

The 3D Elevation Program—Summary for Tennessee

Introduction

Elevation data are essential to a broad range of applications, including forest resources management, wild-life and habitat management, national security, recreation, and many others. For the State of Tennessee, elevation data are critical for agriculture and precision farming, flood risk management, natural resources conservation, infrastructure and construction management, forest resources management, aviation navigation and safety, and other business uses. Today, high-density light detection and ranging (lidar) data are the primary sources for deriving elevation models and other datasets. Federal, State, Tribal, and local agencies work in partnership to (1) replace data that are older 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 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

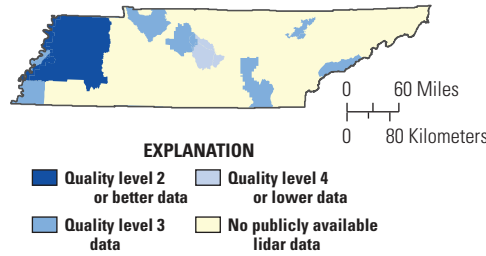


Figure 1. Map of Tennessee showing the extent of existing and planned publicly available lidar data. Information source: United States Interagency Elevation Inventory, August 2013, updated annually. Quality level 2 or better data meet 3DEP requirements. See table 1 for quality level information.

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.

3D Elevation Program Benefits for Tennessee

The top 10 Tennessee 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 Tennessee estimated that the national 3DEP initiative would result in at least \$6.3 million in new benefits annually to the State. The cost for such a program in Tennessee is approximately \$14 million, resulting in a payback period of 2.2 years and a benefit/cost ratio of 3.6 to 1 over an 8-year period. Because monetary estimates were not provided for all reported benefits, the total benefits of the 3DEP to Tennessee are likely much higher. On the basis of the NEEA survey results, all levels of government and many organizations in Tennessee could benefit from access to statewide high-resolution elevation data.

For Tennessee, approximately 83 percent of the identified business use requirements will be met in agriculture and precision farming, flood risk management,

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.

3DEP in Tennessee by the Numbers

Expected annual benefits	\$6.32 million
Estimated total cost	\$14.09 million
Payback	2.2 years
Quality level 1 buy-up estimate	\$8.97 million

and natural resources conservation uses alone, as shown in table 2. The status of publicly available lidar data in Tennessee is shown in figure 1. By enhancing coordination between 3DEP and various government and private organizations in Tennessee, it may be possible to realize more than the cited conservative benefits and attain the higher potential benefits for many business uses.

The following examples highlight how 3DEP data can support business uses in Tennessee: (1) Approximately 44 percent of the land area of Tennessee is devoted to agricultural uses. Enhanced elevation data could dramatically improve precision farming. A more accurate depiction of the terrain could help determine a more precise application of agricultural chemicals, thereby likely yielding significant cost savings, a reduction in agricultural pollution, and a potential increase in crop production. (2) The availability of more accurate state-wide elevation data would reduce onsite data collection costs and the amount of time required to complete some phases of a



flood risk project that help protect lives and property (fig. 2). The quality of analyses and study results would be improved as a result of the more accurate elevation data. Overall, the project completion time and cost would be reduced and the savings could be applied to other priority flood risk projects.

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/>.

Figure 2. Tipton County flooding, May 1, 2010. Analyses using lidar data can help reduce flood risks. Courtesy of Geospatial Information Services, Tennessee Department of Finance and Administration.

Table 2. Conservative benefits estimates for the top 10 business uses of the proposed 3DEP data identified in the National Enhanced Elevation Assessment for Tennessee (Dewberry, 2011).

Rank	Business use	Annual benefits (millions)
1	Agriculture and precision farming	\$2.05
2	Flood risk management	1.68
3	Natural resources conservation	1.49
4	Infrastructure and construction management	0.57
5	Forest resources management	0.23
6	Aviation navigation and safety	0.13
7	Geologic resource assessment and hazard mitigation	0.10
8	Renewable energy resources	0.04
9	River and stream resource management	0.01
10	Homeland security, law enforcement, and disaster response	0.01
	Other	0.01
	Total	6.32

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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