Chapter 6

Calculation of Overburden above the Mahogany Bed in the Uinta Basin, Utah and Colorado

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By Tracey J. Mercier

Chapter 6 of 7

Oil Shale Resources of the Uinta Basin, Utah and Colorado

By U.S. Geological Survey Oil Shale Assessment Team

U.S. Geological Survey Digital Data Series DDS–69–BB

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Calculation of Overburden Above the Mahogany Bed in the Uinta Basin, Utah and Colorado

By Tracey J. Mercier

Introduction

As part of the U.S. Geological Survey (USGS) National Oil Shale Assessment, the volume of overburden material was calculated above the Mahogany bed of the Eocene Green River Formation in the Uinta Basin, Utah. A common Geographic Information System (GIS) method was used to calculate the amount of overburden by subtracting a model of the Mahogany surface from a Digital Elevation Model (DEM). To maintain consistency with other models in the assessment, all overburden calculations and resultant files were analyzed using a one-acre (63.615 m (208.7106 ft) per side) raster model cell size with an effective area of 4,047 m^2/43,560 ft^2.

Procedure

The first step was to digitize (1) the locations of the Mahogany bed outcrops (fig. 1) from four published 1:250,000-scale geologic maps (Bryant, 1992; Cashion, 1973; Rowley and others, 1985; Witkind, 1995); and (2) the detailed structure contours (elevation in ft) on the top of the Mahogany bed (Cashion, 1967). Next, the Mahogany outcrop lines and an approximate 6,000-ft-depth contour to the top of the Mahogany bed were combined to delineate a limiting-resource polygon for calculation purposes; the boundary of the polygon file was confined in the west and northeast due to lack of control (fig. 1). The structure contour map was created by combining the structure contours from the southern part of the basin (Cashion, 1967) and a digital version of structure contours on the top of the Mahogany bed of the northern Uinta Basin by Johnson and Roberts (2003). The resultant structure contour file was converted to a point file containing elevation values for the top of the Mahogany bed. This point file was then processed using the GeoStatistical Analyst's Radial Basis Function (RBF) contouring method to generate a surface model in ArcGIS (ESRI, 2006). The RBF surface model was then converted to an ESRI GRID as well as a Triangulated Irregular Network (TIN) model (fig. 2) to use in ArcGIS's 3D Analyst extension.

An ArcGIS GRID (fig. 3) containing values of total overburden, in ft, above the Mahogany bed for each one-acre cell was created by subtracting the Mahogany surface GRID from the DEM GRID using the ArcGIS Spatial Analyst Raster Calculator. The overburden GRID was converted to a TIN. Figure 4 shows the effect of applying hillshade to the overburden TIN to aid in visual analysis. In order to calculate the volume of overburden material contained in specific polygonal areas, the ArcToolbox's TIN Polygon Volume function was used to calculate the total volume of overburden, in mi^3, within the basin, and the amount of overburden within each Public Land Survey System (PLSS) township (fig. 5).

Conclusion

This analysis determined the total volume of overburden above the defined resource area for the Mahogany bed in the Uinta Basin to be approximately 1,410 mi^3 of rock and other material. For comparison, that amount is approximately equal to 162 times the volume of water in Lake Mead; 2,350,000,000 Olympic-size swimming pools; 2,104 times the amount of rock removed during the Mt. St. Helens eruption; 1.4 times the volume needed to fill the Grand Canyon; or over 52 billion hopper cars at 4,000-ft^3 capacity.

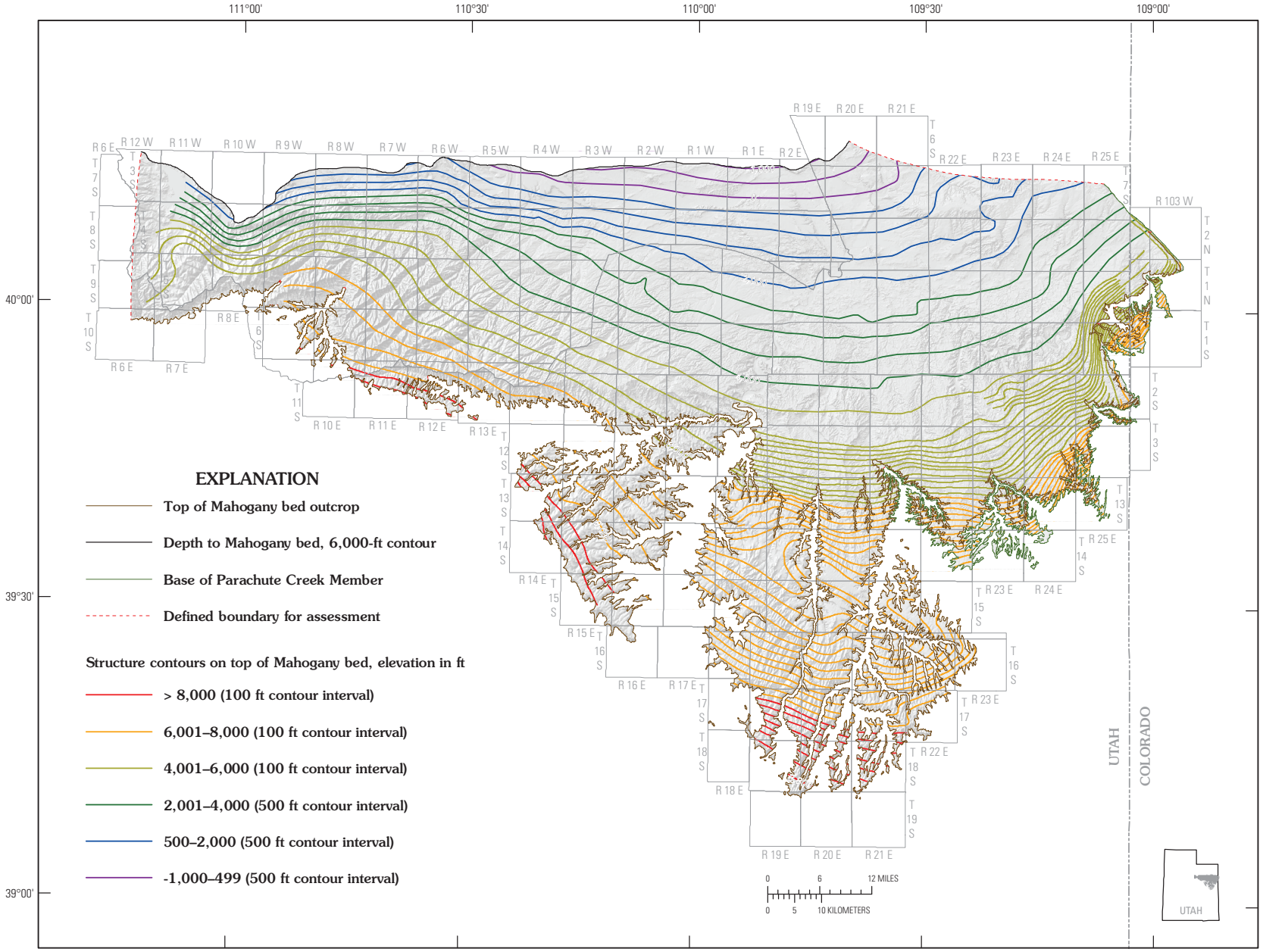

Figure 1. Structure contours on top of the Mahogany bed drawn on the Digital Elevation Model (DEM) clipped to the Uinta Basin.

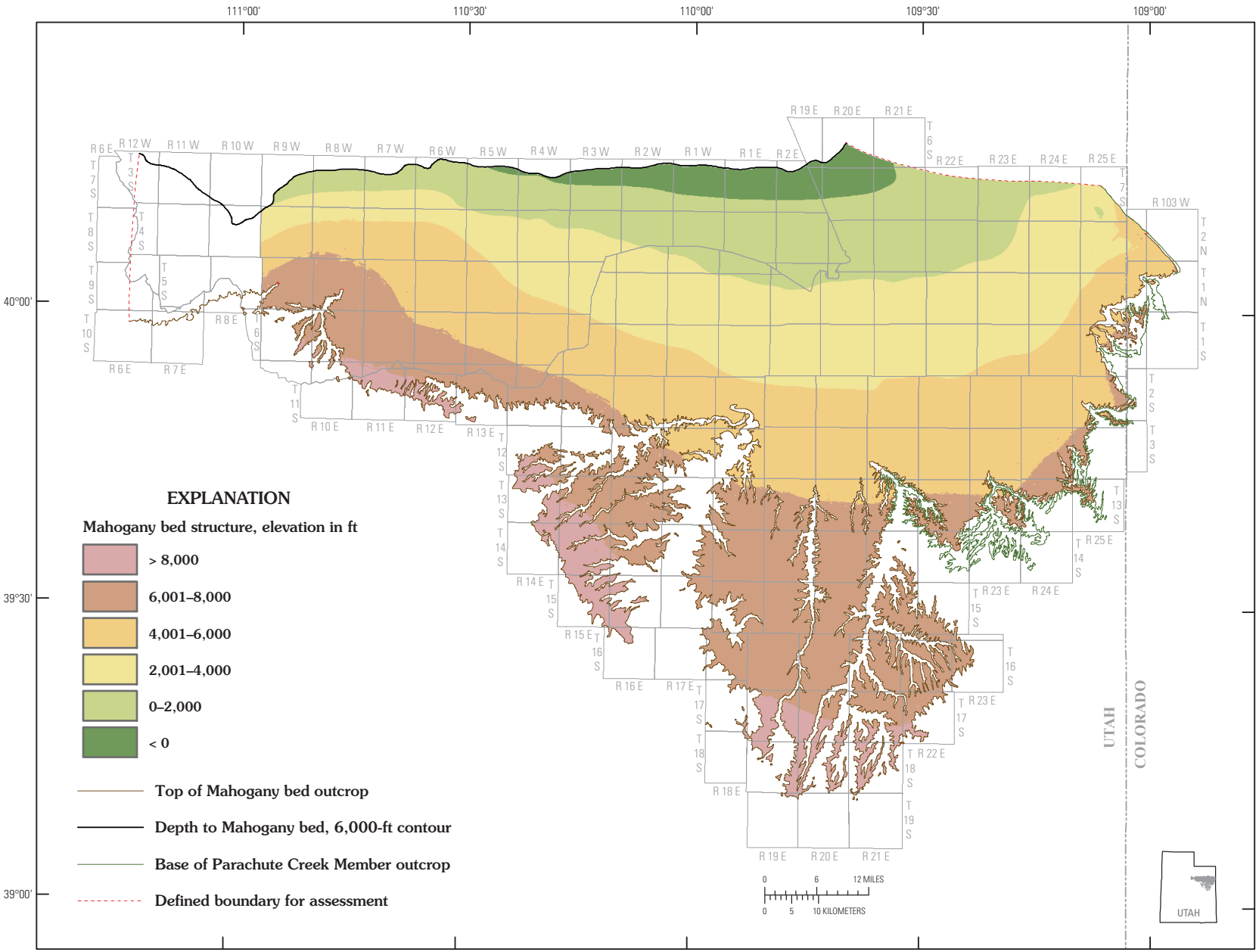

Figure 2. Triangular Irregular Network (TIN) model of the top of the Mahogany bed subsurface structure.

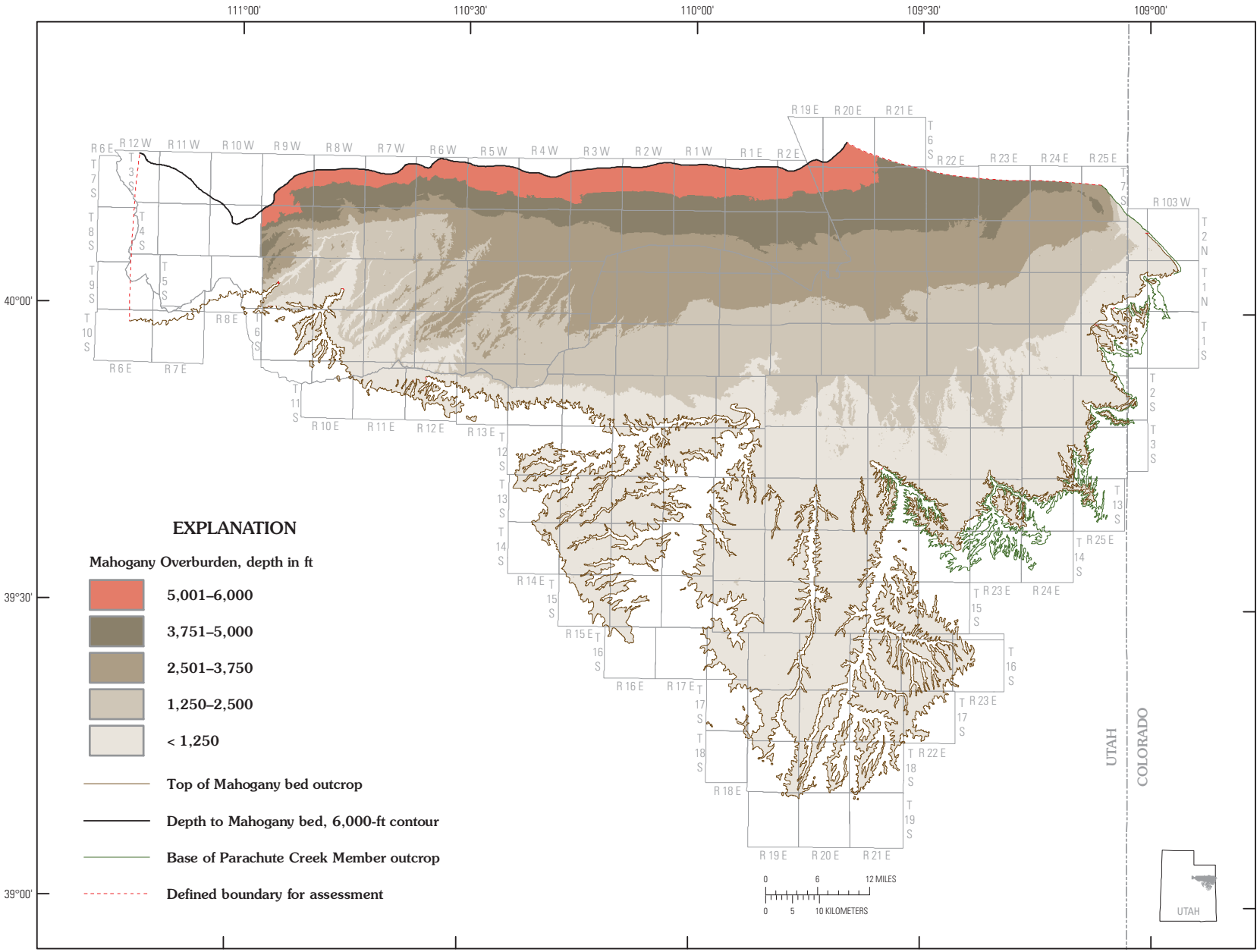

Figure 3. Overburden above the Mahogany bed in the Uinta Basin.

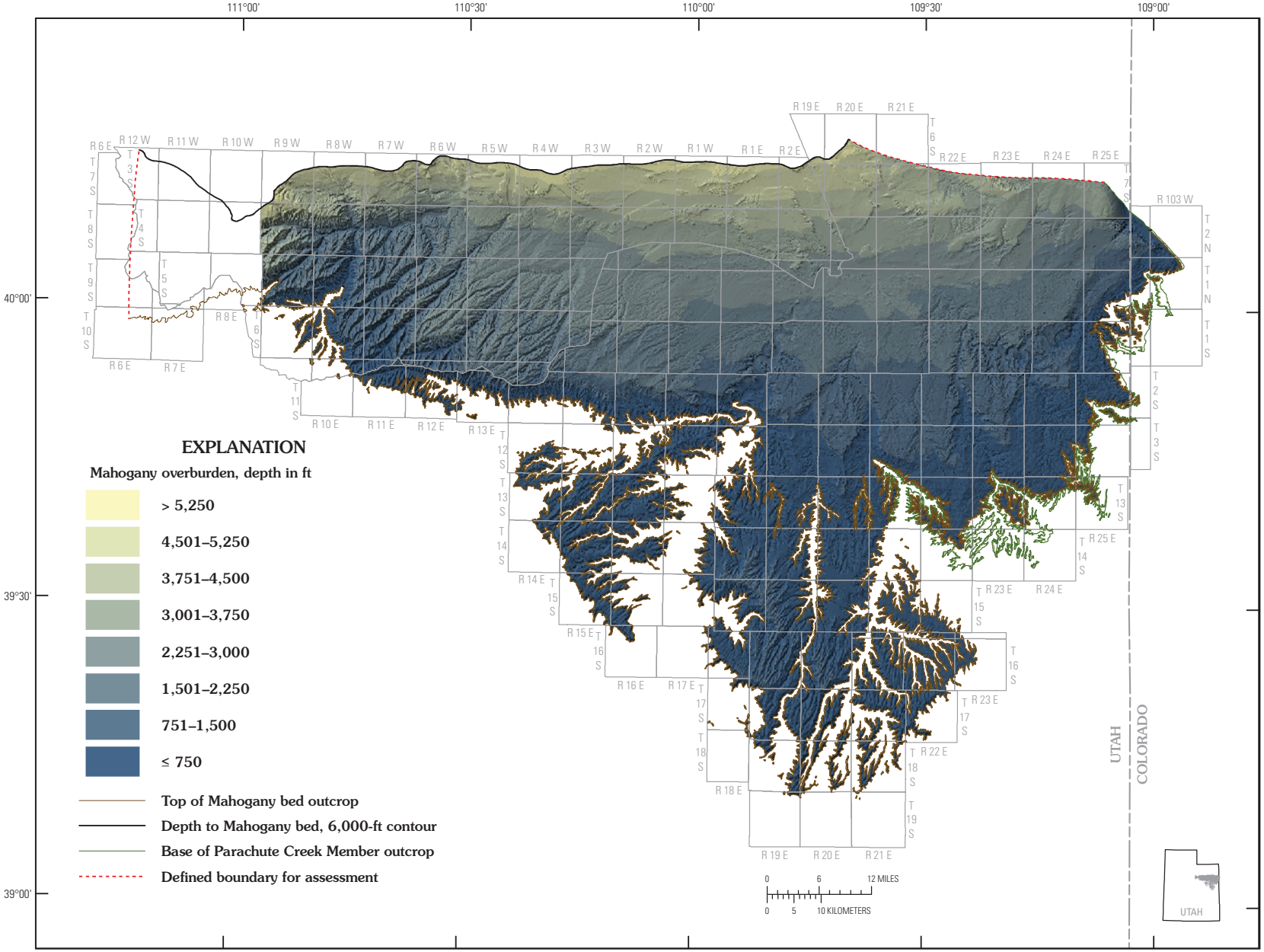

Figure 4. Overburden above the Mahogany bed in the Uinta Basin, hillshade effect applied.

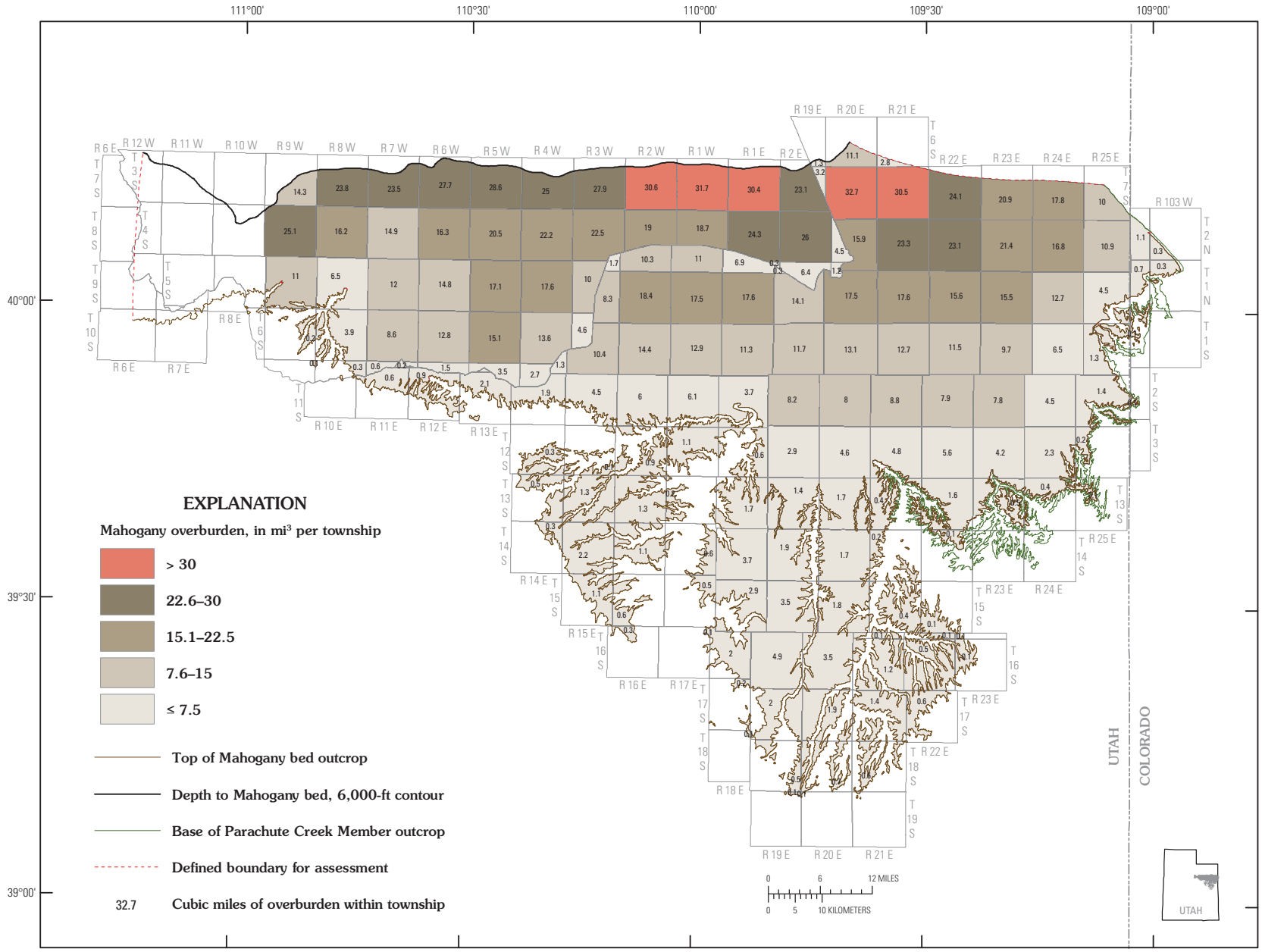

Figure 5. Cubic miles of overburden per township above the Mahogany bed in the Uinta Basin.

References Cited

Bryant, B.H., 1992, Geologic and structure maps of the Salt Lake City 1 degree by 2 degrees quadrangle, Utah and Wyoming: U.S. Geological Survey Miscellaneous Investigation Map I-1997, scale 1:250,000, *http://pubs.er.usgs.gov/usgspubs/i/i1997*.

Cashion, W.B., 1967, Geology and fuel resources of the Green River Formation, southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Professional Paper 548, plate 1, 48 p., *http://pubs.er.usgs.gov/usgspubs/pp/pp548*.

Cashion, W.B., 1973, Geologic and structure map of the Grand Junction quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigation Map I-736, scale 1:250,000, *http://pubs.er.usgs.gov/usgspubs/i/i736*.

Environmental Systems Research Institute, Incorporated (ESRI), 2006, ArcGIS, ver. 9.2: ESRI, Redlands, Calif., *http://www.esri.com/software/arcgis/index.html*.

Johnson, R.C., and Roberts, L.N., 2003, Depths to selected stratigraphic horizons in oil and gas wells for upper Cretaceous and lower Tertiary strata of the Uinta Basin, Utah: U.S. Geological Survey Digital Data Series 69-B, Chapter 13, 33 p., *http://pubs.usgs.gov/dds/dds-069/dds-069-b/*.

Rowley, P.D., Hansen, W.R., Tweto, Ogden, Carrara, P.E., 1985, Geologic map of the Vernal 1 degree by 2 degrees quadrangle, Colorado, Utah, and Wyoming: U.S. Geological Survey Miscellaneous Investigation Map I-1526, scale 1:250,000, *http://pubs.er.usgs.gov/usgspubs/i/i1526*.

Witkind, I.J., 1995, Geologic map of the Price 1 degree by 2 degrees quadrangle, Utah: U.S. Geological Survey Miscellaneous Investigation Map I-2462, scale 1:250,000, *http://pubs.er.usgs.gov/usgspubs/i/i2462*.

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