregon's newest state park, Cottonwood Canyon State Park, in 2013. In this area the river winds through deep basalt canyons shortly before its confluence with the Columbia River. (Lidar data funded by Oregon Parks and Recreation Department) OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

February 2013

S	M	T	W	T	F	S
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	1	2

March 2013

April 2013

S	M	T	W	T	F	S
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	4

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
24	25	26	27	28	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

Image: Daniel E. Coe

Marys Peak, Near Philomath, Oregon

Marys Peak, the highest point on the skyline west of Corvallis, is also the tallest peak in Oregon's Coast Range. The peak is supported by a 1,300-foot-thick gabbro sill that was injected 30 million years ago as molten rock between older layers of sedimentary rock. Differential erosion has removed the softer surrounding sedimentary rock, leaving the resistant gabbro. OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

March 2013

S	M	T	W	T	F	S
24	25	26	27	28	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

April 2013

May 2013

S	M	T	W	T	F	S
28	29	30	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
31	1 April Fool's Day	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	4

Image: Daniel E. Coe

Hole in the Ground, Lake County, Oregon

Hole in the Ground, in central Oregon, is a fine example of a maar. A maar is a volcanic crater formed by the steam explosion that commonly results when magma meets groundwater. Hole in the Ground formed between 13,550 and 18,000 years ago when this region was covered by a lake.

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April 2013

S	M	T	W	T	F	S
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	4

May 2013

June 2013

S	M	T	W	T	F	S
26	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	1	2	3	4	5	6

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
28	29	30	1	2	3	4
5 Cinco De Mayo	6	7	8	9	10	11
12 Mother's Day	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27 Memorial Day	28	29	30	31	1

Image: Daniel E. Coe

Byrds Point, John Day River, Oregon

Byrds Point is major landmark for boaters on the John Day River in Wheeler County, north-central Oregon. The high cliffs that make up Byrds Point today are deeply eroded remnants of a composite volcano that erupted here tens of millions of years ago. The "Byrds Point volcano" is part of the Clarno Formation, volcanic and sedimentary deposits that formed 54 to 39 million years ago and that cover much of eastern and central Oregon.

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May 2013

S	M	T	W	T	F	S
28	29	30	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

June 2013

July 2013

S	M	T	W	T	F	S
30	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
26	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16 Father's Day	17	18	19	20	21	22
23	24	25	26	27	28	29
30	1	2	3	4	5	6

Image: Daniel E. Coe

Three Sisters Volcanoes, Deschutes and Willamette National Forests, Oregon

The Three Sisters are major volcanic peaks in central Oregon's High Cascades. All three volcanoes are over 10,000 feet tall, and they have 15 named glaciers between them. The lava flow in the foreground of the image is approximately 2,000 years old and is one of Oregon's most recent.

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June 2013

S	M	T	W	T	F	S
26	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	1	2	3	4	5	6

July 2013

August 2013

S	M	T	W	T	F	S
28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
30	1	2	3	4 Independence Day	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3

Image: Daniel E. Coe

Wizard Island, Crater Lake National Park, Oregon

Wizard Island is a cinder cone inside Oregon's massive Crater Lake. The island formed after the eruption of Mount Mazama, which created the Crater Lake caldera. The rim of Wizard Island is over 760 feet above the lake's surface and is actually the tip of a larger volcano that grew from the lake floor more than 1,940 feet below the water surface. The crater at the top of the island is about 100 feet deep. OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

July 2013

S	M	T	W	T	F	S
30	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3

August 2013

September 2013

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	1	2	3	4	5

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

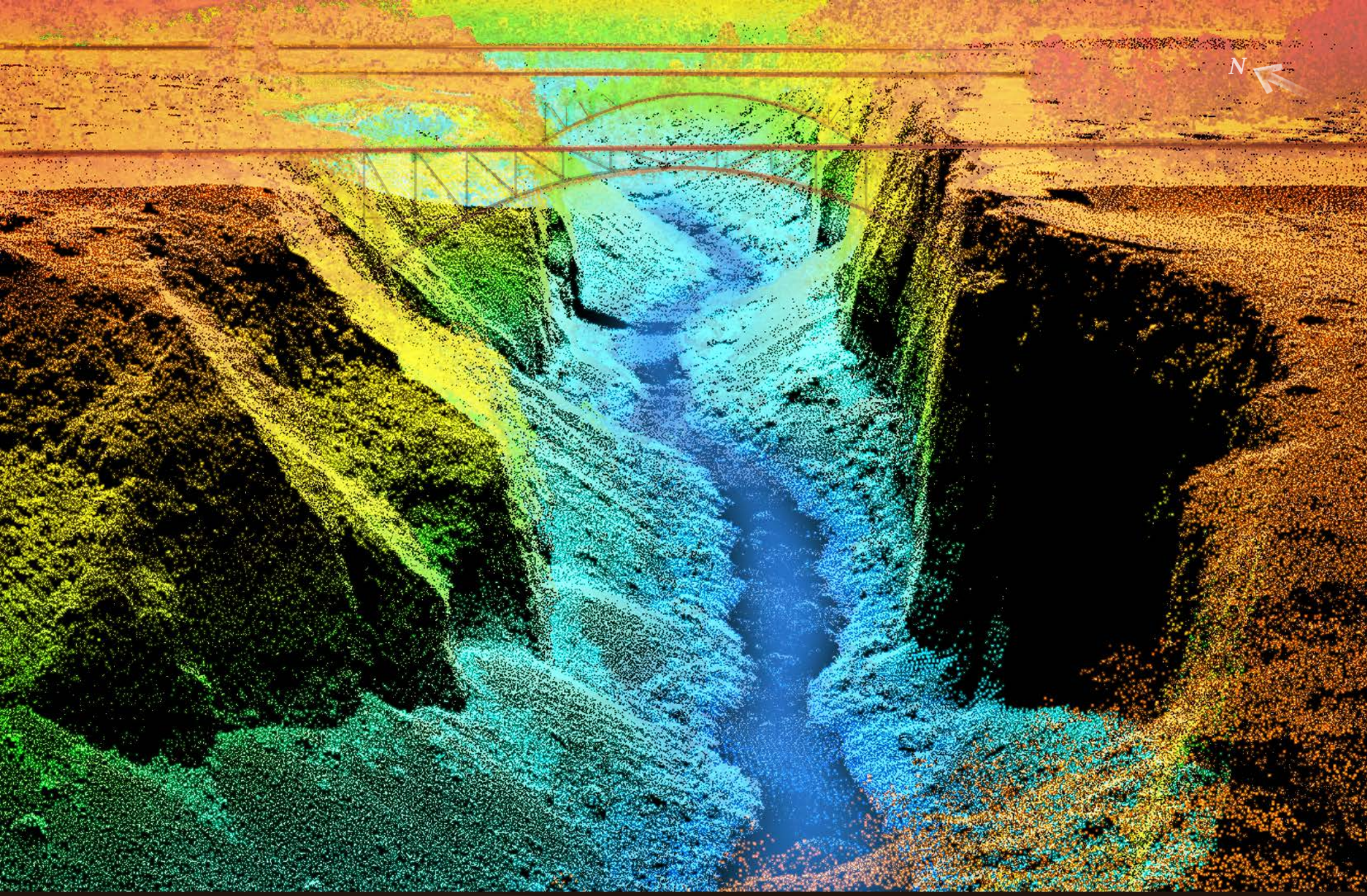


Image: Daniel E. Coe

Crooked River Gorge, Near Peter Skene Ogden State Scenic Viewpoint, Oregon

Lined with vertical 400-foot-high basalt cliffs, central Oregon's Crooked River Gorge is a popular stop along Highway 97 north of Terrebonne. The Peter Skene Ogden State Scenic Viewpoint offers views of the gorge as well as the three bridges that span the chasm. OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

August 2013

S	M	T	W	T	F	S
28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

September 2013

October 2013

S	M	T	W	T	F	S
29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2 Labor Day	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	1	2	3	4	5

Image: Daniel E. Coe

Malheur River, Near Ontario, Oregon

The Malheur River flows out of the Blue Mountains in Grant County, Oregon, and meets the Snake River south of Hells Canyon in Ontario, Oregon. In its lower reaches, the Malheur River irrigates fields of onions and other crops. The network of irrigation and drainage ditches and machine-leveled fields contrasts with the remnants of the floodplain preserved in bends in the river. OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

September 2013

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	1	2	3	4	5

October 2013

November 2013

S	M	T	W	T	F	S
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14 Columbus Day	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31 Halloween	1	2

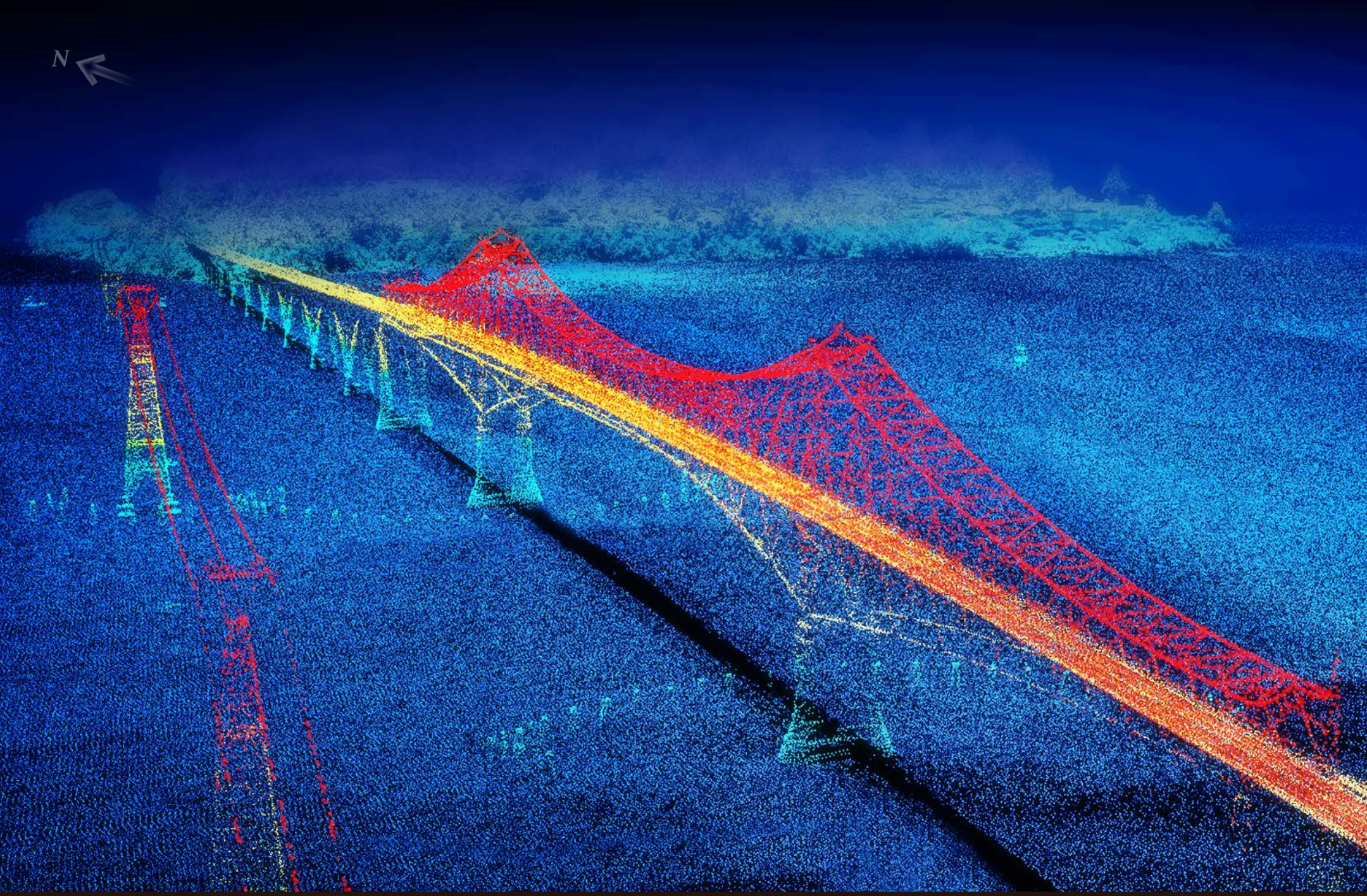


Image: Daniel E. Coe

Conde B. McCullough Memorial Bridge, North Bend, Oregon

The Conde B. McCullough Memorial Bridge (Coos Bay Bridge) north of North Bend, Oregon, spans the state's largest natural coastal harbor, Coos Bay. The bridge was completed in 1936 and was added to the National Register of Historic Places in 2005. OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

October 2013

S	M	T	W	T	F	S
29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2

November 2013

December 2013

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	1	2	3	4

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11 Veteran's Day	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28 Thanksgiving Day	29	30

Image: Daniel E. Coe

Sand Lake Dune, Near Cape Lookout, Oregon

The Sand Lake Recreation Area, south of Cape Lookout in Tillamook County, is underlain by a large parabolic dune approximately 3 miles long and 1 mile wide. A parabolic dune forms when the sides of a dune are stabilized by vegetation and the less-stable head of the dune is repeatedly pushed forward by wind, forming a u-shape. The central portion of the parabola reflects old deflation surfaces (erosion by wind) and smaller inner parabolas. In this image, the trees and other vegetation have been removed to reveal the massive dune's characteristic shape. OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

November 2013

S	M	T	W	T	F	S
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

December 2013

January 2014

S	M	T	W	T	F	S
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7 Pearl Harbor Remembrance Day
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24 Christmas Eve	25 Christmas	26	27	28
29	30	31 New Year's Eve	1	2	3	4

Lidar Illuminated 2013 Calendar

Haystack Rock

Little Deschutes River

John Day River

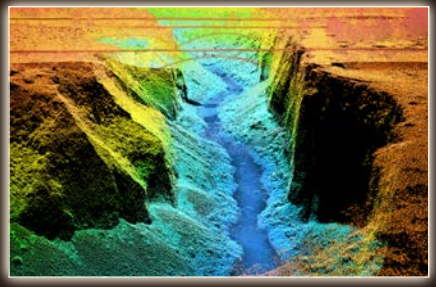
Marys Peak

Hole in the Ground

Byrds Point

Three Sisters Volcanoes

Wizard Island



Crooked River Gorge

Malheur River

Conde B. McCullough Memorial Bridge

Sand Lake Dune

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