Final Technical Report
Portland Urban Geologic Database - Landslide Inventory Project
USGS Grant/Cooperative Agreement Number G10AC00133
2010-2012

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Abstract

In order to reduce landslide risk, a variety of mitigation measures are required, including a landslide inventory. The Oregon Department of Geology and Mineral Industries (DOGAMI) developed a protocol to create landslide inventories using lidar data (Burns and Madin, 2009). This protocol was followed in the Portland Metro region between 2006 and 2012 as part of a collaborative DOGAMI-USGS project. The project resulted in the publication of lidar-derived landslide inventories for 22 individual quadrangles. During the project, we worked with local city, county, and other state entities to accomplish the following: 1) external review of the landslide maps for local knowledge input, 2) pre-publication notification of the forthcoming maps, and 3) partnership capacity increase for future information transfer. We found 7,080 landslide deposits within the study area. The landslides cover approximately 83 square miles which is approximately 7% of the study area. We were able to accomplish a significant amount of work in a short time and attribute the success to the partnership between the various USGS programs, the counties and cities, and DOGAMI.

Report

In 1996 and 1997, severe storms impacted the Portland metropolitan region causing a documented 700 landslides. Over 100 homes were moderately to completely damaged by landslides in just those two years. As the population of the region grows, greater losses are likely to result.

In order to reduce the risk from future landslides, a variety of mitigation measures are required, all of which need to start with an accurate and complete assessment of

where landslide hazards exist. To meet this need, the Oregon Department of Geology and Mineral Industries (DOGAMI) developed a method to create landslide inventories using detailed topographic information derived from lidar (Burns and Madin, 2009).

The Portland Metro landslide mapping project was carried out between 2006 and 2012 as part of a collaborative DOGAMI-USGS mapping project. The project was funded by DOGAMI through this USGS Cooperative Agreement, G10AC00133 (Portland Landslide Compilation, FY10-12) and through G11AC20312 (Portland Surficial Geology, FY11-12), and 07CRGR0009 (Landslide Hazard Program, FY07-08) also from the USGS.

This project followed the protocol and resulted in the publication of 22 individual landslide inventory maps at a scale of 1:8,000 including the following U.S. Geological Survey (USGS) 24,000 scale quadrangles: Washougal, Camas, Mt. Tabor, Gladstone, Damascus, Sandy, Redlands, Estacada, Sherwood, Sauvie Island, Dixie Mt., Vancouver, Scholls, Hillsboro, Forest Grove, and Gales Creek. Each map is accompanied by a digital database of landslide shape, location and attributes (Figure 1 and publication list below).

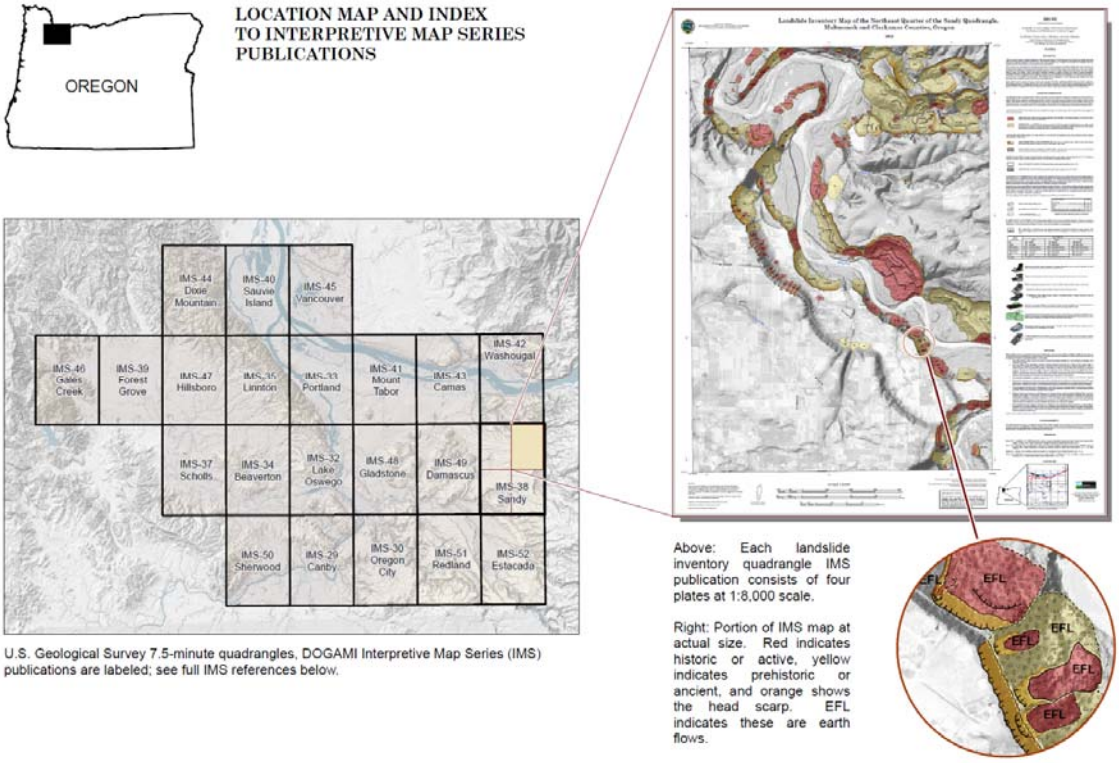

Figure 1. Index map of the study area and example of an individual quarter quadrangle map from IMS-38.

During the project we worked with local city, county, and other state entities on 3 main components detailed in the list below:

1. External review of the landslide maps for local knowledge input.
2. Pre-publication notification of the forthcoming maps
3. Partnership capacity increase for information transfer

These 3 components resulted in better map products, better communication and information transfer, and leveraged future projects including a project we just started with Clackamas County (1/3 of the study area) to make landslide susceptibility maps and do risk analysis, both based on the inventory created in this project.

We found 7,080 landslide deposits within the study area (Figure 2). 3,321 of this total are large deep landslides with failure surfaces estimated to have a mean depth of approximately 40 feet below the surface. 2,376 are shallow landslides with mean estimated failure surface of approximately 10 feet deep. 1,311 of these mapped landslide deposits are debris flow fans. The landslides cover approximately 83 square miles which is approximately 7% of the study area.

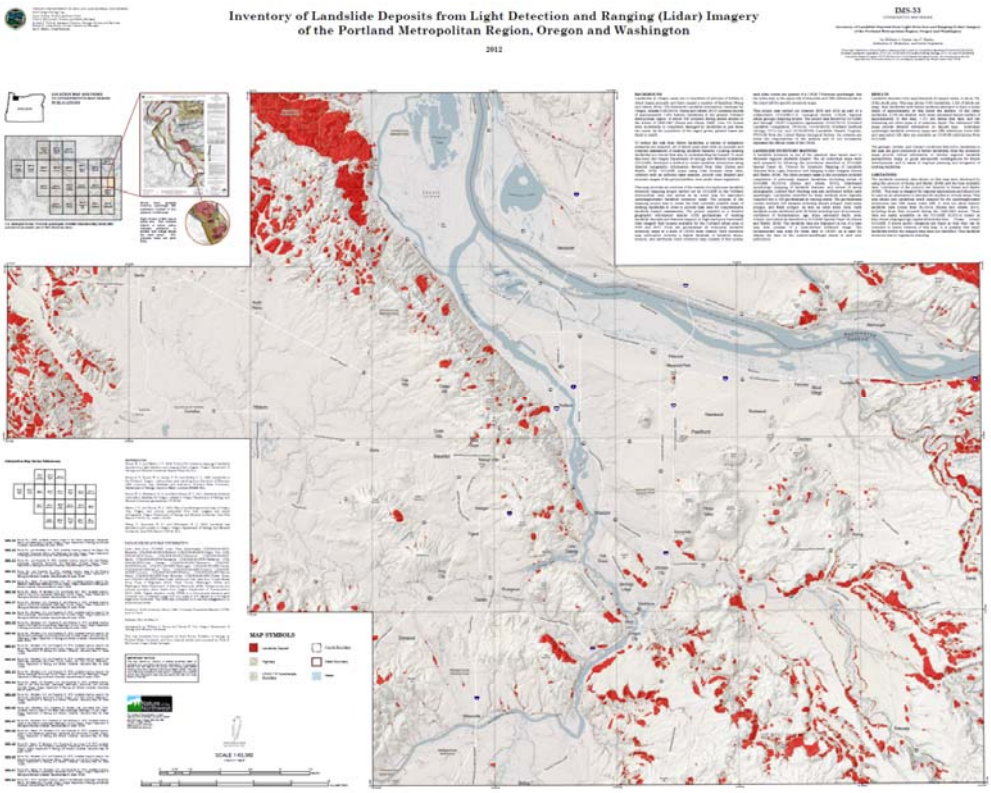

Figure 2. Landslide Inventory Map of Portland Metro (IMS-53). 7,080 landslide deposits are displayed in red.

The project was very successful and will help with risk reduction in this area. We were able to accomplish a significant amount of work in a short time and attribute the success to the partnership between the various USGS programs, the counties and cities, and DOGAMI.

Publications from Work Performed During This Project:

Burns, W.J., Madin, I.P., Mickelson, K.A., and Duplantis, S., 2012, Inventory of Landslide Deposits from Light Detection and Ranging (Lidar) Imagery of the Portland Metropolitan Region, Oregon and Washington, Oregon: Oregon Department of Geology and Mineral Industries, Interpretive Map 53, scale 1:63,360.

Burns, W.J., Mickelson, K.A., Duplantis, S., and Williams, K., 2012, Landslide inventory maps for the Scholls quadrangle, Washington County, Oregon: Oregon Department of Geology and Mineral Industries, Interpretive Map 37, scale 1:8000.

Burns, W.J., Mickelson, K.A., and Duplantis, S., 2012, Landslide inventory maps for the Sandy quadrangle, Clackamas and Multnomah Counties, Oregon: Oregon Department of Geology and Mineral Industries, Interpretive Map 38, scale 1:8000.

Burns, W.J., Mickelson, K.A., Duplantis, S., and Williams, K., 2012, Landslide inventory maps for the Forest Grove quadrangle, Washington County, Oregon: Oregon Department of Geology and Mineral Industries, Interpretive Map 39, scale 1:8000.

Burns, W.J., Mickelson, K.A., and Duplantis, S., 2012, Landslide inventory maps for the Sauvie Island quadrangle, Columbia and Multnomah Counties, Oregon, and Clark County, Washington: Oregon Department of Geology and Mineral Industries, Interpretive Map 40, scale 1:8000.

Burns, W.J., Mickelson, K.A., and Duplantis, S., 2012, Landslide inventory maps for the Mount Tabor quadrangle, Multnomah County, Oregon, and Clark County, Washington: Oregon Department of Geology and Mineral Industries, Interpretive Map 41, scale 1:8000.

Burns, W.J., Mickelson, K.A., and Duplantis, S., 2012, Landslide inventory maps for the Washougal quadrangle, Multnomah County, Oregon, and Clark County, Washington:: Oregon Department of Geology and Mineral Industries, Interpretive Map 42, scale 1:8000.

Burns, W.J., Mickelson, K.A., and Duplantis, S., 2012, Landslide inventory maps for the Camas quadrangle, Multnomah County, Oregon, and Clark County, Washington:: Oregon Department of Geology and Mineral Industries, Interpretive Map 43, scale 1:8000.

Burns, W.J., Madin, I.P., Mickelson, K.A., and Duplantis, S., 2012, Landslide inventory maps for the Dixie Mountain quadrangle, Washington, Multnomah, and Columbia Counties, Oregon: Oregon Department of Geology and Mineral Industries, Interpretive Map 44, scale 1:8000.

Burns, W.J., Mickelson, K.A., and Duplantis, S., 2012, Landslide inventory maps for the Vancouver quadrangle, Multnomah County, Oregon, and Clark County, Washington: Oregon Department of Geology and Mineral Industries, Interpretive Map 45, scale 1:8000.

Burns, W.J., Mickelson, K.A., Duplantis, S., Spritzer, J.M., and Wells, R.E., 2012, Landslide inventory maps for the Gales Creek quadrangle, Washington County, Oregon: Oregon Department of Geology and Mineral Industries, Interpretive Map 46, scale 1:8000.

Burns, W.J., Mickelson, K.A., Duplantis, S., and Williams, K., 2012, Landslide inventory maps for the Hillsboro quadrangle, Washington County, Oregon: Oregon Department of Geology and Mineral Industries, Interpretive Map 47, scale 1:8000.

Burns, W.J., Madin, I.P., Mickelson, K.A., and Duplantis, S., 2012, Landslide inventory maps for the Gladstone quadrangle, Clackamas and Multnomah Counties, Oregon: Oregon Department of Geology and Mineral Industries, Interpretive Map 48, scale 1:8000.

Burns, W.J., Madin, I.P., Mickelson, K.A., Duplantis, S., and Jones, C. B., 2012, Landslide inventory maps for the Damascus quadrangle, Clackamas and Multnomah Counties, Oregon: Oregon Department of Geology and Mineral Industries, Interpretive Map 49, scale 1:8000.

Burns, W.J., Mickelson, K.A., and Duplantis, S., 2012, Landslide inventory maps for the Sherwood quadrangle, Clackamas, Marion, Washington, and Yamhill Counties, Oregon: Oregon Department of Geology and Mineral Industries, Interpretive Map 50, scale 1:8000.

Burns, W.J., Madin, I.P., Mickelson, K.A., and Duplantis, S., 2012, Landslide inventory maps for the Redland quadrangle, Clackamas County, Oregon: Oregon Department of Geology and Mineral Industries, Interpretive Map 51, scale 1:8000.

Burns, W.J., Madin, I.P., Mickelson, K.A., and Duplantis, 2012, Landslide inventory maps for the Estacada quadrangle, Clackamas, Marion, and Washington Counties, Oregon: Oregon Department of Geology and Mineral Industries, Interpretive Map 52, scale 1:8000.

Publications from Related Projects:

Burns, W.J. and Mickelson, K.A., 2011. Landslide Inventory Maps for the Linnton Quadrangle, Washington County, Oregon, Oregon Department of Geology and Mineral Industries, IMS-35, Plates 1, 2, 3, 4, 5

Burns, W.J. and Mickelson, K.A., 2011. Landslide Inventory Maps for the Beaverton Quadrangle, Washington County, Oregon, Oregon Department of Geology and Mineral Industries, IMS-34, Plates 1, 2, 3, 4,5

Burns, W.J. and Duplantis, S., 2010. Landslide Inventory Maps for the Portland Quadrangle, Multnomah, and Washington Counties, Oregon, Oregon Department of Geology and Mineral Industries, IMS-33, Plates 1, 2, 3, 4, 5

Burns, W.J. and Duplantis, S., 2010. Landslide Inventory Maps for the Lake Oswego Quadrangle, Clackamas, Multnomah, and Washington Counties, Oregon, Oregon Department of Geology and Mineral Industries, IMS-32, Plates 1, 2, 3, 4, 5

Burns, W.J. and Mickelson, K.A., 2010. Landslide Inventory Maps for the Oregon City Quadrangle, Clackamas, County, Oregon, Oregon Department of Geology and Mineral Industries, IMS-30, Plates 1, 2, 3

Burns, W.J., 2009. Landslide Inventory Maps for the Canby Quadrangle, Clackamas, Marion, and Washington Counties, Oregon, Oregon Department of Geology and Mineral Industries, IMS-29, Plates 1, 2, 3, 4

Burns, W.J., Madin, I.P., 2009. Protocol for Inventory Mapping of Landslide Deposits from Light Detection and Ranging (lidar) Imagery, Oregon Department of Geology and Mineral Industries, Special Paper 42