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The 3D Elevation Program—Summary for Oregon

Introduction

Elevation data are essential to a broad range of business uses, including forest resources management, wildlife and habitat management, national security, recreation, and many others. In the State of Oregon, elevation data are critical for river and stream resource management; forest resources management; water supply and quality; infrastructure and construction management; wildfire management, planning and response; natural resources conservation; and other business uses. Today, high-density light detection and ranging (lidar) data are the primary source for deriving elevation models and other datasets. The Oregon Lidar Consortium (OLC), led by the Oregon Department of Geology and Mineral Industries (DOGAMI), has developed partnerships with Federal, State, Tribal, and local agencies to acquire quality level 1 data in areas of shared interest. The goal of OLC partners is to acquire consistent, high-resolution and high-quality statewide coverage to support existing and emerging applications enabled by lidar data.

The National Enhanced Elevation Assessment (NEEA; Dewberry, 2011) evaluated multiple elevation data acquisition options to determine the optimal data quality and data replacement cycle relative to cost to meet the identified requirements of the user community. The evaluation demonstrated that lidar acquisition at quality level 2 (table 1) for the conterminous United States and quality level 5 ifsar data (table 1) for Alaska with a 6- to 10-year acquisition cycle provided the highest benefit/cost ratios. The 3D Elevation Program (3DEP) initiative (Snyder, 2012a,b) selected an 8-year acquisition cycle for the respective quality levels. 3DEP, managed by the U.S. Geological Survey (USGS), the Office of Management and Budget Circular A–16 lead agency for terrestrial elevation data, responds to the growing need for high-quality topographic data and a wide range of other 3D representations of the Nation's natural and constructed features.

3DEP in Oregon by the Numbers

Expected annual benefits (quality level 2)	$45.73 million
Estimated total cost (quality level 2)	$32.41 million
Payback	0.7 years
Quality level 1 buy-up estimate	$20.62 million

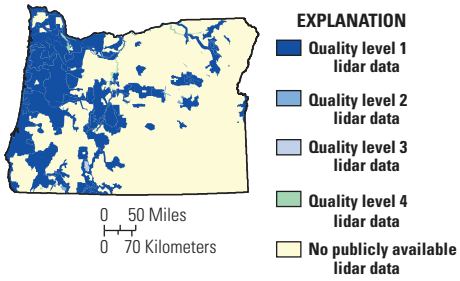

Figure 1. Map of Oregon showing the extent of existing and planned publicly available lidar data. Information source: United States Interagency Elevation Inventory, August 2013, updated annually. Quality level 2 or better data meet 3DEP requirements. See table 1 for quality level information.

3D Elevation Program Benefits for Oregon

The top 10 Oregon business uses for 3D elevation data, which are based on the estimated annual conservative benefits of the 3DEP initiative, are shown in table 2. The NEEA survey respondents in the State of Oregon estimated that the national 3DEP initiative would result in at least $45.7 million in new benefits annually to the State. The cost for such a program in Oregon is approximately $32 million, resulting in a payback period of 0.7 years and a benefit/cost ratio of 11.3 to 1 over an 8-year period. Because monetary estimates were not provided for all reported benefits, the total benefits of 3DEP to Oregon are likely much higher. On the basis of the NEEA survey results, all levels of government and many organizations in Oregon could benefit from access to statewide high-resolution elevation data.

For Oregon, approximately 72 percent of the identified business use requirements will be met in river and stream resource management, forest resources management, and water supply and quality uses, as shown in table 2. The status of publicly available lidar data in Oregon is shown in figure 1, with

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 the end of 2022, depending on funding and partnerships. 3DEP can conservatively provide new benefits of $1.2 billion/year and 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). A shared, common elevation dataset would foster cooperation and improve decision-making among all levels of government and other stakeholders.

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.

31 percent of the State's area covered and 93 percent of the population. By enhancing coordination between 3DEP and the OLC, which emphasizes quality level 1 data, it may be possible to realize additional benefits, increasing the total to approximately $83 million per year.

The following are examples of how 3DEP data can support business uses in Oregon: (1) Higher quality elevation data provide better outcomes for river and stream resource management projects (fig. 2). The Oregon Watershed Enhancement Board (OWEB) funds projects and makes targeted investments for whole watershed approaches. OWEB sees positive gains from high-quality lidar, which reduces the need for field site visits, in-field data collection, and contractor surveys, saving time and funds that can be applied to other projects. (2) The engineering use of high-quality lidar data for forest management activities is impressive. The lidar bare earth model provides an accurate representation of the ground surface under vegetation—the model can be used for landslide and steep, unstable slope identification as well as for identifying cultural resource and historical activity locations. High-quality elevation models and lidar-derived hillshades also support preliminary site engineering for road design and layout and for cut-and-fill mass calculations. (3) In urban environments, the higher quality products support preservation and restoration activities along wetlands and other protected waterways, determination of impervious surface area for stormwater master planning, and surface-water accumulation models for systems rehabilitation. (4) High-accuracy lidar topography is being used by DOGAMI to update Federal Emergency Management Agency flood maps and to model and map likely tsunami inundation from a Cascadia Subduction Zone earthquake.

Figure 2. Higher quality (more accurate and precise) elevation data provide better outcomes for river and stream resource management projects. Quality level 1 lidar image courtesy of Oregon Department of Geology and Mineral Industries.

References Cited

Dewberry, 2011, Final report of the National Enhanced Elevation Assessment (revised 2012): Fairfax, Va., Dewberry, 84 p. plus appendixes, http://www.dewberry.com/Consultants/GeospatialMapping/FinalReport-NationalEnhancedElevationAssessment.

Snyder, G.I., 2012a, National Enhanced Elevation Assessment at a glance: U.S. Geological Survey Fact Sheet 2012–3088, 2 p., http://pubs.usgs.gov/fs/2012/3088/.

Snyder, G.I., 2012b, The 3D Elevation Program—Summary of program direction: U.S. Geological Survey Fact Sheet 2012–3089, 2 p., http://pubs.usgs.gov/fs/2012/3089/.

Table 2. Conservative benefits estimates for the top 10 business uses of the proposed 3DEP data identified in the National Enhanced Elevation Assessment for Oregon (Dewberry, 2011). Benefit estimates are based on a quality level 2 program and would increase to approximately $83 million per year if fully coordinated with the Oregon plan, which calls for quality level 1 data.

Rank	Business use	Annual benefits (millions)
1	River and stream resource management	$18.45
2	Forest resources management	8.12
3	Water supply and quality	6.27
4	Infrastructure and construction management	3.48
5	Wildfire management, planning and response	2.48
6	Natural resources conservation	2.19
7	Geologic resource assessment and hazard mitigation	1.51
8	Flood risk management	1.47
9	Agriculture and precision farming	0.80
10	Coastal zone management	0.39
	Other	0.57
	Total	45.73

3D Elevation Program—Continued

The USGS and its partners will acquire quality level 2 or better (table 1) 3D lidar data over the conterminous United States, Hawaii, and the U.S. territories. Interferometric synthetic aperture radar (ifsar) data are being collected at quality level 5 (table 1) in Alaska. The data will be acquired over an 8-year period and will be made available to the public. By using this acquisition scenario, a number of high-quality elevation-data products can be created to serve a wide range of business uses in government and the private sector.

Table 1. Data quality levels used in the National Enhanced Elevation Assessment (Dewberry, 2011).

[≤, less than or equal to]

Quality level	Nominal pulse spacing (meters)	Vertical accuracy (centimeters)
1	0.35	9.25
2	0.7	9.25
3	1–2	≤18.5
4	5	46–139
5	5	93–185

Next Steps for Implementing 3DEP

Accomplishing the 3DEP initiative's goal of national coverage in 8 years depends on the following factors:

- Increased partnerships among Federal, State, Tribal, and local governments.
- Partnerships that acquire elevation data to the program's specifications across larger project areas.
- Increased communication about and awareness of the program's benefits and goals.
- Support for the program from government and other stakeholders.

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