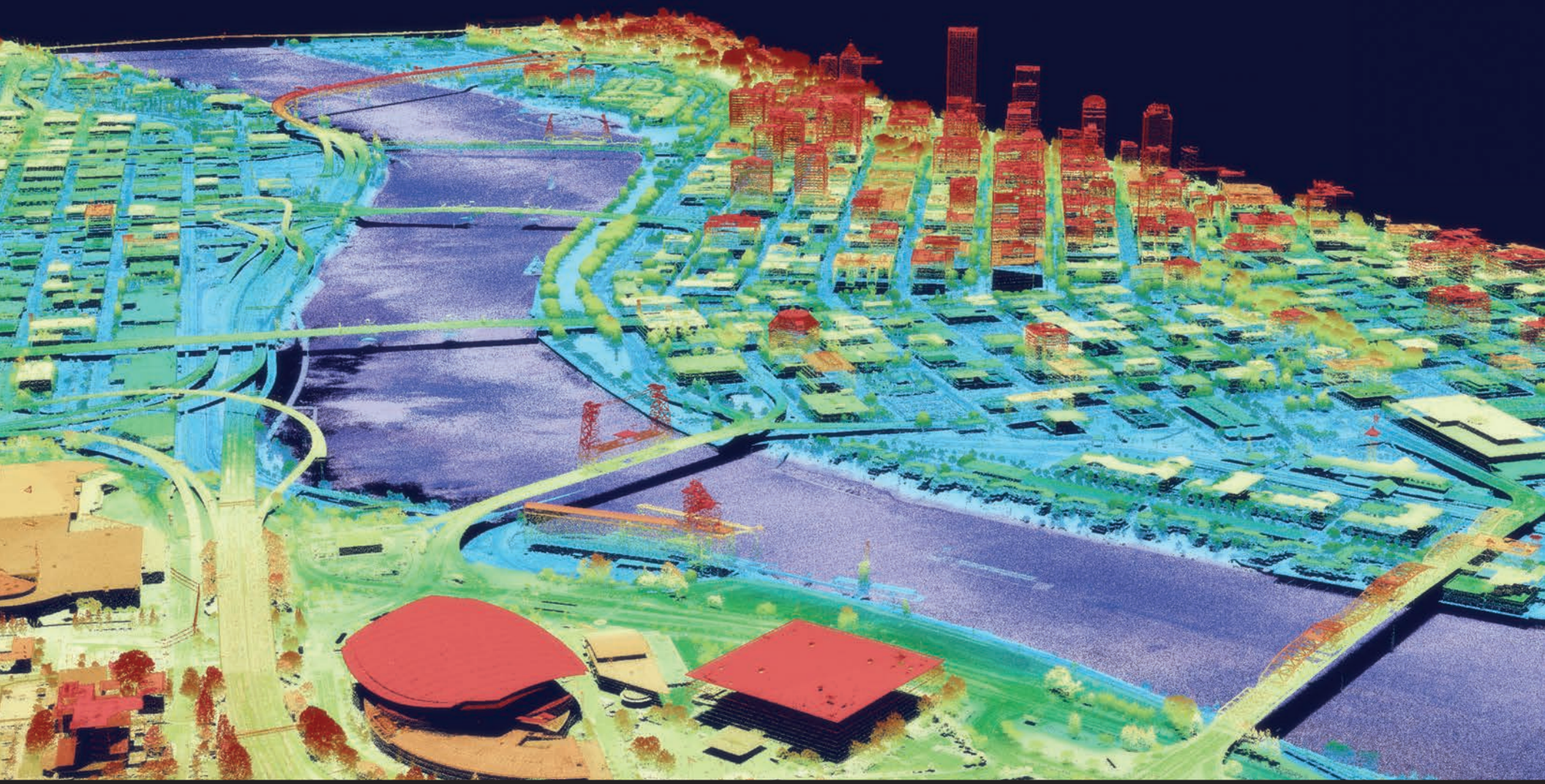
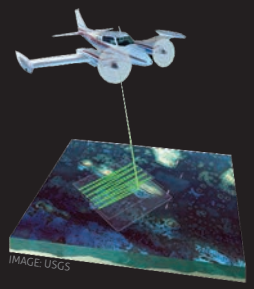
Lidar Illustrated

2012 Calendar



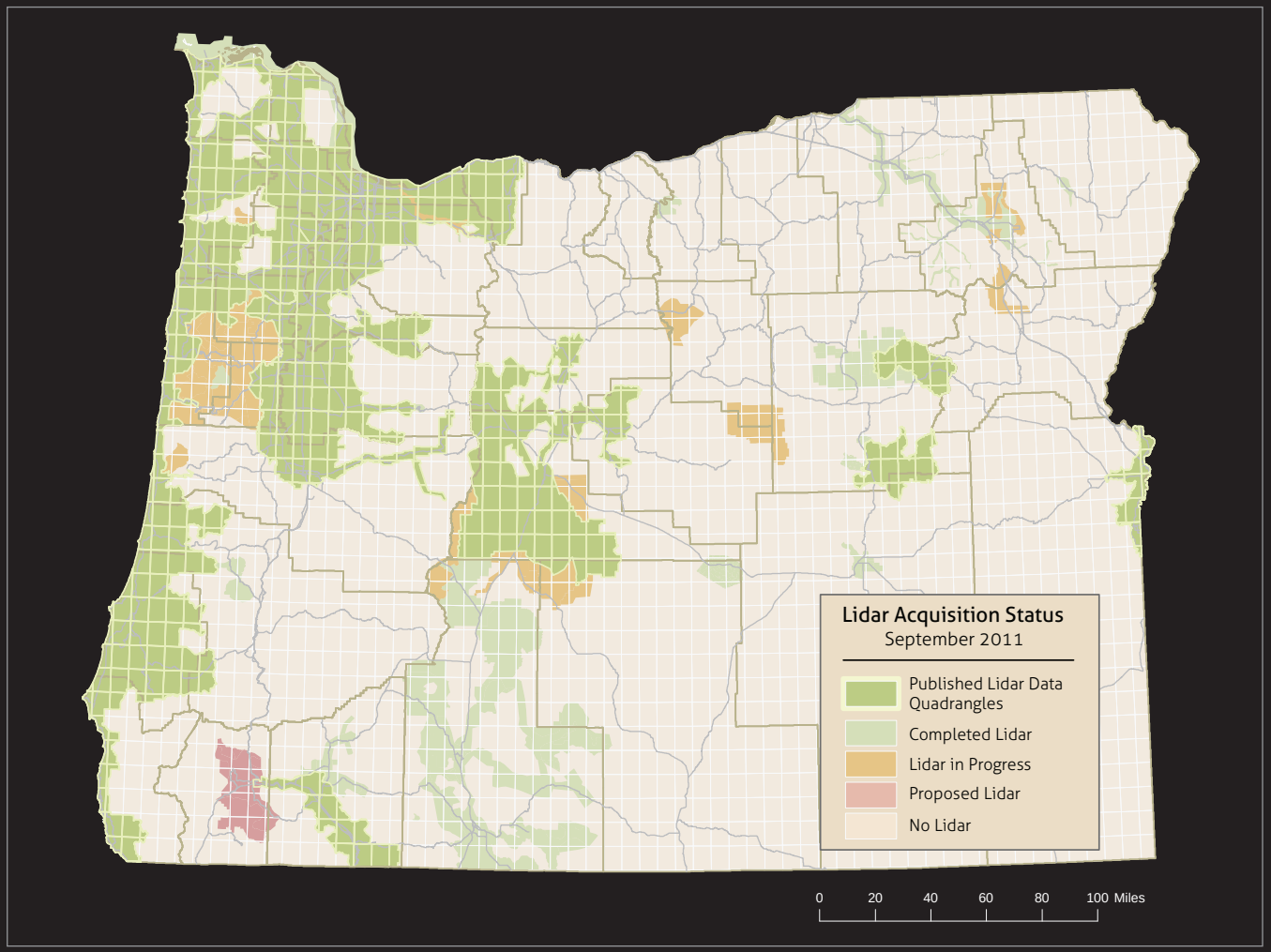
Oregon Department of Geology and Mineral Industries

Lidar Technology & Coverage 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. This calendar provides a sampling of the kinds of information that can be obtained with lidar.



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

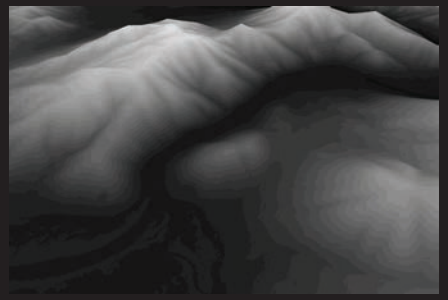
How can DOGAMI help you?
Contact us to find out!

Ian Madin, DOGAMI Chief Scientist
telephone (971) 673-1542
Ian.Madin@dogami.state.or.us

How are lidar images made?

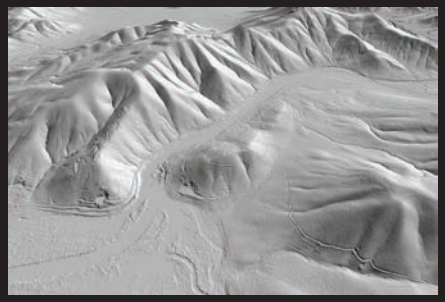
Lidar systems produce a mass of points known as a point cloud. Complex algorithms classify points on the basis of relative point-to-point and absolute geometries. These classification methods allow lidar points representing returns off the ground surface to be discriminated. Ground points are interpolated 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.

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.



bare-earth DEM

shades from black to white represent elevation change from lowest to highest in the last-return, or bare-earth, lidar data

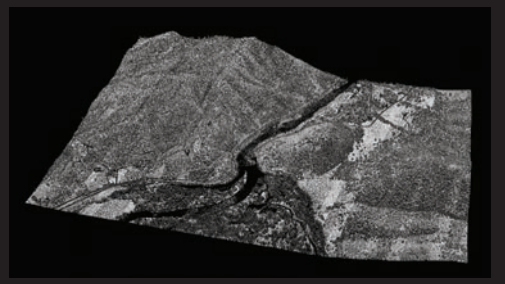


bare-earth hillshade

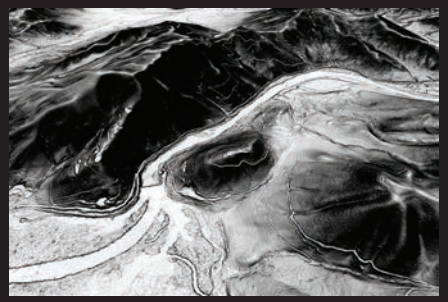
lighting effects can be added to a DEM to better simulate topography

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

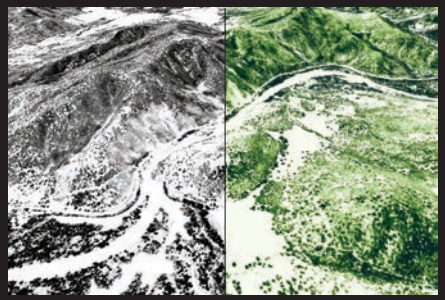


lidar point data can be rotated to provide 3-D perspective



hillslope

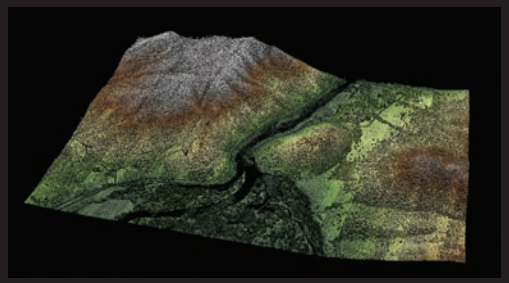
change in slope can be emphasized to help visualize the shape of the landscape



(left) black and white canopy model
(right) colorized canopy model

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. Effects can then be applied to the canopy layer only.

colorized canopy model over highest-hit hillshade



lidar point data rotated with color ramp applied to enhance elevation change

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

MOUNT BACHELOR, DESCHUTES NATIONAL FOREST, CENTRAL OREGON

This image, derived from highest-hit hillshade and canopy raster lidar data, shows clearly the many ski trails at Mount Bachelor.

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

OREGON

DECEMBER 2011

S	M	T	W	T	F	S
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

January 2012

FEBRUARY 2012

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	1	2	3

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
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
22	23	24	25	26	27	28
29	30	31	1	2	3	4

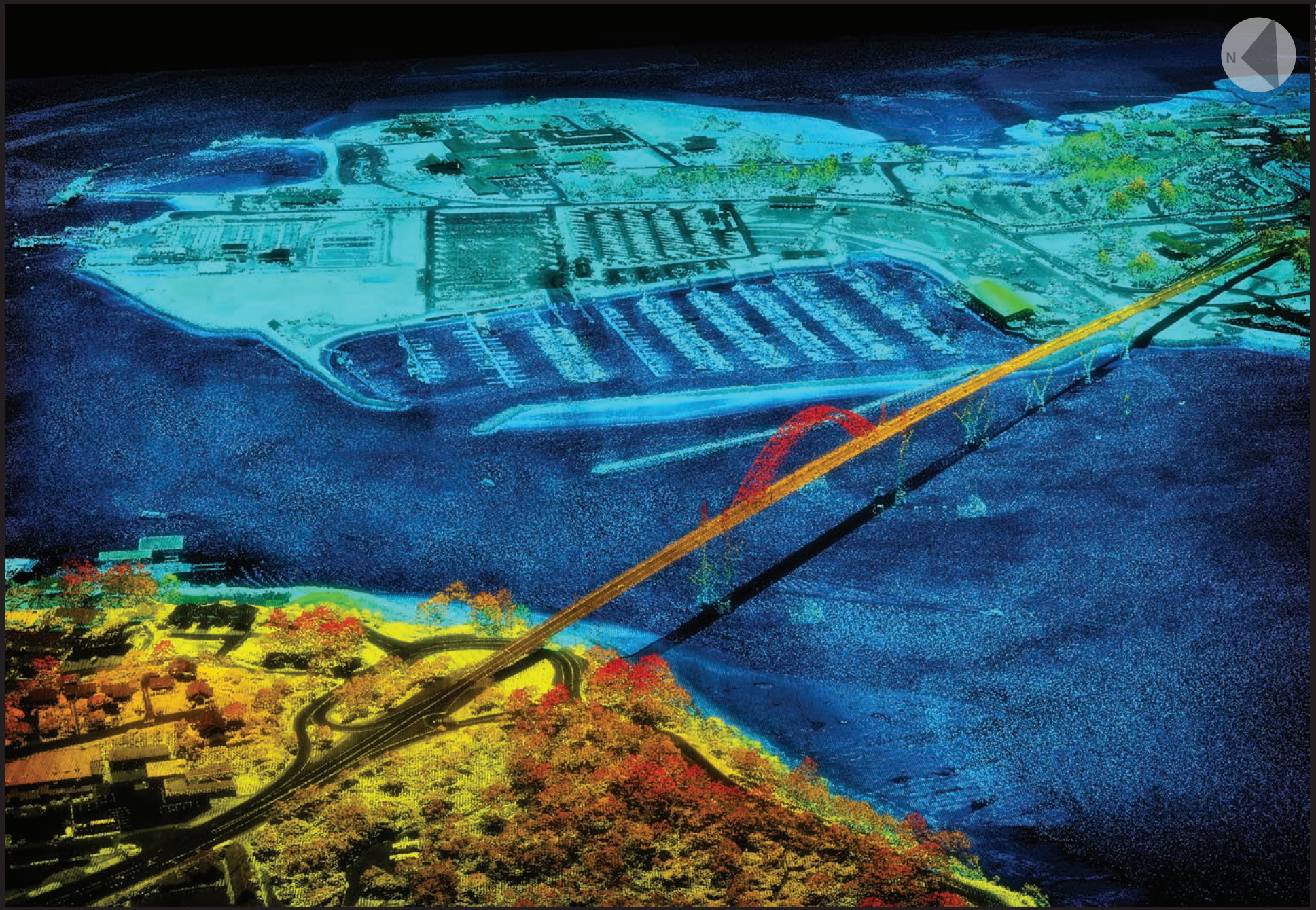


IMAGE: DANIEL E. COE

YAQUINA BAY BRIDGE, NEWPORT, OREGON

This image, derived from lidar point data, shows by means of millions of single points a snapshot of the marina, bridge, buildings, treetops, and even individual vehicles.

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

OREGON

JANUARY 2012

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

February 2012

MARCH 2012

S	M	T	W	T	F	S
26	27	28	29	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
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
19	20	21	22 Washington's Birthday	23	24	25
26	27	28	29	1	2	3

IMAGE: DANIEL E. COE

BONNEVILLE LANDSLIDE, NORTHWEST OF CASCADE LOCKS, OREGON

This image, derived from bare-earth DEM and hillshade lidar data, plus an orthophoto, dramatically highlights the 5.5-square-mile Bonneville landslide. The Bonneville slide is likely part of the Native American story of the Bridge of the Gods, a natural land bridge over the Columbia River. The landslide is shown with a warm color ramp fading from beige at higher elevations to browns at lower elevations. The image contains other landslides that are not enhanced. OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

FEBRUARY 2012

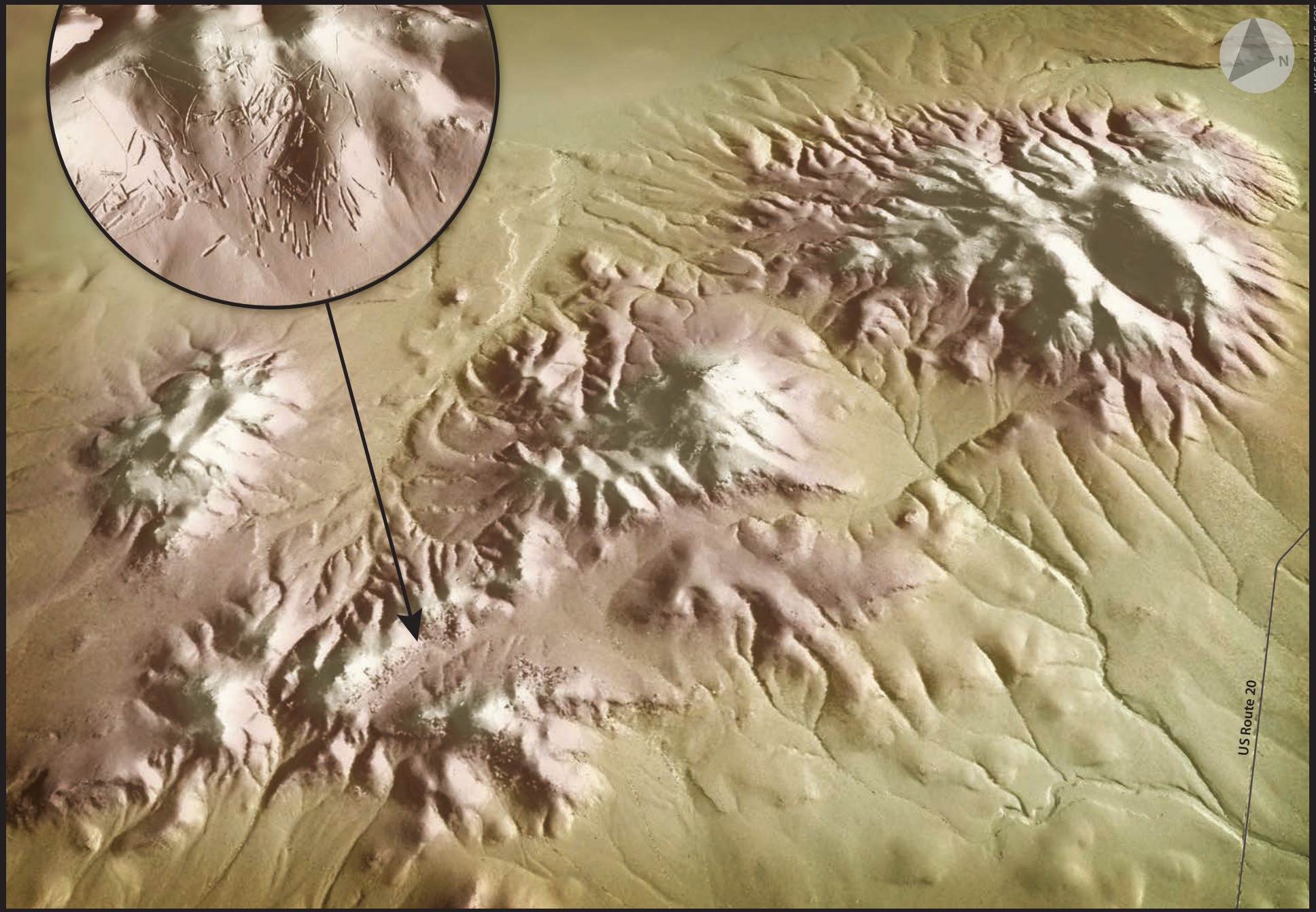
S	M	T	W	T	F	S
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	1	2	3

March 2012

APRIL 2012

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
26	27	28	29	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



GLASS BUTTES ABANDONED MINE WORKINGS, WEST OF RILEY, OREGON

This image, derived from bare-earth DEM and hillshade lidar data, shows the abandoned mine workings (inset) in this volcanic complex.
Lidar provides accurate locations and dimensions for potential reclamation of disturbed areas.

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

MARCH 2012

S	M	T	W	T	F	S
26	27	28	29	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

April 2012

MAY 2012

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 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	5

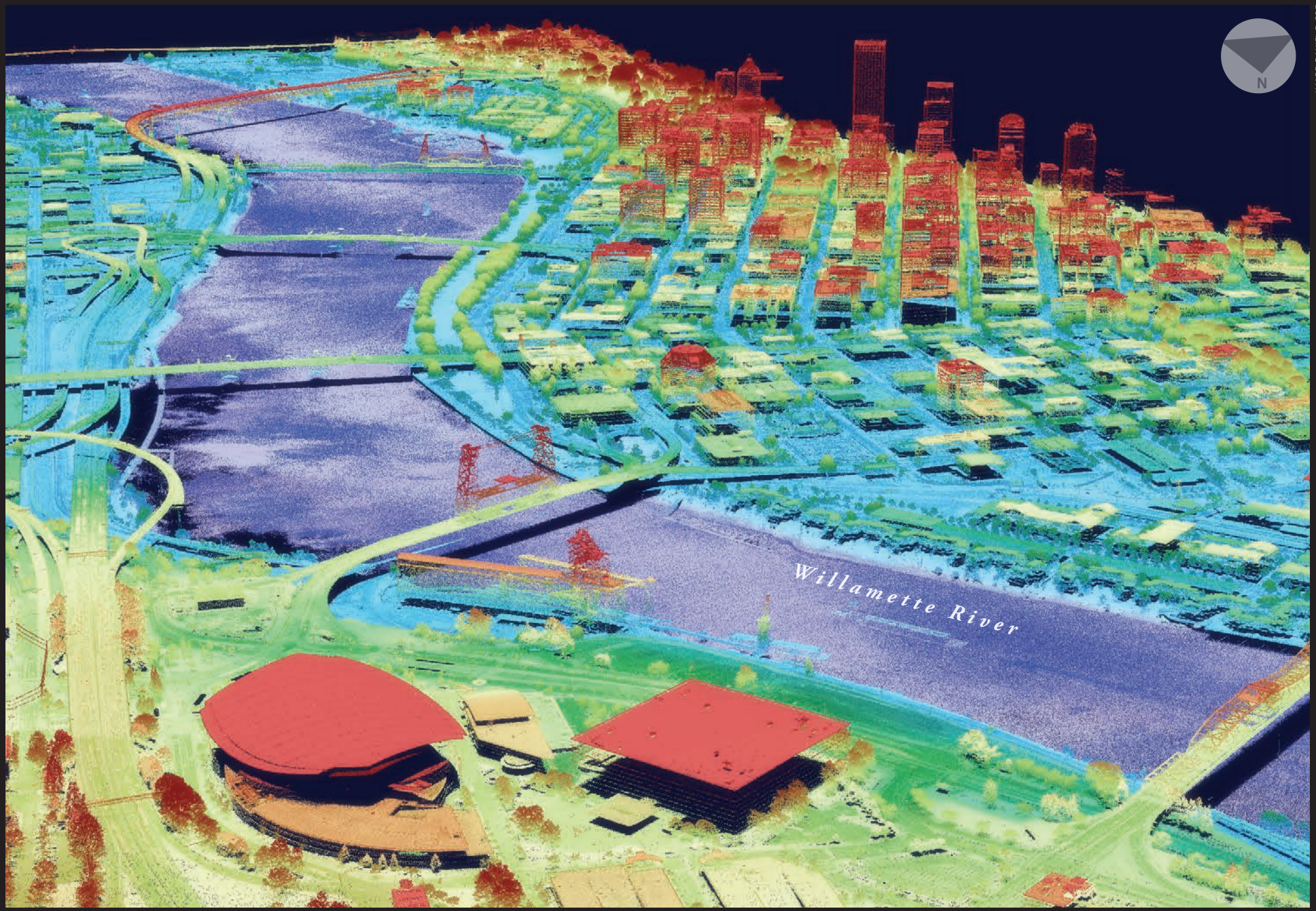


IMAGE: DANIEL E. COE

CITY CENTER, PORTLAND, OREGON

This image, derived from lidar point data, shows the bridges and buildings of Portland. The Steel Bridge, a lift bridge, is in the center. The Broadway Bridge is to the right. The Rose Garden and Memorial Coliseum are in the foreground. Buildings look like wireframes because points on vertical surfaces are not sensed as completely by the near-vertical laser pulses from the aircraft.

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

APRIL 2012

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

May 2012

JUNE 2012

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 Cinco De Mayo
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

IMAGE: DANIEL E. COE

SANDY RIVER, OXBOW REGIONAL PARK, OREGON

This image, derived from bare-earth DEM and hillshade lidar data, shows the current channel as well as terraces built up from past lahars (volcanic debris flows) from Mount Hood. A color ramp that fades from dark blue at river level to purple at elevations above river level can help define individual lahar events.

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

MAY 2012

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

June 2012

JULY 2012

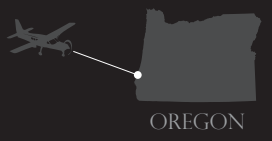
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	1	2	3	4

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

IMAGE: DANIEL E. COE

POTENTIAL TSUNAMI INUNDATION, BANDON, OREGON

This image, derived from bare earth DEM and hillshade lidar data, along with an orthophoto, has been enhanced with building footprints and tsunami inundation zones developed by DOGAMI. A local earthquake on the Cascadia subduction zone, which sits off the Pacific Northwest coast, can create a tsunami that will reach the coast in 15-20 minutes. A distant tsunami produced by an earthquake far from Oregon will take 4 or more hours to travel across the Pacific Ocean. OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES



JUNE 2012

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

July 2012

AUGUST 2012

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 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	4

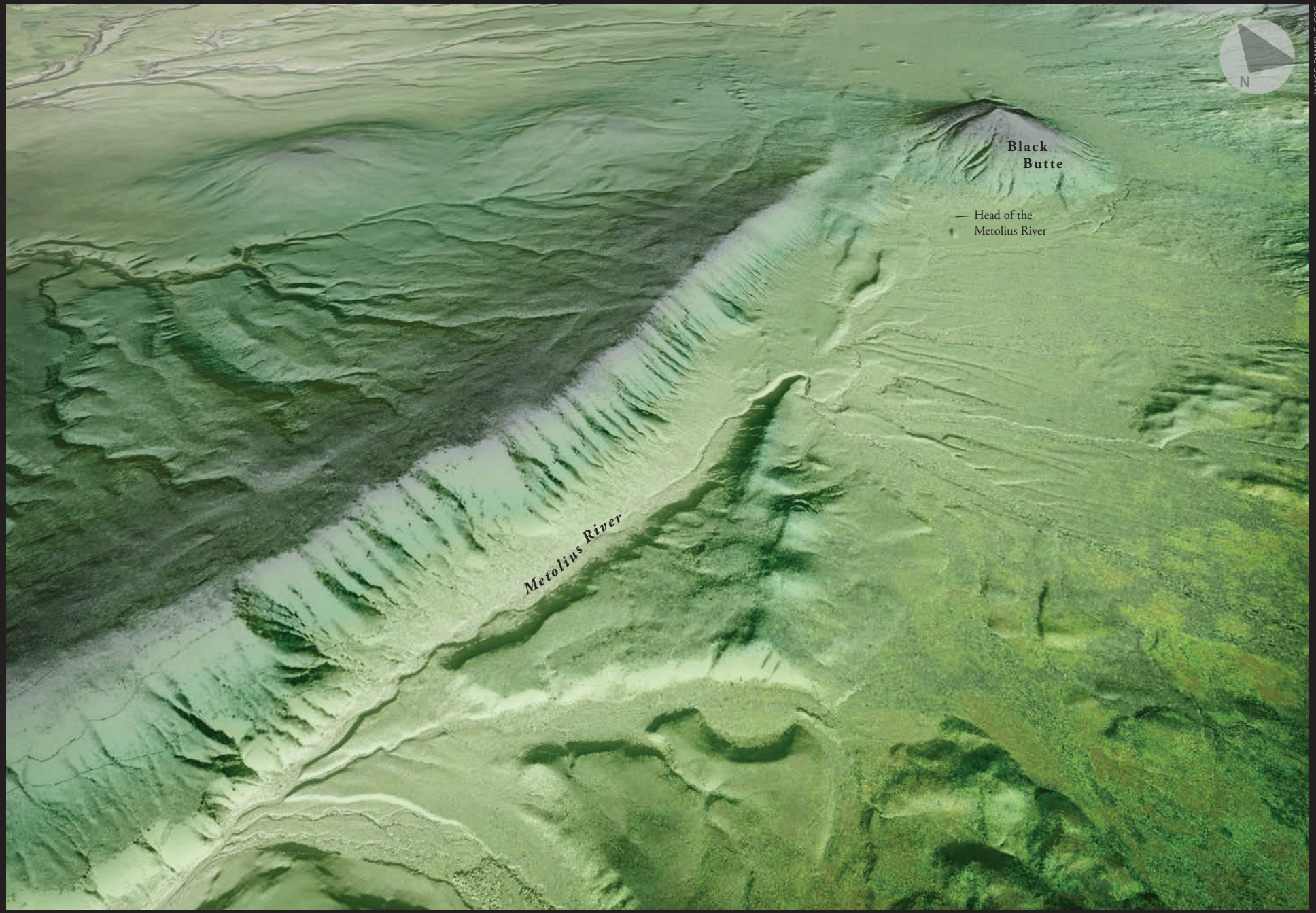


IMAGE: DANIEL E. COE

GREEN RIDGE FAULT SCARP, NORTH OF BLACK BUTTE, OREGON

This image, derived from bare-earth DEM and hillshade lidar data, shows the north-south-trending Green Ridge fault scarp. The Green Ridge fault formed approximately 4.5 million years ago. Black Butte, a basaltic composite cone, lies on the south end of the fault. The channel of the Metolius River, which flows north from springs near Black Butte, follows the fault.

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

JULY 2012

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

August 2012

SEPTEMBER 2012

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

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
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

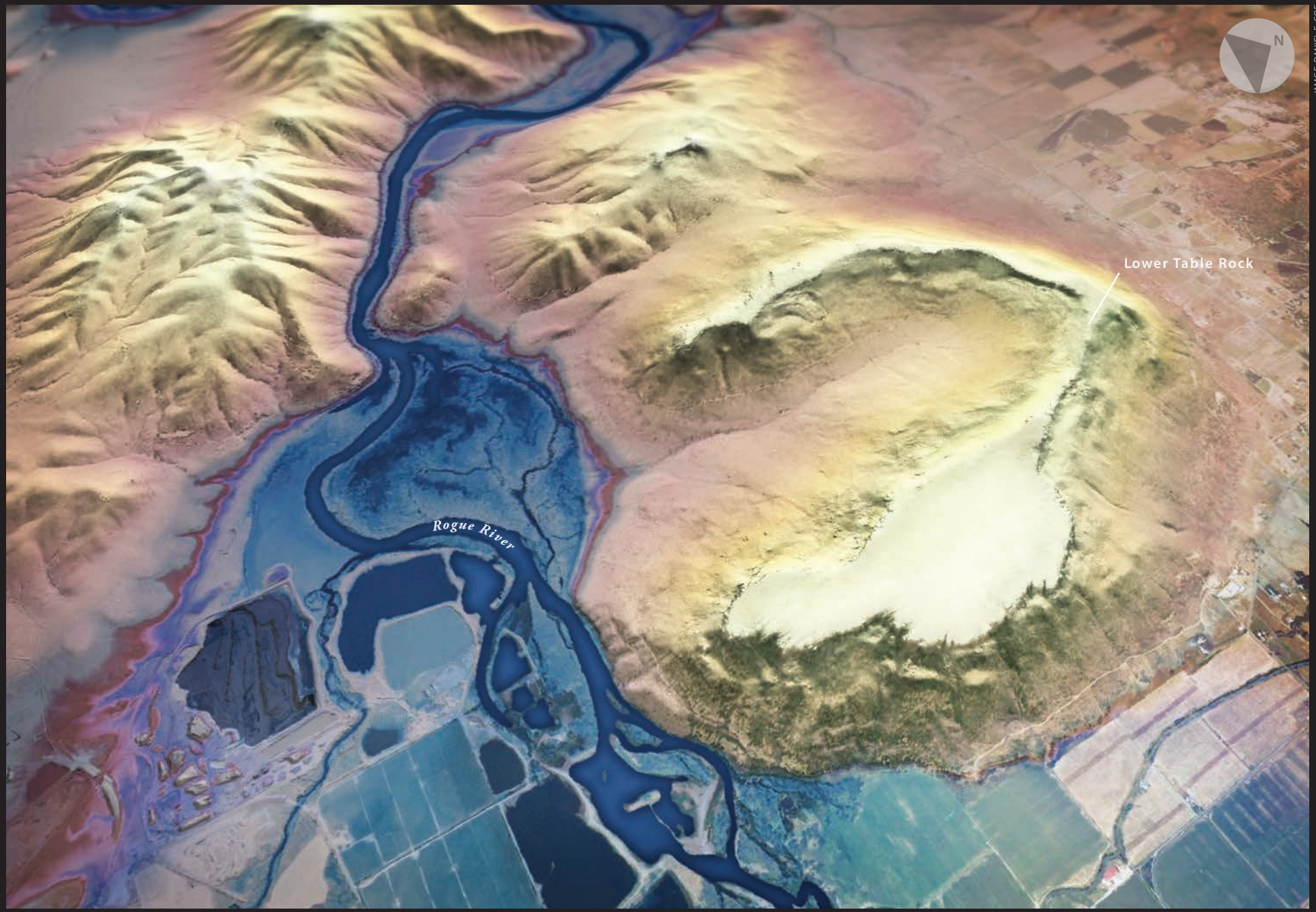


IMAGE: DANIEL E. COE

LOWER TABLE ROCK AND ROGUE RIVER, EAST OF GOLD HILL, OREGON

This image, derived from bare-earth DEM and hillshade lidar data, has been enhanced with an orthophoto to show the Rogue River channel at the base of Lower Table Rock, a volcanic plateau that stands about 800 feet above the surrounding area. The gravel pits and ponded surfaces south of Lower Table Rock can be measured accurately from lidar-derived imagery.

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

AUGUST 2012

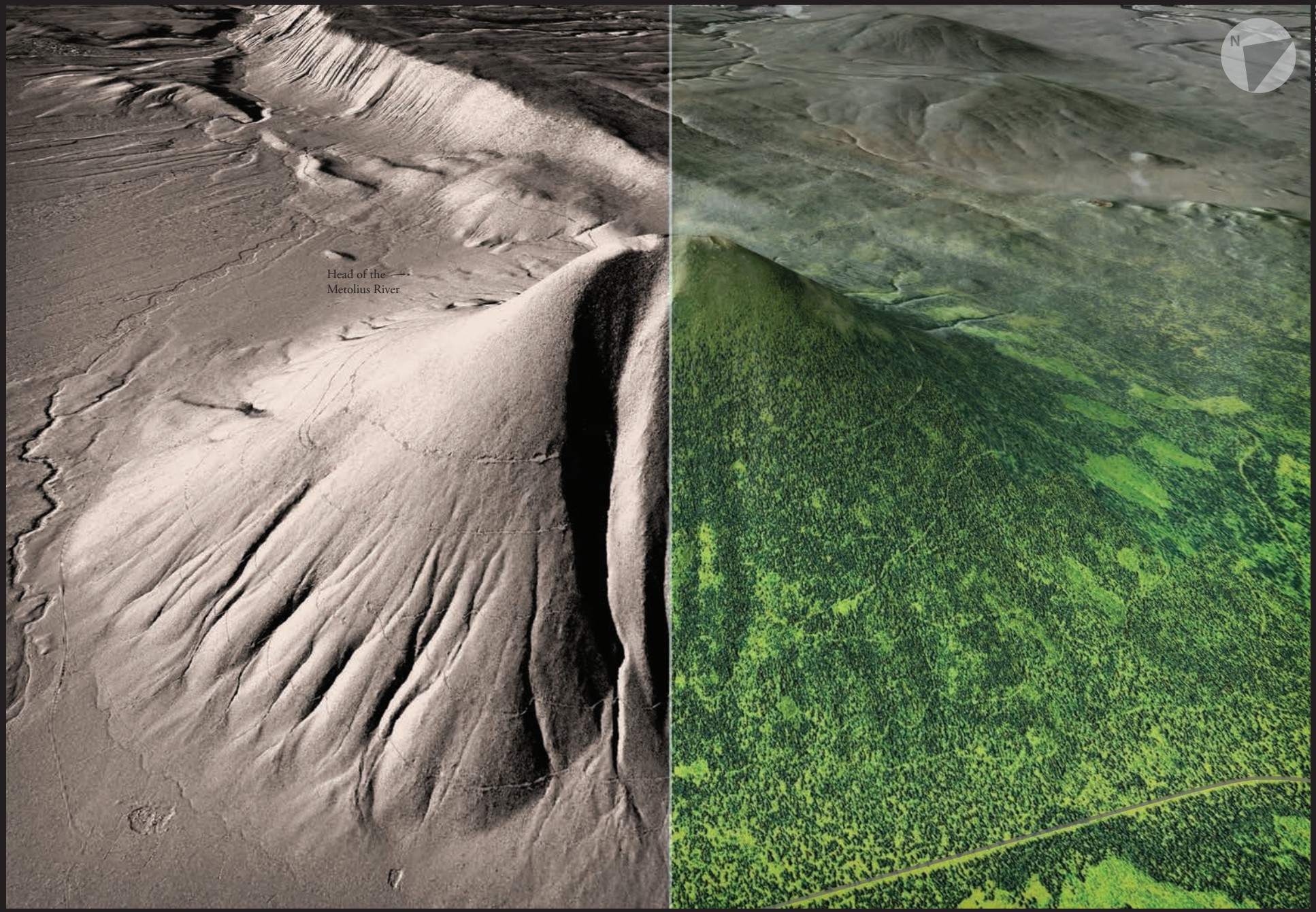
S	M	T	W	T	F	S
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

September 2012

OCTOBER 2012

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 Patriot Day	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



BLACK BUTTE, NORTHWEST OF SISTERS, OREGON

This side-by-side comparison of (left) a bare-earth hillshade image and (right) a canopy raster over highest-hit hillshade image effectively shows this composite volcano without and with its vegetative cover.

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

SEPTEMBER 2012

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

October 2012

NOVEMBER 2012

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	1

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
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

Halloween

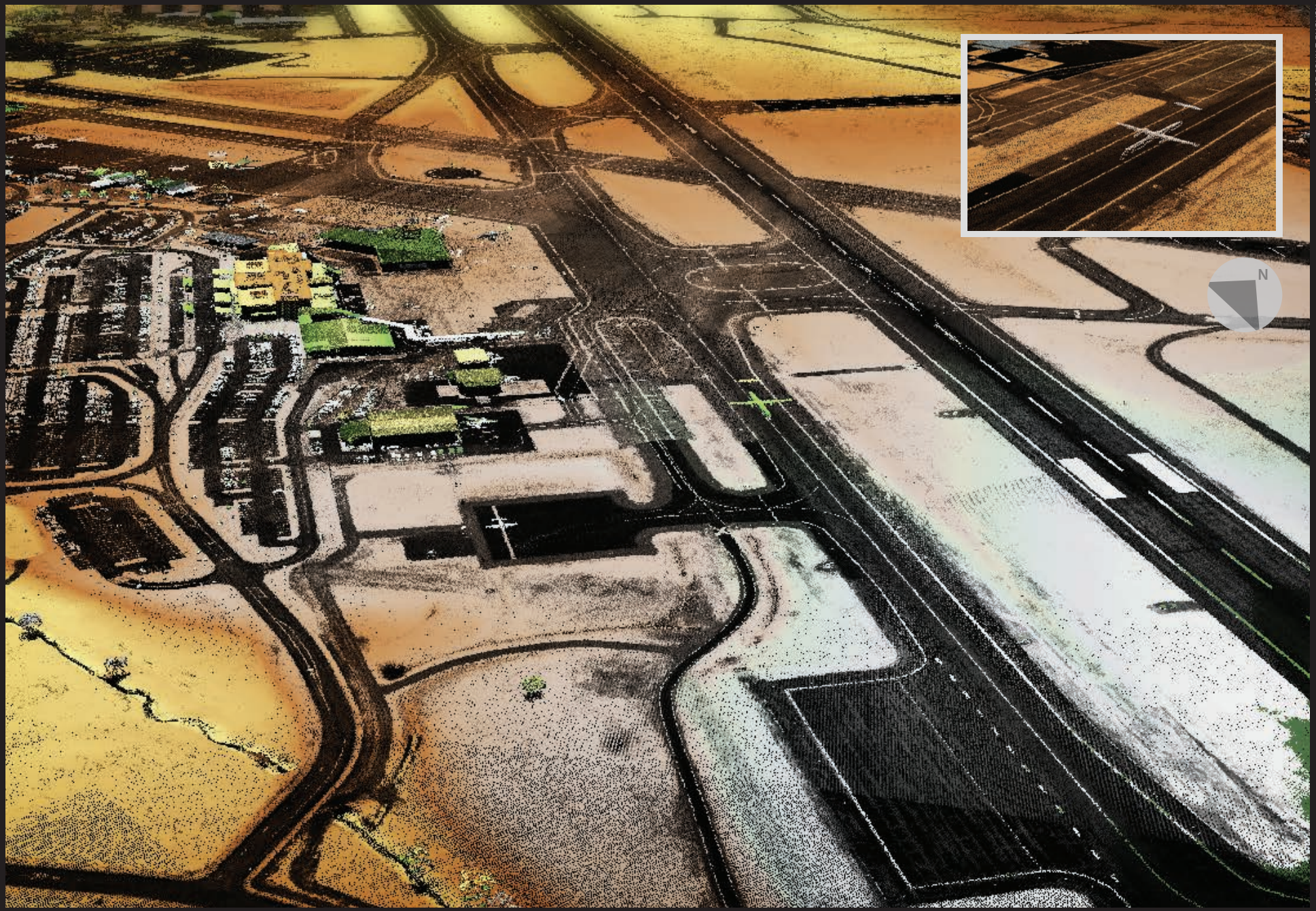


IMAGE: JOHN T. ENGLISH

ROGUE VALLEY INTERNATIONAL AIRPORT, JACKSON COUNTY OREGON

This image, derived from lidar point data, shows both the bare earth and the built environment of the airport. The relative intensity of laser pulse reflections is especially distinct on the runway, where dark colors like blacktop have low reflectance and light colors like the runway lines have high reflectance.

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

OCTOBER 2012

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

November 2012

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

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
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	29	30	1

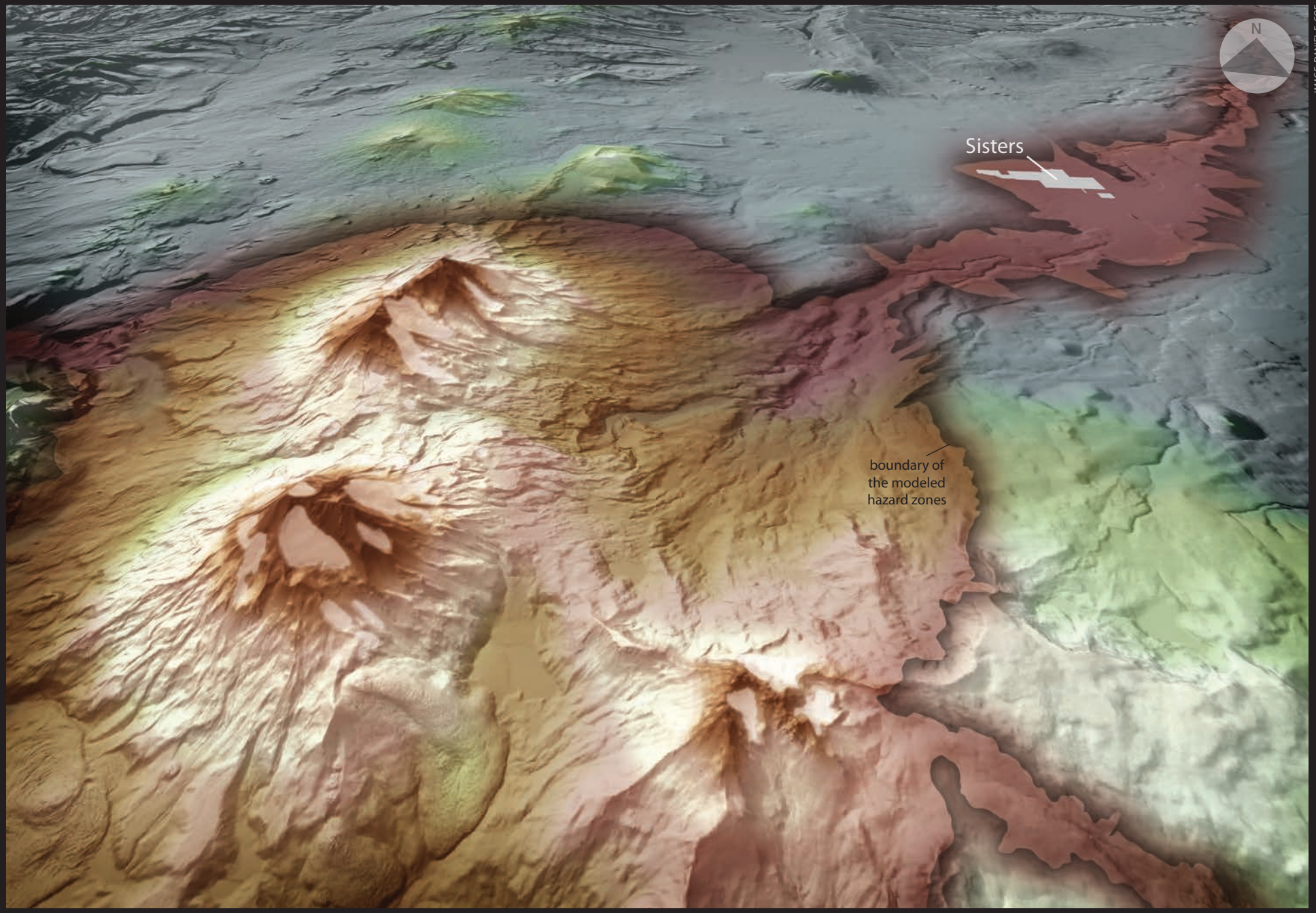


IMAGE: DANIEL E. COE

THREE SISTERS VOLCANO HAZARD ZONE, SOUTHWEST OF SISTERS, OREGON

This image, derived from bare-earth DEM and hillshade lidar data, shows the U.S. Geological Survey modeled proximal (near) volcano hazard zone combined with the modeled 500-cubic-meter lahar hazard zone. OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

OREGON

NOVEMBER 2012

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	1

December 2012

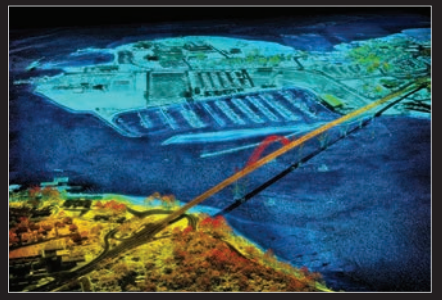
JANUARY 2013

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

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
25	26	27	28	29	30	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	5

Lidar Illustrated 2012 Calendar

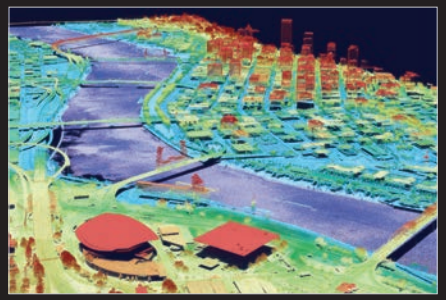
Mount Bachelor



Yaquina Bay Bridge

Bonneville Landslide

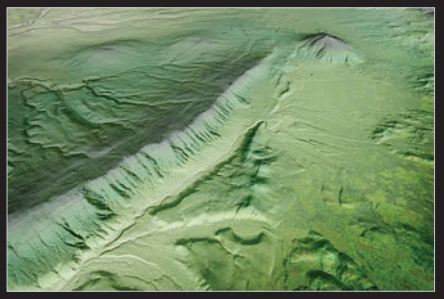
Glass Buttes Abandoned Mine Workings



Portland City Center

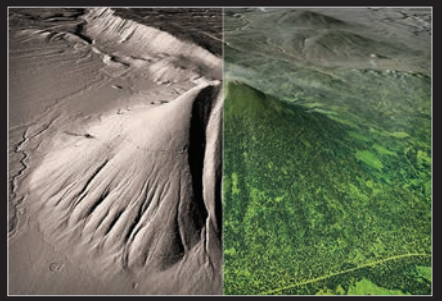
Sandy River

Potential Tsunami Inundation, Bandon



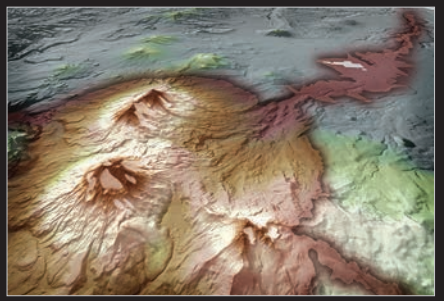
Green Ridge Fault Scarp

Lower Table Rock and Rogue River



Black Butte

Rogue Valley International Airport



Three Sisters Volcano Hazard Zone

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