State of Oregon
Department of Geology and Mineral Industries
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U.S. GEOLOGICAL SURVEY NATIONAL COOPERATIVE GEOLOGIC MAPPING PROGRAM

STATEMAP COMPONENT – LONG RANGE GEOLOGIC MAPPING PLAN

By

Oregon Department of Geology and Mineral Industries

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OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

INTRODUCTION

The Oregon Department of Geology and Mineral Industries (DOGAMI) conducts geologic mapping, creates and maintains digital geologic databases, and collects high-resolution aerial lidar in order to characterize the state's geology and to enhance our understanding of the state's geologic resources and hazards. DOGAMI's mission is to provide earth science information and regulation to make Oregon safe and prosperous (DOGAMI 2009-2015 strategic plan – http://www.oregongeology.org/sub/pub%26data/dogami-stratplan-2009-2015.pdf). A complex regional geology combined with the proximity to the active Cascadia Subduction Zone leaves Oregon prone to numerous geologic hazards including earthquakes, volcanic eruptions, landslides, and tsunamis (Figure 1). A growing population combined with the emergence of new industries has also emphasized the need to have a more thorough understanding of the distribution, sustainability, and conservation needs of the state's mineral, energy, and water resources. Geologic maps further provide important information pertaining to land use evaluation and planning, infrastructure development, and siting of critical facilities. In many regions of the state, the latest available geologic mapping is decades old and of too large of a scale to adequately address many local and regional issues. Targeted new mapping updates the geologic framework of these areas and places an emphasis on digital map products and derivatives that are accessible and usable by the public.

Funding from the STATEMAP component of the U.S. Geological Survey's (USGS) National Cooperative Geologic Mapping Program (NCGMP) (http://ncgmp.usgs.gov/about/statemap.html) has been at the core of DOGAMI'S geologic-mapping program since 1993. The primary objective of the STATEMAP program is to establish the geologic framework of areas that are vital to the welfare of individual States. State mapping priorities are determined by the State Geologist in consultation with a State Mapping Advisory Committee. These priorities are based on State requirements for geologic map information in areas of multiple-issue need or compelling single-issue need and in areas where mapping is required to solve critical Earth science problems.

Since the inception of the program in 1993, STATEMAP funding has allowed DOGAMI to significantly increase the production of new geologic maps and has, through the Oregon Geologic Mapping Advisory Committee (OGMAC), helped focus mapping on areas where resource- and hazard-management issues require good geologic data. For example, DOGAMI has focused previous STATEMAP projects on core areas surrounding La Grande, Prineville, Medford, Hood River, and in the

southern Willamette Valley of western Oregon (Figure 2; McClaughry and others 2009; Ferns and others, 2010; McClaughry and others 2010; Wiley and others, 2011; McClaughry and others, 2012, McClaughry and others, 2013 in review). These studies have improved our understanding of the geology and structure in these areas, and have been used to delineate landslide and debris flow hazards, to better predict groundwater resources, to aid in highway design and construction, to define geologic resources on public lands, and to aid in watershed assessment. The regular incorporation of lidar bare earth imagery and lidar derived base maps since 2007 has revolutionized the accuracy and completeness of DOGAMI's geologic maps, allowing for the construction of spatial digital databases of both bedrock and surficial geology with a resolution of 1:8,000 (Figure 3). By building on existing data and cooperative mapping strategies with the USGS, developing integrated databases, and using lidar data we produce high-quality, multi-use geologic products in a very cost-effective way.

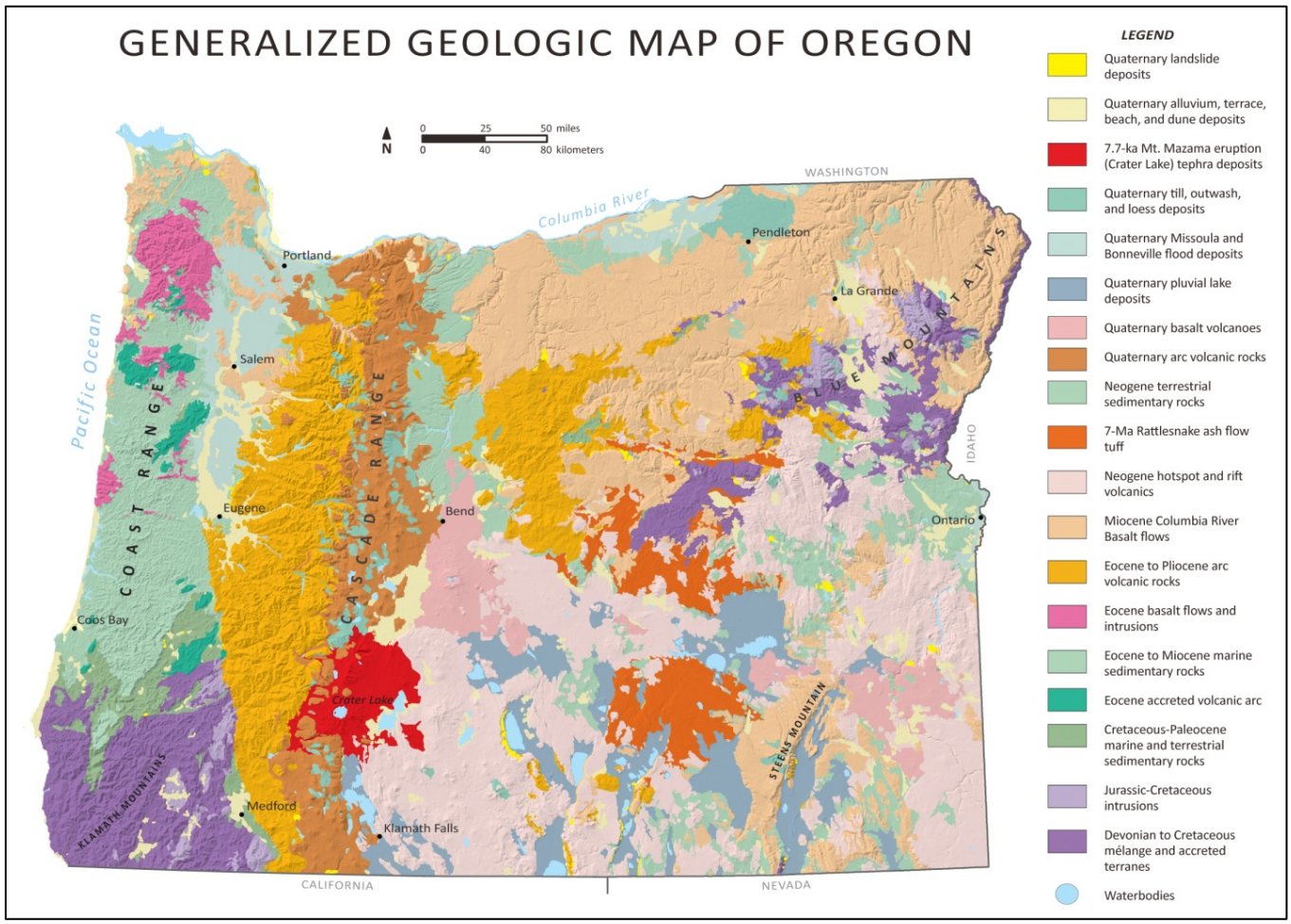

Figure 1. Generalized geologic map of the State of Oregon. Geology from OGDC-5 (Ma and others, 2009).

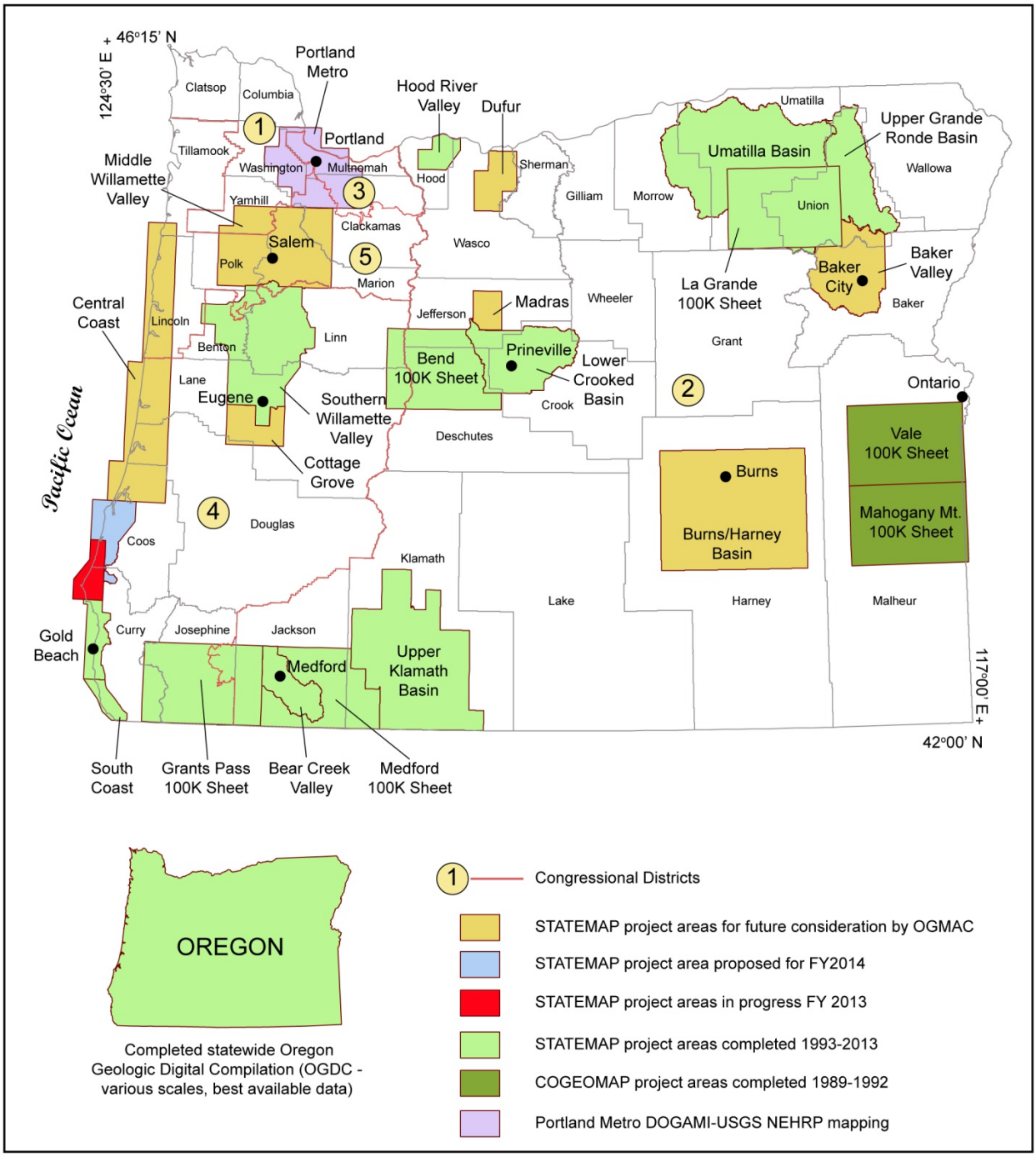

Figure 2. Former, current, and proposed STATEMAP project areas in Oregon since 1993. Map includes outline of Portland/Metro NEHRP (National Earthquake Hazard Reduction Program) geologic mapping and maps completed under COGEOMAP funding.

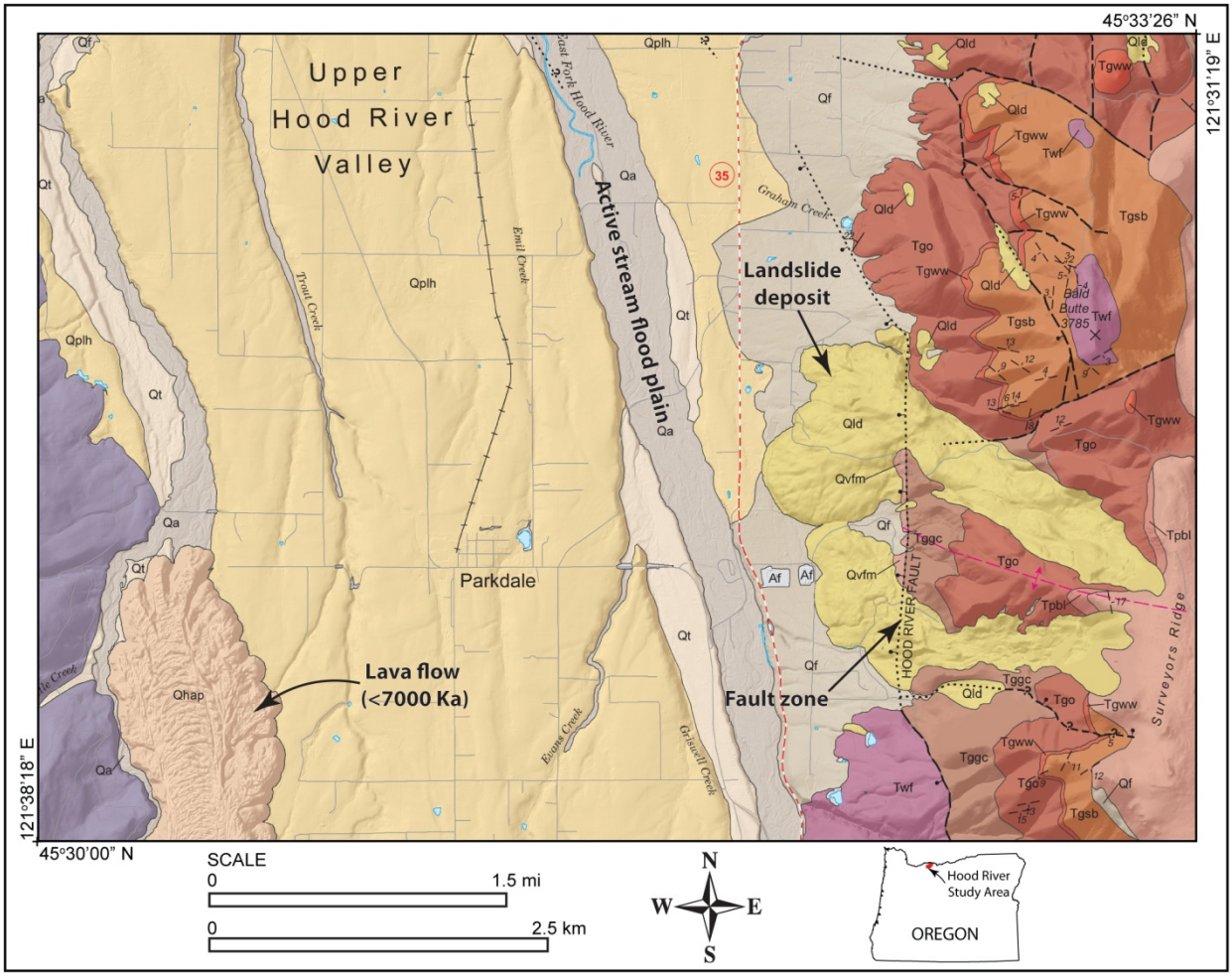

Figure 3. Example of part of a geologic map from the Hood River area in north-central Oregon (McClaughry and others, 2012). Detailed geologic maps, constructed using high-resolution lidar dems as base maps, identify a number of potential geologic hazards in targeted map areas, including Recent lava flows, large-scale landslide deposits, potentially active fault zones, and active flood plains along major stream drainages. Features were mapped at a scale of 1:8,000 through a combination of detailed field work and intensive lidar terrain analysis.

LONG RANGE GEOLOGIC MAPPING PLAN

DOGAMI, in consultation with the Oregon Geologic Mapping Advisory Committee (OGMAC), has developed a long range geologic mapping plan. The long range mapping plan is consistent with the *10 Year Plan for Oregon Project*, an executive initiative designed to develop a statewide integrated strategy to improve the economy, health, and environment of Oregon (http://www.oregon.gov/COO/Ten/Pages/index.aspx). Outcomes of the 10 Year Plan include:

- ***Jobs and Innovation*** – Oregon has a diverse and dynamic economy that provides jobs and prosperity for Oregonians.

- ***Education*** – All Oregonians will have an opportunity for a quality education from pre-school to career.
- ***Healthy People*** – Oregonians are healthy and have the best possible quality of life at all ages.
- ***Safety*** – Oregonians will be safe and feel safe where they live, work, and play.
- ***Healthy Environment*** – Oregon's natural resources are managed sustainably in support of a healthy economy, environment, and community.

DOGAMI's geologic mapping projects will support the 10 Year Plan for Oregon Project initiative in three primary areas:

- ***Safety –*** Geologic maps serve as the foundation for derivative geologic and other natural hazard studies which are designed to benefit Oregonians by avoiding losses and ensuring that people feel safe where they live, work, and play. DOGAMI's geologic-map-based hazard studies provide information regarding surface and subsurface fault mapping and age assignment, earthquake susceptibility, future earthquake damage estimates (Burns and others, 2008), landslide hazard inventories (Burns and others, 2011a), inventories of assets and hazards (Burns and others, 2011b), and tsunami inundation models (Witter and others, 2011)(Figure 3). Geologic maps also serve as a basis for a more thorough characterization of naturally occurring hazardous materials and their potential effects on public health and the environment (Niewendorp, 2011; Mabey and Niewendorp, 2013)(Figure 4). The wide range of geologic mapping and derivative publications provided by DOGAMI provide the information that all Oregonians need to better understand the risks posed by future earthquakes and tsunamis, volcanic eruptions, floods, landslides, and coastal erosion (Figures 1, 3).

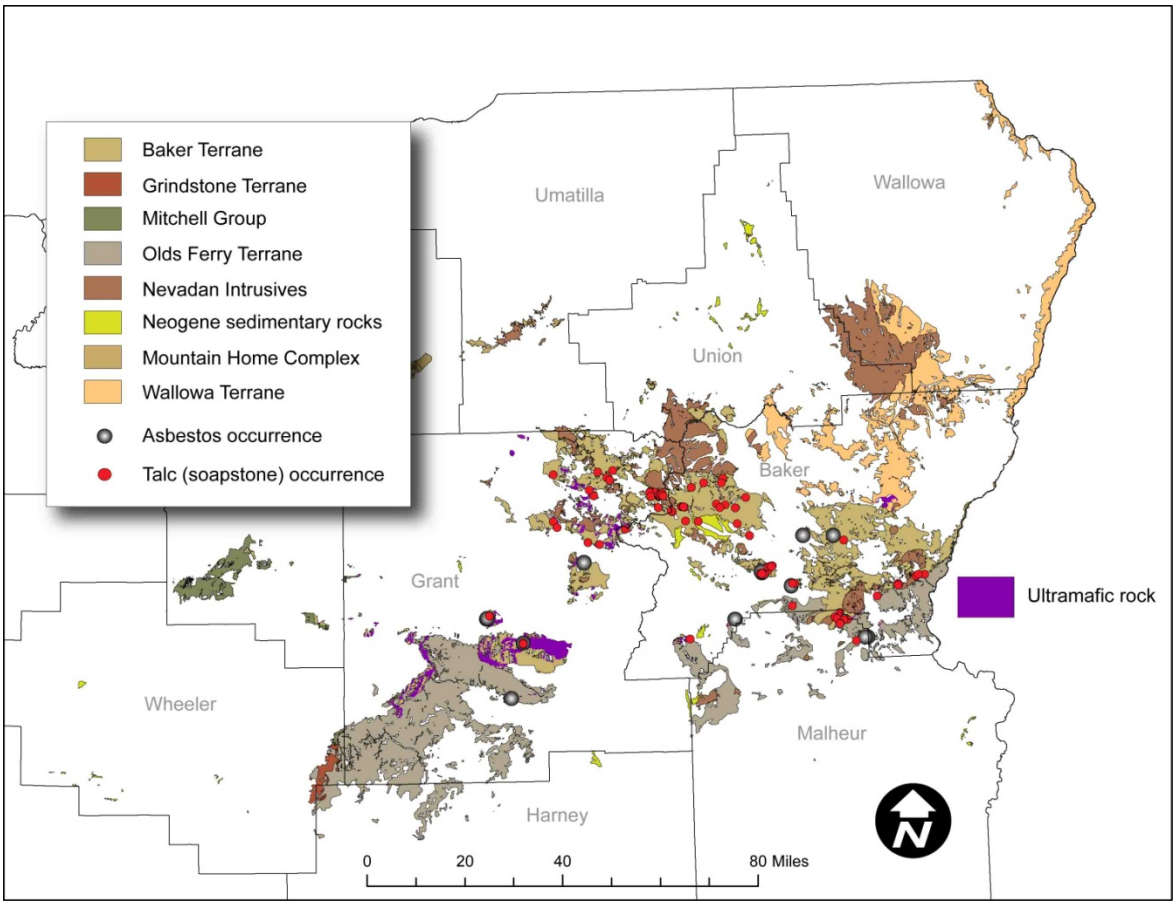

Figure 4. Map of the Pre-Tertiary terranes of the Blue Mountains, northeastern Oregon showing locations of naturally occurring asbestos. Figure from Niewendorp (2011) and Mabey and Niewendorp (2013). Geologic mapping compiled from Ma and others (2009; OGDC v. 5)

- ***Healthy Environment*** – Oregon is renowned for its water, one of the state's most precious natural resources. Water is necessary for drinking, recreation, industry, agriculture, and fish and wildlife, all things that promote a healthy economy, environment, and community. Oregon has adopted an integrated water resources strategy that provides a roadmap for the state to follow as it prepares to meet Oregon's water needs in the present and future. (http://www.oregon.gov/OWRD/LAW/Integrated_Water_Supply_Strategy.shtml). Geologic maps produced by DOGAMI (McClaughry and others 2009; Ferns and others, 2010; McClaughry and others 2010; Wiley and others, 2011; McClaughry and others, 2012) serve as the basis for ongoing surface water assessment and groundwater investigations that must be completed in order to inform management decisions concerning Oregon's water resources.

- ***Jobs and Innovations*** **–** Geologic maps produced by DOGAMI characterize and assess the state's mineral, energy, and water resources. Resource-directed geologic mapping forms the foundation for the construction of associated statewide databases (e.g., MILO, GTILO; Niewendorp and Geitgey, 2009; Niewendorp and others, 2013), and is an "incubator" for ideas, jobs, and innovations as it is used by the private sector for the basis of assessments, exploration activities, and possibly resource development (e.g., geothermal or precious metals; Ferns and others, 1993a,b; Edwards, 2013). Detailed information regarding mineral, energy, and water resources is particularly important in rural resource-based economies, where other opportunities may be limited. Geologic maps also serve as the foundation for advancing scientific investigations and public knowledge of Oregon's geology (e.g., Ferns and McClaughry, 2013).

OGMAC ranks areas proposed for new geologic mapping using the priorities set forth by the STATEMAP program and the framework of the 10 Year Plan for Oregon Project, along with five additional state-specific components including: **1) compelling societal needs** including identifying and mitigating geologic hazards (e.g., tsunamis, earthquakes, landslides, volcanoes, flooding) and the conservation and sustainability of state resources (e.g., water supply**,** infrastructure and lifelines, mineral and agricultural resources); **2) Formal Departmental Key Performance Measure 6 (KPM6)** which identifies areas of population concentration as determined on the basis of census data and water wells per square mile. This performance measure supports agency goal #4, which is to create and compile geologic data needed in natural resource and land use problem solving (Figure 5); **3) The availability of high resolution aerial lidar topography**. A large percent of populated areas in the state are now covered by lidar which serves as the fundamental base for all geologic mapping products (Figure 6); **4) local opportunities for collaboration, public education, and outreach**; and **5) scientific merit**.

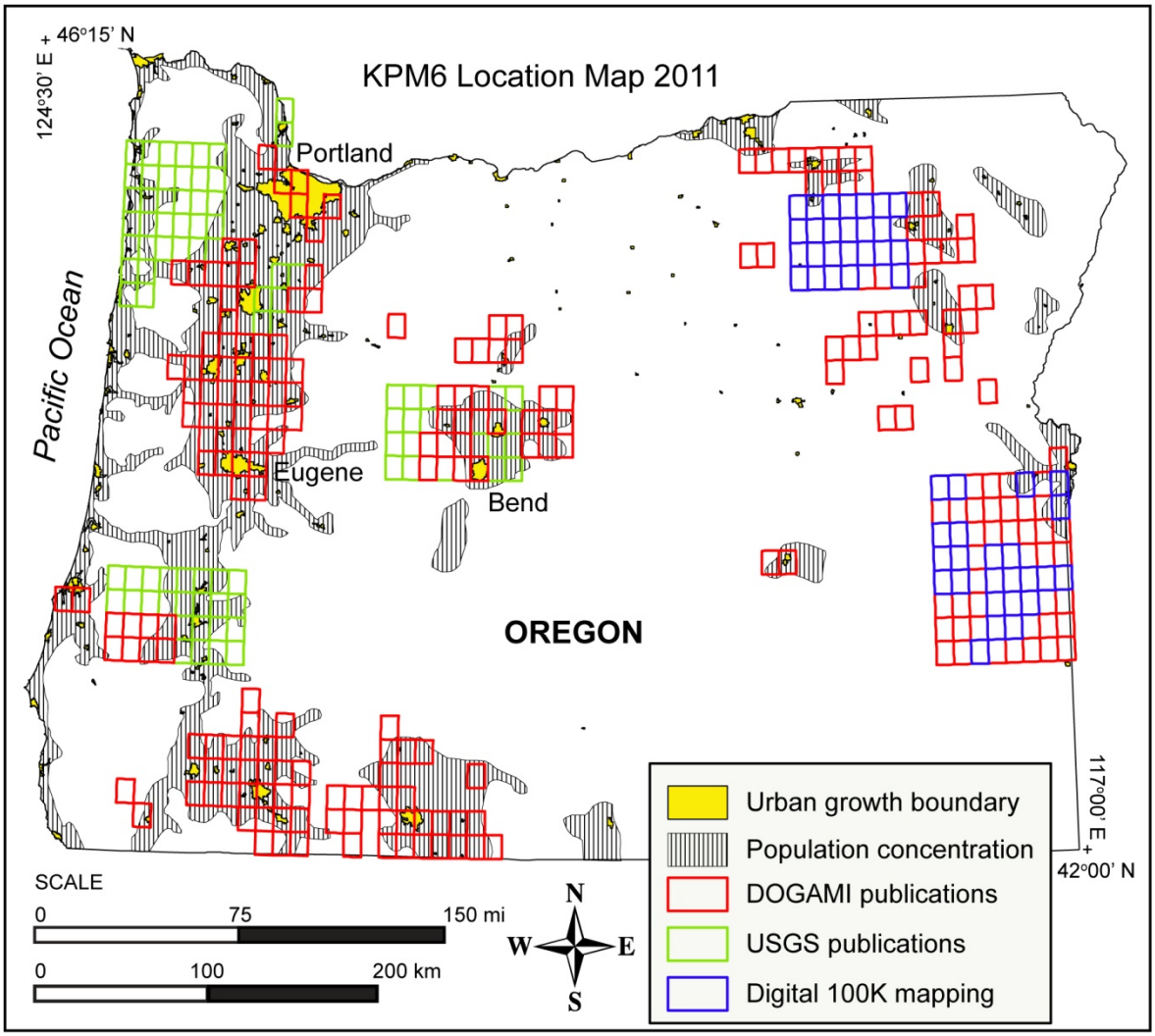

Figure 5. Key Performance Measure 6 (KPM6). This performance measure supports agency goal #4, which is to create and compile geologic data needed in natural resource and land use problem solving. Key Performance areas are shown in light blue shade (Population concentration) and are determined on the basis of census data and water well concentration. Key Performance areas cover ~18 percent of Oregon and include ~98 percent of Oregonians. Red and green rectangle polygon overlays show areas where 1:24,000-scale geologic maps have been published by DOGAMI or the USGS. Blue colored polygons are included in 1:100,000-scale geologic maps published by DOGAMI.

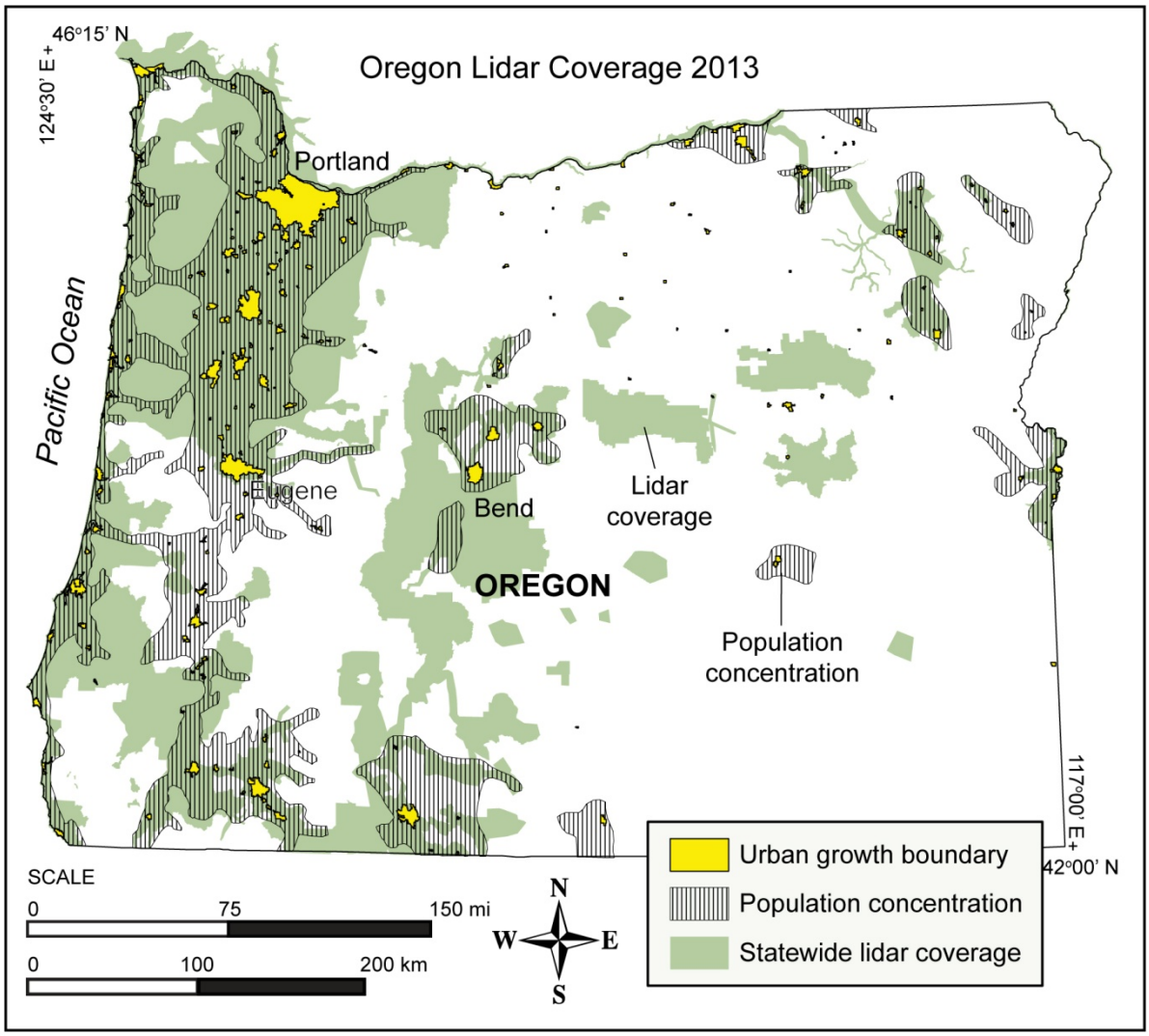

Figure 6. Overlay map of statewide geologic mapping priorities and extent of lidar coverage as of 2012. Urban growth boundaries shown in yellow. Lidar available or contracted in green. Areas in blue display the distribution of geologic mapping targets as defined by Key Performance Measure 6 (KPM6).

The following criteria were ranked by OGMAC in 2012 to reflect geologic conditions and priority mapping needs specific to Oregon. They are listed below from highest to lowest priority.

- Conservation and sustainability of water resources (e.g. Integrated water resource strategy).
- Identifying and reducing losses from tsunamis, landslides, flooding, earthquakes, and volcanoes.
- Land use evaluation and planning (e.g. aggregate mining vs. agriculture).
- Design and construction of infrastructure requirements such as utility lifelines, transportation corridors, and surface water impoundments.
- Siting of critical facilities (e.g., power transmission lines, wind farm developments).

- Conservation and sustainability of agriculture and timber resources.
- Mitigating effects of coastal and stream erosion.
- Exploration for, and development of, metallic mineral, aggregate, and energy resources.
- Correlation between geology and fire-fuel loads.
- Basic earth-science research.

PROPOSED MAPPING AREAS

Seven project areas, consistent with the ranking-criteria outlined above and in need of updated geologic mapping, have been defined by OGMAC. They are listed below from highest to lowest priority on the basis of discussion at the 2012 OGMAC meeting.

- **South Coast** – The project includes the population centers of Brookings (DOGAMI STATEMAP FY2006), Gold Beach, Port Orford, Bandon, and Coos Bay (Area in progress during FY 2012 and 2013 DOGAMI STATEMAP; Figure O-1). These communities face many geologic hazards including coastal erosion, frequent landslides, and debris flows. The area also has a potential for major earthquakes and inundation by tsunamis.
- **Middle Willamette Valley** – The project area includes the population centers of Salem (state capitol), Woodburn, McMinnville, and Silverton. The project ties together geologic mapping in the Portland/Metro area (NEHRP funded DOGAMI/USGS mapping in progress) and the southern Willamette Valley (DOGAMI STATEMAP FY2006 to 2010). The Willamette Valley is the most densely populated area in Oregon, is the main agriculture and aggregate production area in the state, and has issues related to groundwater quantity and quality.
- **Central Coast** – The project area includes the population centers of Florence and Newport. These communities are impacted by many geologic hazards including coastal erosion, frequent landslides, and debris flows. The area also has a potential for major earthquakes and inundation by tsunamis.
- **Cottage Grove/Lowell –** The project includes the population center of Cottage Grove and ties together geologic mapping along the Interstate-5 corridor between Eugene and Roseburg. The area has a potential for significant population growth and has issues related to groundwater quantity and quality, seismic susceptibility, aggregate resources, and energy fuels.
- **Baker Valley –** The project includes the population centers of Baker City, North Powder, and Haines. The area has a potential for population growth and has issues related to

groundwater quantity and quality, landslides and rapidly moving debris flows, and seismic susceptibility. New geologic mapping is also needed to inform potential Bureau of Reclamation dam location projects in the region.

- **Dufur Area –** The project includes the population center of Dufur and connects with geologic mapping in the Hood River-Mosier area (DOGAMI STATEMAP FY2011) and The Dalles (FEDMAP FY2011). The area has issues related to groundwater quantity and quality and sustainability of agriculture.
- **Madras –** The project includes the population center of Madras and would connect with geologic mapping in the Bend area and the Lower Crooked Basin (DOGAMI STATEMAP FY2005 to 2006) on the south. The area has a potential for significant population growth and has issues related to groundwater quantity and quality, seismic susceptibility, and aggregate resources.

ADDITIONAL AREAS FOR CONSIDERATION

- **I-5 corridor Grants Pass to Roseburg 100k**
- **Butte Creek / Medford Watershed**
- **Burns/Harney Basin**

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