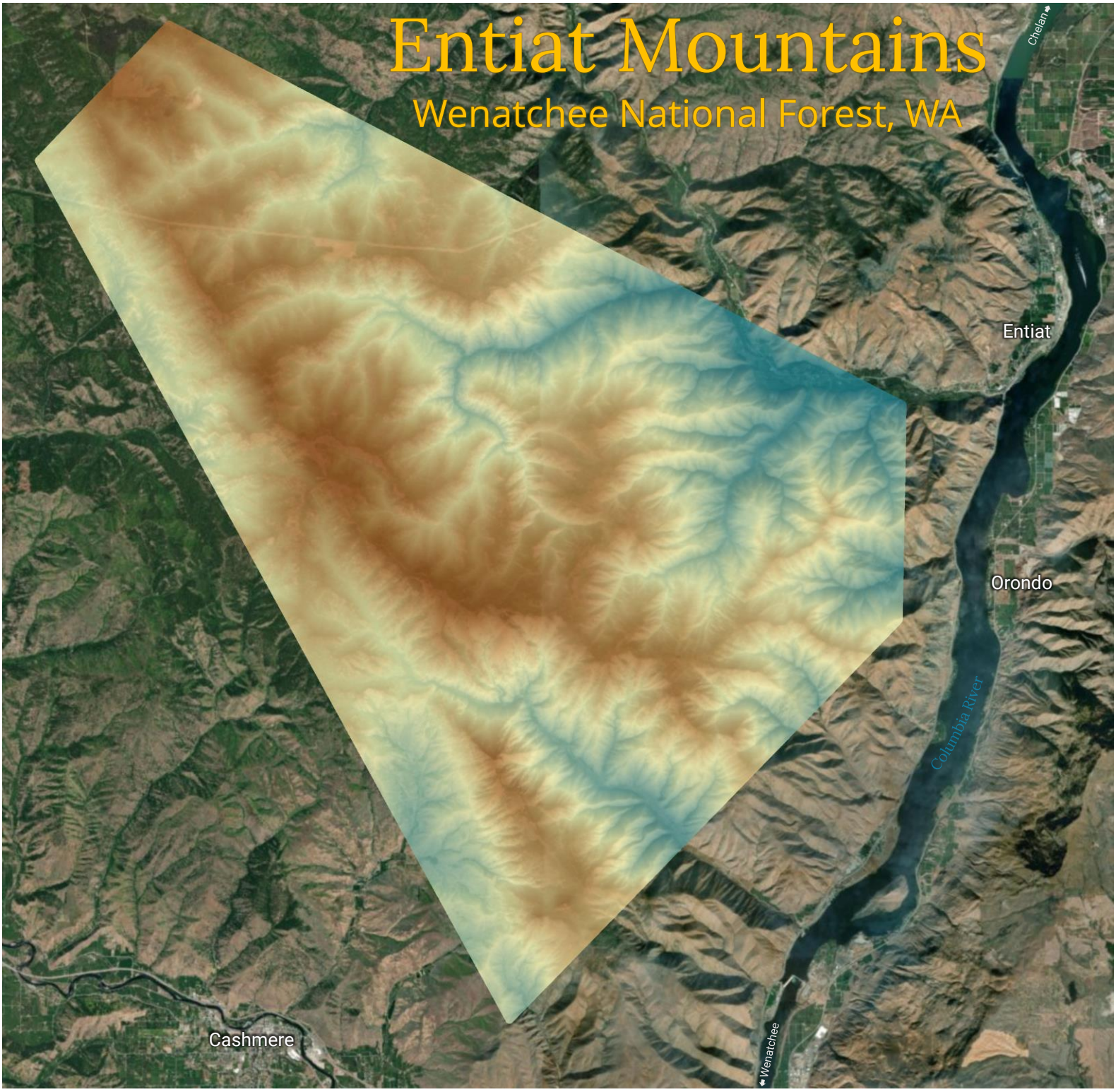
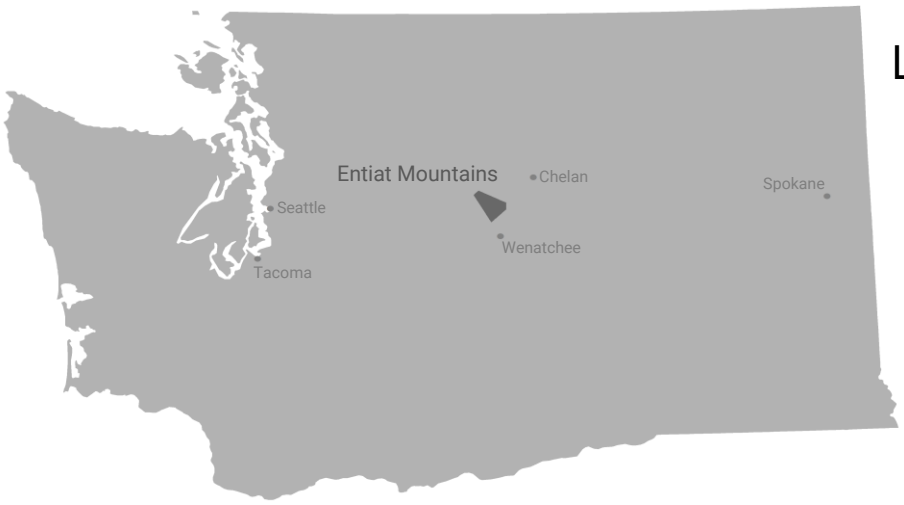
Entiat Mountains

Wenatchee National Forest, WA





LANDSLIDE SUSCEPTIBILITY USING SLOPE ANALYSIS

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GIS 506 Lab 2: LiDAR

LANDSLIDE SUSCEPTIBILITY USING SLOPE ANALYSIS

The goal of this project is identify landslide susceptibility for the Entiat Mountains located within the Wenatchee National Forest in Washington state. Landslide susceptibility is defined as the spatial probability of landslide occurrence. Spatial probability for landslides can be calculated using LiDAR (Light Detection and Ranging) data to calculate the slope angle to identify percent change in elevation. The slope data is then combined with water flow & accumulation data, geological data, geomorphological data, and environmental data to get an accurate understanding of landslide susceptibility for a given area. Due to the limited time constraints of this project, only a slope percent analysis will be perform for the given area.

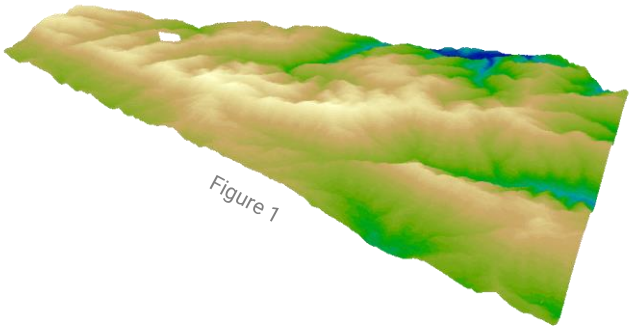

Figure 1

For this analysis the Entiat Mountains were chosen to analyze how safe the area is for vacationing and mountaineering. The 2013 Entiat River LiDAR data was collected from the Puget Sound LiDAR Consortium. LiDAR, acronym for light detecting and imaging, uses laser pulses to profile the Earth's surface. To make a complete profile of the area known for outdoor recreation, 251 files were chosen which equated to 3.8 billion points along the Entiat River. The largest challenge during the analysis attributed to the data file sizes and potential for computer crashing. The total download time for the 251 files was roughly 25 minutes. After the download was complete, the LAZ files were converted to LAS files using a LAZ compressor. Due to the magnitude of the files, the extraction time was roughly 35 minutes. While the conversion tool was working, the program became unresponsive until all of the tasks were complete.

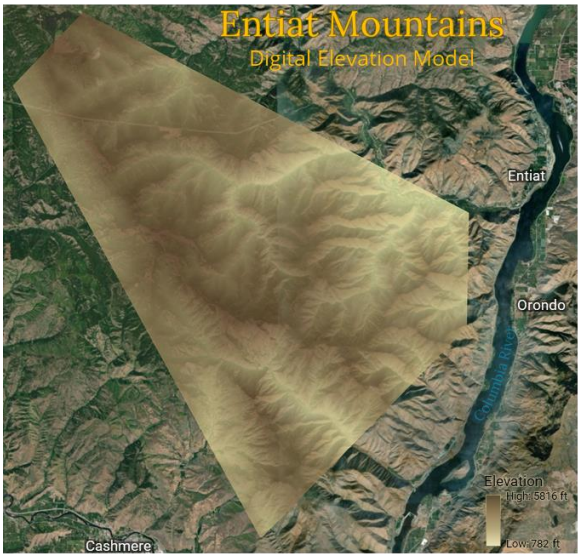

Figure 2

Using ArcScene the 3.8 billion points were converted into a digital surface model (DSM) which captured the first return values, image shown on right. This can be done using the LAS Dataset to Raster tool. Both hillshade and base rendering were applied to give a more realistic profile of the region. After creating the DSM, the ground return values were used to create the digital elevation model (DEM), image shown on right. There was little variation in returns between the DSM and DEM due to the lack of vegetation in the region.

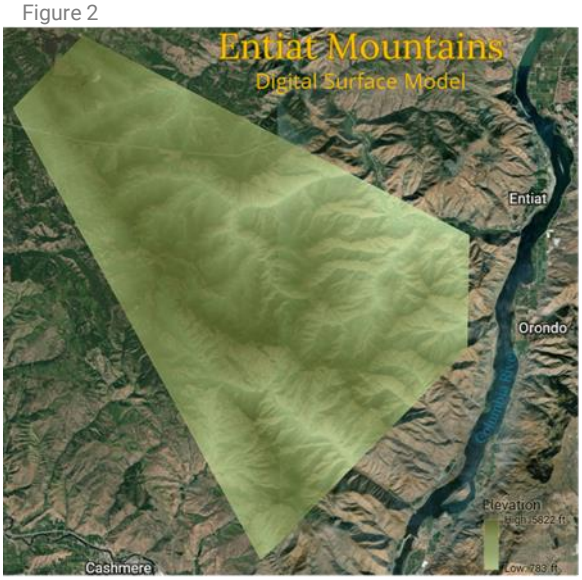

Figure 3

Utilizing the change in elevation, the slope analysis was conducted by selecting the slope from the LAS toolbar and converting the slope dataset to raster. The outcome, shown on the right, highlights the areas where the slope is at the steepest angle in bright red. These areas would have the highest likelihood for a landslide, whereas the areas in green would have the lowest probability of a landslide.

While this analysis stops at a "keep it simple" point, the analysis could continue, in order to increase the accuracy, by combining the slope analysis with findings from a landslide susceptibility assessment and a water flow analysis to help determine landslide susceptibility in the Entiat River region.

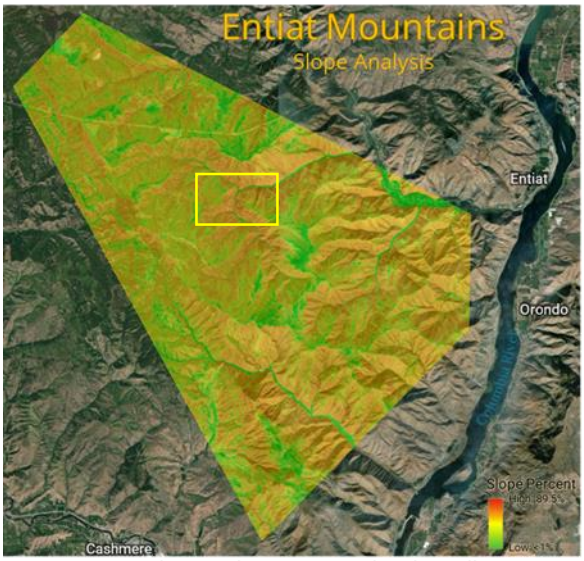

Figure 4: Supplemental Map area outlined in yellow

Figure 1: 3.8 billion LiDAR Points

Figure 2: Digital Elevation Model (DEM)

Figure 3: Digital Surface Model (DSM)

Figure 4: Slope Analysis

SUPPLEMENTAL MAPS

Enlarged DEM

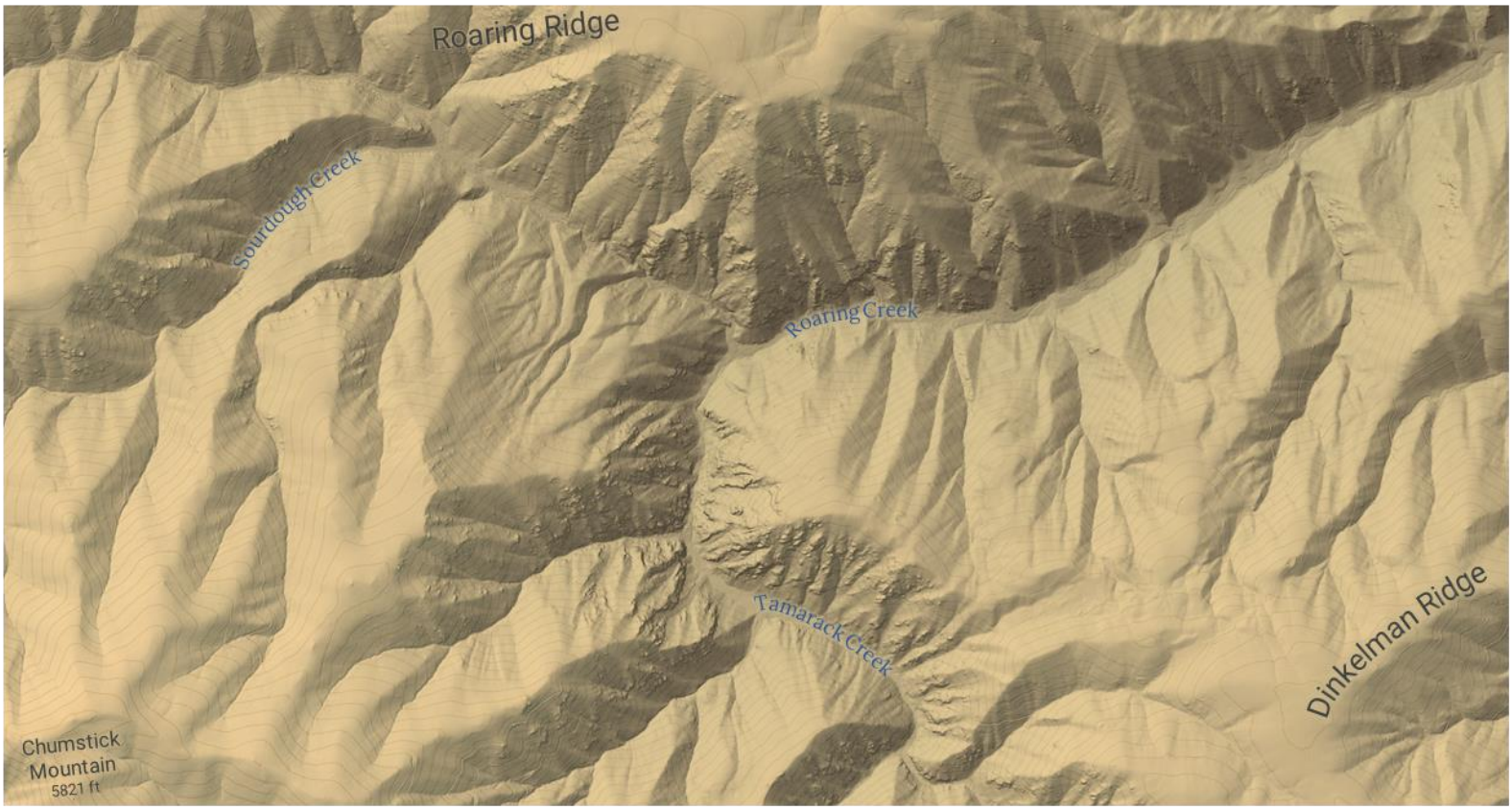

Figure 5: 100ft contour interval

Enlarged view of an area within the Entiat Range. DEM made from the bare-earth LiDAR returns.

Enlarged Slope Analysis

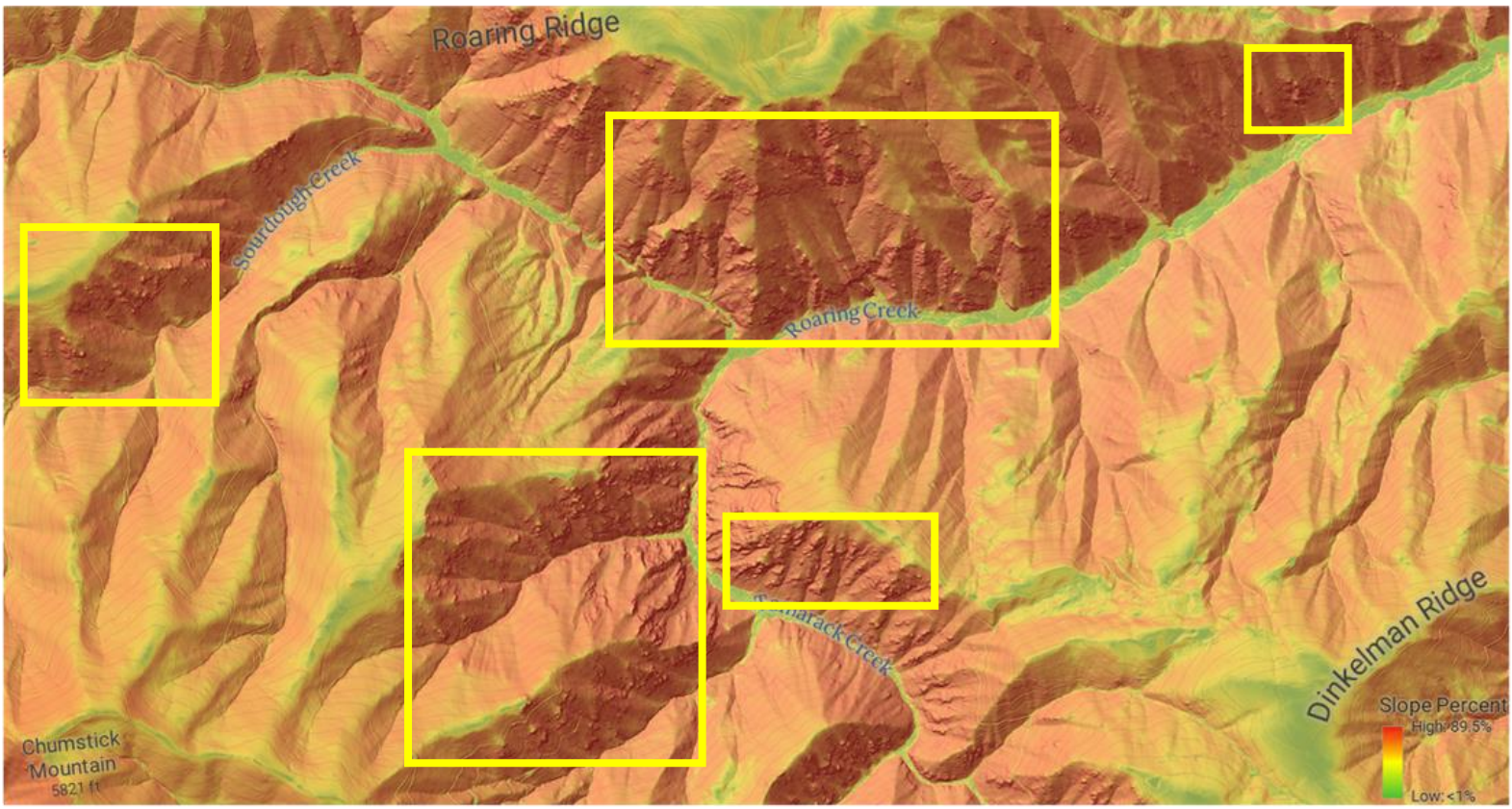

Figure 6: 100ft contour interval

Enlarged view of an area within the Entiat Range. Areas with high landslide susceptibility are outlined in yellow.