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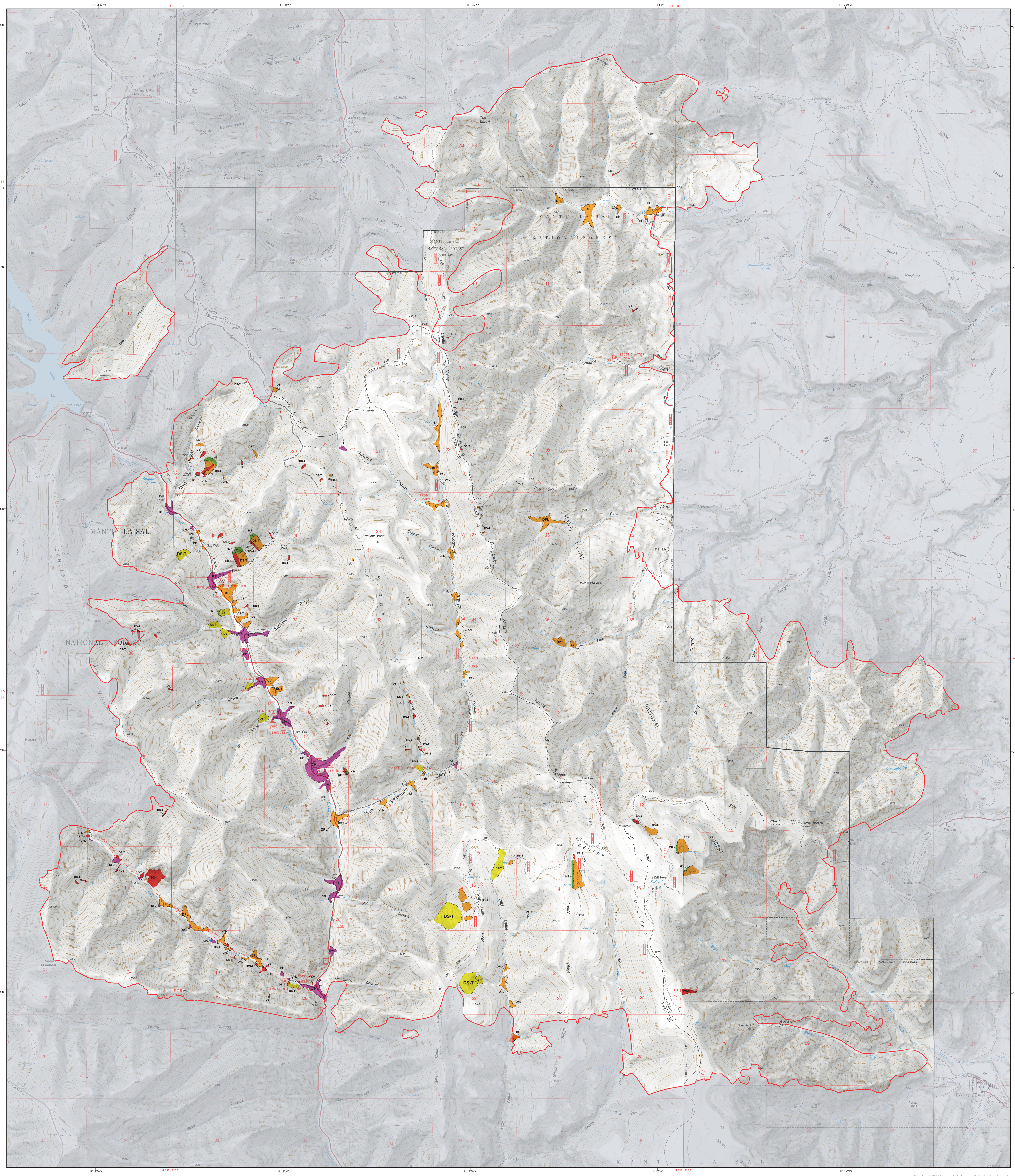
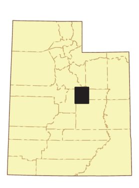


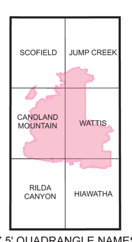
SCALE 1:24,000

CONTOUR INTERVAL 40 FEET



MAP LOCATION

APPROXIMATE MEAN DECLINATION, 2014



7.5' QUADRANGLE NAMES

Base from USFS Hiawatha, Rilda Canyon, Wattis, Candland Mountain, Jump Creek, and Scofield 7.5' Quadrangles 2012
Projection: UTM Zone 12
Datum: NAD 1983
Spheroid: Clarke 1866

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LANDSLIDE INVENTORY MAP OF THE 2012 SEELEY FIRE AREA, CARBON AND EMERY COUNTIES, UTAH

by
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2014

EXPLANATION

This map presents a landslide inventory for the 2012 Seeley fire area, Carbon and Emery Counties, Utah, at a scale of 1:24,000. The purpose of the map and accompanying geodatabase is to show and characterize prehistorical and historical landslides that are within and near the Seeley fire boundary that are larger than about 40 feet across their shortest dimension, and to provide information useful for managing landslide-related issues within the burn area. The map and accompanying geodatabase were prepared by the Utah Geological Survey (UGS) as a cooperative project with the Manti-La Sal National Forest. The 2012 Seeley fire, initiated on June 26 and contained on July 18, covered approximately 75 square miles on the Wasatch Plateau. The map covers areas within and near the burn area and includes parts of the following Hydrologic Unit Names and Codes: Mud Creek (140600070203), Left Fork Huntington Creek (140600090101), Right Fork Huntington Creek (140600090102), South Fork Gordon Creek (140600070403), Mud Water Canyon (140600070401), Pinnacle Wash (140600070801), Miller Fork Canyon-Huntington Creek (140600090103), Clawson Spring-Miller Creek (140600070602), and Serviceberry Creek (140600070601) (Utah Automated Geographic Reference Center, 2012). We used geographic information system (GIS) software to capture, store, and display data for each mapped landslide.

We prepared the landslide inventory by analyzing and interpreting 12 sets of stereo and orthophoto aerial photography acquired periodically from 1938 through 2011, which provide a 73-year history of landsliding in the burn area. In addition, we performed limited field reconnaissance of the area following damaging debris flows and flooding during the summer of 2012. We cite photography dates and scales in our aerial photographs reference list. The 1981 and 1984 photo sets have limited coverage in the map area. We recorded spatial and tabular data for each mapped landslide. Spatial data pertain to landslide deposit and landslide geomorphic source type; source types include slide and flow main scarps and rock-fall cliff bands. Tabular data describe landslide characteristics in text or numeric form. The spatial and tabular data are stored in the geodatabase and linked to the inventory map. Landslide information stored in the database includes area, material type, movement type, landslide deposit name, landslide source name, movement activity, thickness, movement direction, approximate movement dates, bedrock unit(s) associated with the landslide, confidence in mapped boundaries, mapper name, peer reviewer name, and comments.

Seeley Fire Boundary (provided by the Manti-La Sal National Forest)

Area not mapped

Landslide Classification

The characteristics used to classify landslides were observed on aerial photography of various dates, on topographic quadrangle maps, in Manti-La Sal National Forest reports, and in the field. Our landslide classification methodology is similar to that used by the California Geological Survey (Irvine and others, 2007) and the Oregon Department of Geology and Mineral Industries (Burns and Madin, 2009). Landslide classification is based primarily on terminology and mapping criteria of Varnes (1978), Wieczorek (1984), Cruden and Varnes (1996), Keaton and DeGraff (1996), and Haskins and others (1998). Landslide deposits are classified based on type of geologic material and type of movement. Where a landslide source could be identified and mapped, the source was classified based on the geomorphic source type. Both the landslide deposit and source are further classified based on landslide movement activity and boundary-mapping confidence. The geodatabase includes additional landslide information not shown on the map.

Landslide Deposit Materials and Movement

Each landslide deposit is assigned a two-part name based on dominant material and movement types after Cruden and Varnes (1996). The material is classified as rock or soil, and soil is further subdivided as debris (mostly coarser than sand-sized particles) or earth (mostly sand-sized or finer particles). The observed movement types in the Seeley fire area consist of falls, flows, and translational slides. We used the following landslide names in our mapping:

RF	rock fall
RS-R	rock slide, rotational
RS-T	rock slide, translational
DS-R	debris slide, rotational
DS-T	debris slide, translational
DFL	debris flow
ES-R	earth slide, rotational
ES-T	earth slide, translational
EFL	earth flow

Landslide Source Type

Landslide source areas are classified based on geomorphic source type. Cliff bands and outcrops are typically the source areas for rock-fall deposits. Main scarps are typically the source area for slide and flow deposits. We identified the following landslide source types in our mapping:

CB	cliff band
MS	main scarp

Landslide Movement Activity

We classified landslide deposit and source activity based on landslide features observed on aerial photographs and/or in the field. Because 2012 debris flows occurred during and after the fire, we include 2012 fire-related debris flows to show the most recent post-fire activity.

2012 fire-related debris flow: Debris flows triggered in 2012 during and following the Seeley fire. Most 2012 deposits only covered part of the mapped alluvial fan.

Active or historical: The landslide has documented movement or landslide features observed on aerial photography and/or in the field indicative of historical movement.

Dormant or very slow moving: Landslide deposit landforms are fresh or uneroded, but there is no evidence of historical movement. Landslide movement is suspended or at a slow rate, preventing development of sharp recognizable features associated with active movement and allowing erosion to smooth existing features.

Dormant-eroded: Landslide deposit landforms are smoothed, subdued, and incised by erosion.

Landslide Mapping Confidence

The confidence of landslide mapping is based on the visual clarity of boundaries around landslide sources or deposits. Erosion or vegetation may obscure boundaries, making them difficult to map accurately.

High: The landslide boundary is clearly evident and discernable. The landslide generally shows features indicative of recent movement.

Moderate: Some, but not all parts of the boundary are clearly evident, other parts are approximate or gradational. Diagnostic landforms are generally present.

Low: The boundary is difficult to determine and is approximately located, and few diagnostic landforms may be present.

GEOLOGY AND LANDSLIDES IN THE SEELEY FIRE AREA

The Seeley fire area lies on the northern Wasatch Plateau. The rock units exposed within and near the burn area consist of, from oldest to youngest, Cretaceous Mancos Shale, Star Point Sandstone, Blackhawk Formation, Castlegate Sandstone, and Price River Formation; and Tertiary-Cretaceous North Horn Formation (Witkind and others, 1987; Witkind and Weiss, 1991). The Mancos Shale consists of the upper Blue Gate Member and contains shale with minor interbedded sandstone. The Star Point Sandstone contains sandstone, shale, and shaley siltstone. The Blackhawk Formation contains sandstone, shaley siltstone, shale, and coal. The Castlegate Sandstone contains massive sandstone with some conglomerate. The Price River Formation contains sandstone and shale. The North Horn Formation is primarily shale with lesser amounts of sandstone. Shale in the North Horn Formation commonly weathers to clay and typically produces more landslides than other rock units on the Wasatch Plateau (McDonald and Giraud, 2011). However, in the Seeley fire area, the North Horn Formation has limited exposure on flatter topography and produces fewer landslides. The rock units are generally flat-lying and are cut by north-south-trending, high-angle, small-displacement normal faults. The Pleasant Valley fault zone trends through the center of the burn area, and part of the northern Joes Valley fault zone lies at the west edge of the burn area (Foley and others, 1986; included in Lund and others, 2011).

Thunderstorm rainfall triggered numerous fire-related debris flows and floods in the summer of 2012, causing widespread damage along Huntington Creek and other streams that drain the burn area. The intense rainfall and rapid runoff converged into steep drainage basin channels, eroding sediment and forming debris flows. The debris flows consisted of boulders, cobbles, gravel, sand, silt, clay, and wood debris. The wood debris ranged from large burned tree trunks to smaller wood fragments. Some debris flows eroded channels down to bedrock, and the present lack of channel sediment will limit the volume of future debris flows until the channels fill back in with sediment. The most active historical landslide period, prior to 2012, was 1983, when landsliding and flooding caused widespread damage (U.S. Forest Service, 1983).

The mapping identifies alluvial fans impacted by 2012 fire-related debris flows and is useful for understanding where debris flows may deposit sediment in future events and to prioritize areas where risk-reduction measures are needed. Guidelines for the geologic evaluation of debris-flow hazards in Utah are available in Giraud (2005). The numerous 2012 debris flows show the sensitivity of the burned landscape to debris flows and floods triggered by intense thunderstorm rainfall.

The potential for fire-related debris flows will decrease in time as revegetation stabilizes burned hillslopes, intercepts rainfall, and buffers runoff. Most fire-related debris flows in Utah (Giraud and McDonald, 2007) and in the intermountain western United States in the Rocky Mountains (Gartner and others, 2004) occur within two or three years following the fire. Drought conditions can limit vegetation regrowth and result in a longer recovery. In burned stands of trees, the decay of tree roots may result in reduced stability of steep hillslope materials and increase the potential for shallow post-fire landslides.

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DISCLAIMER

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