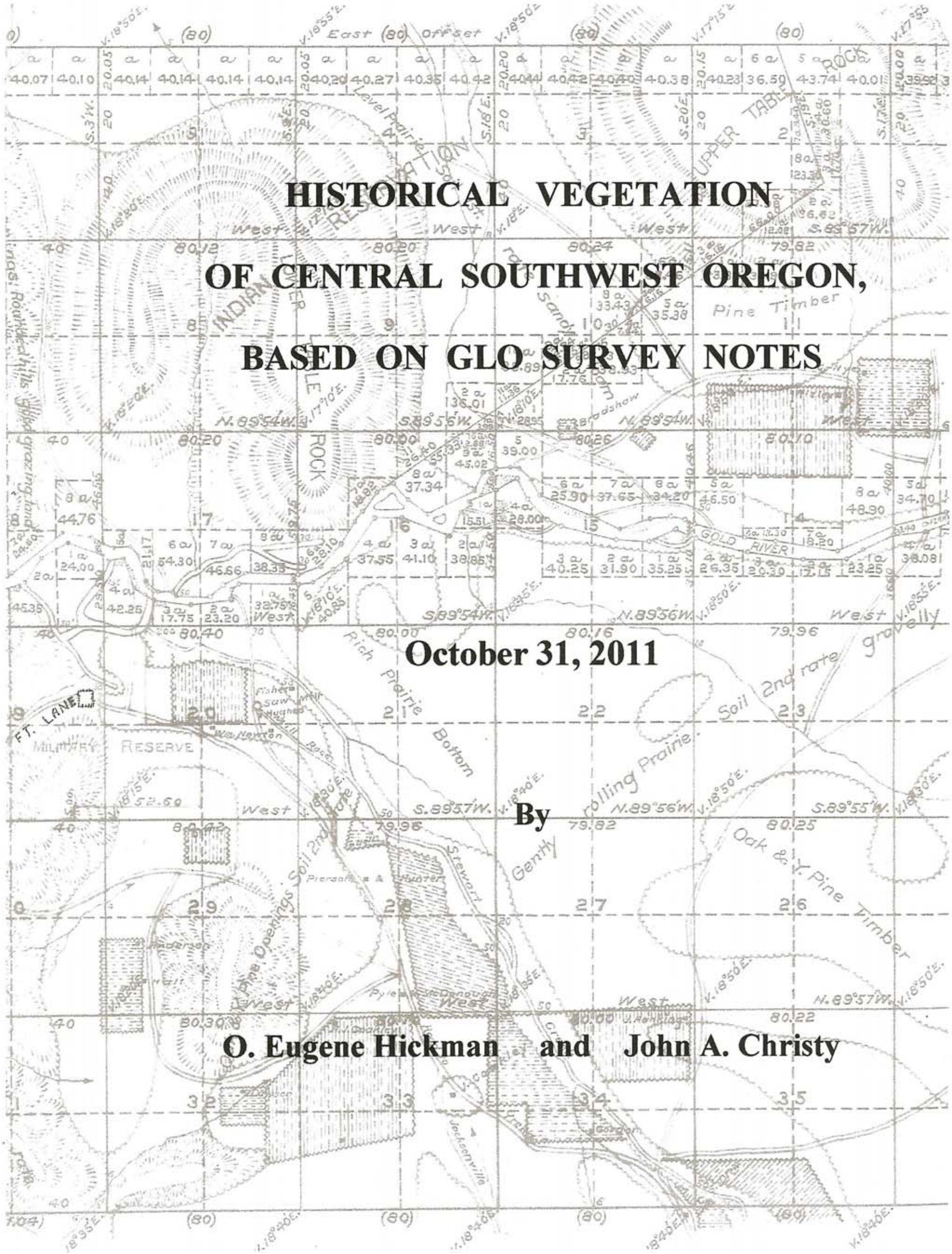

HISTORICAL VEGETATION
OF CENTRAL SOUTHWEST OREGON,
BASED ON GLO SURVEY NOTES

October 31, 2011

By

O. Eugene Hickman and John A. Christy

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Final Report to

USDI BUREAU OF LAND MANAGEMENT

Medford District

October 31, 2011

By

O. Eugene Hickman and **John A. Christy**

Consulting Rangeland Ecologist
Retired, USDA - NRCS
61851 Dobbin Road
Bend, Oregon 97702
(541, 312-2512)
ghickman@bendcable.com

Oregon Biodiversity Information Center
Portland State University
PSU – INR, P.O. Box 751
Portland, Oregon 97207-0751
(503, 725-9953)
john.christy@pdx.edu

Suggested citation: Hickman, O. Eugene and John A. Christy. 2011. Historical Vegetation of Central Southwest Oregon Based on GLO Survey Notes. Final Report to USDI Bureau of Land Management. Medford District, Oregon. 124 pp.

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Front Cover: GLO plat for T36S, R2W, north of present-day Medford in the upper Rogue River Valley (formerly called Gold River). Both Upper and Lower Table Rocks are shown at the top, defining where Sams Valley and the Indian Reservation begin. The mouth of Stewart Creek (now Bear Creek) joins Gold River below Lower Table Rock. Historic Fort Lane is visible on the west center (edge) of the map. This plat, drawn in January, 1855, shows both rolling prairie and rich prairie bottom, oak/yellow pine timber, pine timber, early roads, settler cabins, a sawmill, and some cultivated fields in the lower Stewart Creek (Bear Creek) valley.

SUMMARY

Historical vegetation at the time of European settlement is of great interest to both the public and land managers, but is poorly documented. One source of data are the earliest land survey records of the General Land Office (GLO). Rectangular township surveys in Southwest Oregon were initiated in the mid 1850's as settlers began to claim homesteads in the Bear Creek Valley surrounding what is now Medford.

We examined GLO land survey field notes and plats (maps) accompanying the surveys, transcribed GLO landscape data into an Access database, and classified the data set into very general vegetation types for mapping. About 89 vegetation types (subclasses) were described for mapping historic vegetation, distinguished by major differences in plant composition and topographic features. Tree density was estimated from section line descriptions and witness tree spacing at corners, and was used to classify stands into tree classes. These types then were combined into broad "Vegetation Classes" for mapping (i.e. savanna, shrubland, forest, prairie). Classifying and mapping historical vegetation occurred on about 418,500 acres in an earlier OSU study, and about 720,700 acres in this BLM study, located in Jackson and Josephine Counties. The authors merged results from these adjacent GLO studies, expanding the coverage to approximately 1.14 million acres (49 townships).

Modern soil surveys of the study area helped the authors interpret GLO data and draw vegetation boundaries. About 44% of the landscape was closed upland forest, 41% woodland, 1.4% riparian forest, 2% oak or conifer savanna, 1% shrublands, and 11% bottomland meadow or upland prairie. Forest types ranged from moist, mixed conifer uplands to dry valley ponderosa pine-hardwood grassland. Large areas of prairie and mixed oak-conifer woodland dominated many low elevation locations on plains, foothills, and especially clayey terraces or southern slopes near what is now Medford. Nearly 115 plant species or plant groups were identified by the surveyors, mostly trees and shrubs. Some were misidentified and not easily interpreted by the authors when archaic names were used by the surveyors. Grazing quality was frequently noted as surveyors attempted to describe land productivity for livestock.

Historic baseline plant data is presented for broad landscape transects and sometimes by topographic positions, but is limited by the sketchy nature of the original surveyor notes. Nearly 350 homestead parcels of various sizes were claimed in the study, as identified in GLO survey notes and on Donation Land Claim maps, showing how quickly settlement occurred in the study area after gold was discovered in 1851. Most early homesteads included prairie or oak savanna, which was open and more easily converted to farmland or pasture. Early saw mills, grist mills, fields, roads, water diversions and major Indian trails were also identified and transcribed from the GLO records.

ACKNOWLEDGEMENTS

This report summarizes work completed between 2003 and 2009, for two separate but adjoining projects. The first was through a contract with the Oregon Natural Heritage Information Center (ORNHIC) of Oregon State University (OSU), and the second through the Bureau of Land Management (BLM), Medford District. Funding for the OSU study (2002-2003) was provided by the **Oregon Watershed Enhancement Board**, and funding for the BLM study (2007-2009) was provided by a grant from the **Joint Fire Science Council**.

I am grateful to Principal Investigator, Dr. Paul Hosten of BLM for giving me the GLO contract and entrusted me with the responsibility for conducting this study as an integral component of his larger project. I am indebted to John Christy of ORNHIC for giving me the OSU contract, and providing training, oversight, advice on technical problems, and quality control for my work on both the OSU and BLM studies.

Several individuals from BLM were helpful in facilitating pieces of the project. Orrin Frederick, Chief of Spatial Products at the Oregon State Office (Portland), provided microfiche film of the raw data, with a projector for viewing the film to do transcription work. He also provided information and background about the GLO program. At Medford, Steve Slavik handled the local BLM contract administration processing paperwork, and approval of work submitted for payments. A final report, or one combining the results of both studies was not envisioned for either contract. So it is much appreciated that the BLM considered and authorized funding to combine the results of both studies. Botanist Doug Kendig supported and facilitated the retention of funds and administrating these funds until this final report could be completed.

Several individuals contributed work to the technical aspects of the project. My thanks go to Nancy Christy who transcribed a number of townships in both studies. Jackson County Surveyor, Roger Roberts, provided GLO and other information, including State Line survey records. He also provided CDs of typed GLO records and the files for all Donation Land Claims surveys. Numerous historical references to local landscapes, development, and vegetation in early documents and newspapers were forwarded to me by Medford resident and local historian, Ben Truwe. He also located and provided a number of early landscape photographs of the Bear Creek Valley. Greg Card, retired NRCS - USDA of Bend, Oregon, used his excellent engineering computer skills to produce the graphs and a township drawing for the report.

Dave Smith of Bend Tech Support in Bend, Oregon, worked many times at the Hickman office to help solve technical computer problems. He managed to retrieve and save all the data from a hard drive crash and move it to a new computer without loss, which saved the project data set. My daughter, Dr. Laura J. Hickman of Portland State University, was very helpful providing technical support involving MS Word and Excel spreadsheets. She also generated the Table of Contents and heading / subheading structure for this report.

A number of historical plant names were difficult to associate with modern plant names or any local species. Fortunately a number of professional colleagues were willing to review the plant species checklist and in some cases, search the literature for old names not in common use today or in this region. They provided input as to possible candidate species and a review of the GLO plant name correlation legend with scientific names. We are grateful to this group of reviewers and contributors listed below, that assisted us with this effort.

Tom Atzet, PhD, Regional Ecologist for SW Oregon. USFS (retired), Grants Pass, Oregon.
Frank Callahan, Botanist and owner of Callahan Seeds and Nursery, Central Point, Oregon.
Dominic DiPaolo, formerly Conservation Coordinator, Southern Oregon Land Conservancy; Ashland, Oregon.
Richard Halse, PhD, Professor of Botany and Herbarium Curator. Department of Botany and Plant Pathology, Oregon State University. Corvallis, Oregon.
Royce Hill, Cadastral Surveyor and author of "Willamette Meridian Word Lore" (2008, unpublished), BLM, Portland, Oregon.
Frank Lang, PhD, Professor of Biology Emeritus, Southern Oregon University. Ashland, Oregon.
Paul C. MacMillan, PhD, Professor of Botany Emeritus. Hanover College. Hanover, Indiana (now at Bend, Oregon).
Suzanne Marshall, PhD, Environmental Historian, Ashland, Oregon.
Joan Seevers, BLM State Botanist (retired), Bureau of Land Management. Portland, Oregon, (now at Ashland, Oregon).
Don Todt, Biologist (retired), Ashland Parks & Recreation Dept. (now at Corvallis, Oregon).

Lastly, ORNHIC recently moved to Portland State University after nine years at OSU, and was renamed the Oregon Biodiversity Information Center. Although both studies were completed during the connection with OSU, the final GLO report was written after the transfer to PSU. Hereafter, OSU is the only institution (university) referenced in this report.

--- Gene Hickman ---

INTRODUCTION

Historical vegetation of our nation at the time European settlement is of great interest to natural resource managers and the general public, but is poorly documented. Many assumptions about potential vegetation or historical land cover have been made as a basis for management decisions, particularly for restoration goals, without good baseline data or even general information regarding site potential or site specific historical cover. Some question the validity of baseline data for restoration because of the instability of natural landscapes over time, and the difficulty in finding a “point in time” across a large variable landscape that represents the most natural presettlement vegetation (Noss 1985). Also, what is perceived as the least disturbed or most natural examples of historical cover were influenced by millennia of management by Native Americans. Noss asks “is there any point in knowing what the vegetation was like at a one point in time if, as many paleoecological studies suggest, each point represents a transient association of species, each responding individualistically to long-term change?” He does suggest that “the presettlement model may yet be salvageable” and “despite all complications, presettlement vegetation is a concept that conservationists must reckon with, as it figures prominently in our laws and statements of management policy.” We recognize the dynamic nature of natural landscapes and concur with the both the difficulties and implications of describing a presettlement “state.” Knowing that there is valuable information and understanding to be gained from the investigation of presettlement landscapes, we will promote its use for both restoration and natural resource management.

One source of data is the earliest land survey record by the federal government’s **General Land Office** (GLO). This was the first systematic, detailed, spatially-explicit inventory of natural resources of the United States, during the early period of Euroamerican settlement and development. These records have been used extensively to develop historic base line data, such as plant community composition and/or tree stand structure, in the midwestern and western United States (Bourdo 1956; Habeck 1994; Eagen and Howell 2001, pp 156-157; Cowell and Jackson 2002; Peter and Harrington 2010), and in the Pacific Northwest (Buckley 1992; Habeck 1961; Sullivan 2000; Christy and Alverson 2010). The GLO record provides an accurate insight into presettlement vegetation, at least for the period of the survey, and for the ecological state of the landscape at that date. It also improves our understanding of where and how vegetation has changed over the last 150 years. GLO cadastral survey data provided a valuable contribution to the study of historical vegetation in southwestern Oregon, since surveys began here very early in the period of European settlement and land development.

SW Oregon Pre-GLO Survey History

Prior to the influx of miners, farmers, ranchers, business men and other settlers into southwestern Oregon, the interior valleys of the Rogue River were occupied by a number of Indian tribes. The area was considered to be a remote, uninhabitable region in the Oregon Territory (Emmerson 1996, ch.1; Hannon 1993; LaLande and Pullen 1999). Intrusions in the area during the first half of the 19th century were mainly by explorers, trappers, and occasional travelers moving between California and Hudson Bay Company outposts in what is now Oregon and Washington. For example, in 1826-7, a Hudson Bay trapping expedition documented their travel into the area from southeast Oregon, and their return (Emmerson 1996; LaLande 1987; Ott 2003). In the 1840’s, while the Willamette valley was being settled by immigrants via the Oregon Trail, Lindsey Applegate blazed a trail from the Klamath Falls area across the southern Cascade Mountains and through this valley, forging a travel route across southwest Oregon to the upper Willamette Valley. He then led a wagon train from the East through the region under disastrous winter conditions, to the Umpqua and

Willamette Valley (Emmerson 1996). Numerous historical quotes about travel over this new southern route, and information about the very early settlement history and landscapes of the Greensprings area (SE Jackson County) are provided by Foley (1994, pp. 2-13).

Indians remained in portions of the valley during early settlement and were involved in numerous conflicts with the settlers (Atwood 1993; Foley 1994, p.2), Atwood 2008, p 159). Later, most were moved to a Reservation established north of the Rogue River in what is now called Sams Valley after an agreement was signed with Chief Sam in 1853. This arrangement was short lived, and in 1857 the federal government moved the Indians to the Siletz Reservation in the northern Coast Range (Reyes 1994, pp. 13-26; Robbins 1997, pp. 84-85; Douthit 1999, p. 413).

Prospectors discovered gold in Rich Gulch in 1851, at what soon became a tent city called Table Rock (Marschner 2008, pp. 124, 138). Not long afterwards, gold was discovered at other locations such as the one at Sailors' Diggings, later called Waldo, in the southern Illinois Valley. These gold strikes quickly attracted more miners, and in September, 1852, Table Rock City was platted and became Jacksonville (Webber and Webber 1982) (see Fig 1). and Appendix III – plats). Mining immediately brought in more settlers such as business men, farmers and stockmen to feed the miners. By the late 1850s nearly 350 homestead parcels were claimed in the project area, as recorded in GLO notes and/or on Donation Land Claim (DLC) maps. These DLC records housed in both County and BLM files, were provided for the project area by Roberts (2003-9) and are delineated by DLC claim number on USGS 1:24,000 quadrangle maps.

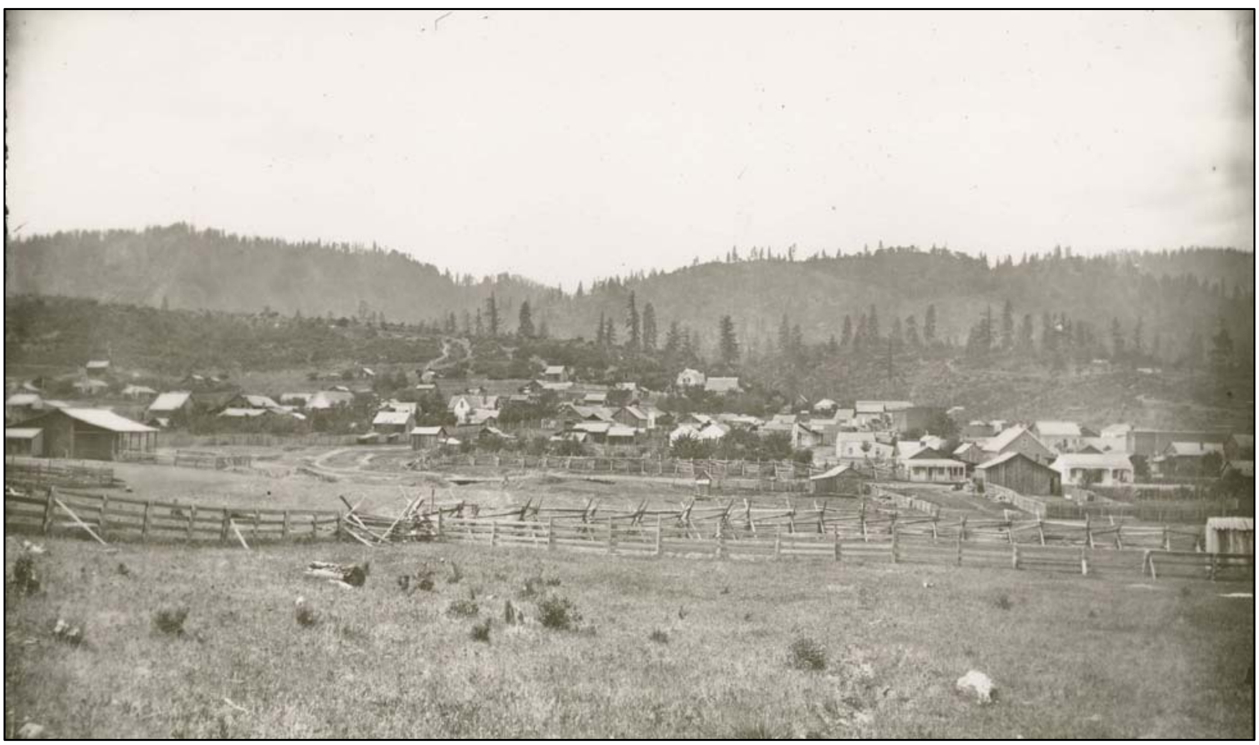

Figure 1. Jacksonville, looking west across Dairy (Daisy) Creek about 1860. The city was founded on the boundary between wooded hillslopes and valley floor prairie. Prospecting, burning, and logging have already changed the adjacent hillsides to young brush fields with scattered trees. (Source: Josephine County Historical Society, Peter Britt #N82-66-26)

By the time of the beginning of the GLO land survey in this area, portions of the Bear Creek Valley floor had been fenced, and natural resource exploitation had initiated significant localized landscape disturbance (Atwood 1993, Robbins 1997, p. 90). Besides prospecting and mining around Jacksonville, Waldo, and numerous other mining camps, many fields were being plowed, cattle and sheep were being trailed into the area for grazing, prairie was being fenced for pastures, logging of the more accessible lowlands were providing wood for construction and firewood, and aggressive burning in adjacent uplands was used to clear land for prospecting and to enhance grazing in the mountains (Fried et al. 2004, p. 9 citing Gannet). Also, new communities were developing, additional wagon roads were expanding the regional road system, and ditches for mining, grist mills, and very limited irrigation were established (Fig. 2). The rapid settlement and demands for documenting land claims soon forced the federal government to initiate GLO land surveys in southern Oregon (Atwood, 2008).

Figure 2. A gold mining operation near Gold Hill in 1897, located somewhere in the Blackwell Hill area. The owner, George B. Ross, used a hillside water delivery ditch and equipment operated by a 1 horsepower system. The background vegetation and location seem to be typical of a droughty slope on granitic soils common in the area. (Source: Gold Hill Historical Society)

The General Land Office, Its Function and History

The Land Ordinance Act of 1785 passed by the U.S. Congress established a rectangular survey system, the foundation for public land surveys. All unsettled land west of the original 13 colonies was considered public domain, where exploration, settlement and development were encouraged. In 1812, the US Congress established the General Land Office (GLO) to execute the Act and supervise land surveys (Bureau of Land Management 2002a). An excellent overview of the beginnings and progression of this national survey program, along with an evaluation and the application of this data for judging presettlement landscapes, was provided by Galatowitsch (1990).

For the first century, the work was done by private surveyors who contracted with the GLO. Work progressed across the West as Congress authorized surveys where settlement was being initiated. For example, GLO contractors began surveying the Willamette Valley in 1851, because a constant influx of settlers was arriving from the Oregon Trail. Not until 1854 was a survey program authorized for the upper Rogue Valley, well after gold was discovered and miners rushed into southern Oregon (Atwood 2008).

The rectangular survey system first required the creation of a grid of townships, each measuring 6x6 miles, followed by the subdivision of each township into 36 sections of one square mile each. Later surveys established the boundaries of settler's land under the Donation Land Claim Act. The rectangular grid formalized a system for locating property boundaries, within which homestead claims could be surveyed and legal ownership established. A manual standardizing GLO procedures for the Oregon Territory was published in 1851 and revised in 1855 (White 1983).

Planning to begin a survey program in Oregon began in Congress in 1850 (Atwood, 2008). The program was to be supervised by a **Surveyor General** headquartered in the Territorial Capitol at Oregon City. During the winter and spring of 1851, Congress authorized funds, the Surveyor's office was established, and recruitment of qualified surveyors was initiated. In May, 1851, contracts with two Deputy Surveyors were signed to begin the first GLO land surveys in Oregon near Oregon City. From here, work extended out in all directions, especially southward into the Willamette Valley, where much settlement was occurring.

Transition to Southern Oregon

"Although the General Land Office planned eventually to extend the Willamette Meridian [from the initial point near Portland] to the Oregon-California boundary, for now [early 1851, Commissioner] Butterfield instructed Preston [Oregon Surveyor General] to survey only the Willamette and Umpqua valleys' rich farmlands, discounting southwestern Oregon as too unattractive to make the surveying of it available at present." (Atwood 2008, p. 27)

After three years of surveying in the Willamette Valley, adjacent foothills and western Washington, pressure was building for the Oregon Surveyor General to issue contracts to survey the newly settled interior valleys of extreme SW Oregon. As a result, a GLO contract signed on January 4, 1854 at the Territorial Capitol in Oregon City, instructed two seasoned surveyors, George Hyde and Butler Ives, to extend the northern survey southward through the Umpqua Valley area into the central Rogue River Basin (Atwood 2008).

sAn interesting account of the late winter departure of this survey party from the Willamette Valley, for this difficult region, was given by Atwood (2008, ch. 9). "Ives and Hyde waited January through March of 1854 for snows to recede in the Rogue-Umpqua Divide and for the hostilities between Indians and white settlers in southwest Oregon to subside". "The first of April, Ives and Hyde readied for the Rogue country, packing tents, blankets food, compasses, and transits. On April 6, George McFall and Sewall Truax went ahead [to Albany]…and the rest of the company arrived in Albany on April 18. Camped near town, the men spent the next day loading packs, only to be delayed again when a mule strayed away. Early on the morning of April 21, the company left town in mid morning, men and mules stretched out along the trail, all armed and equipped and in fine spirits for Rogue river. Twelve assistants joined Ives and Hyde…..…signed on as chainmen....axmen….mound builders" [and for other roles including compassmen, flagmen, marker, cook, campman, etc.]. So began the excursion south on the territorial road "traveling as much as twenty-two miles on a good day and as few as ten in driving rains." After waiting out a storm and continuing on to present day Canyonville, "Ives sent the packers and mules south along the road and, with the rest of the company, shouldered their packs and hiked east into the mountains" to reach their starting point. On May 1, 1854, they began the extension of the Willamette Meridian and its offset around rough terrain, southward into the Rogue Valley, preliminary to chaining the townships of Southwest Oregon.

SW Oregon GLO Survey Program

The GLO township survey of southern Oregon began in late May, 1854. For the first five years the work accelerated in what is now central Jackson and Josephine Counties, already being populated by settlers since the gold discoveries. Atwood (2008) provided an excellent account of the background and politics of this early survey work, the hardships of the survey teams, their personal efforts to progress with the work during periods of Indian unrest, and the settler history unfolding as they laid out the townships and sections.

About three quarters of our total GLO study area was surveyed during the first five years of the program, while the remainder, mostly rough mountainous topography, was surveyed over the next six decades. Of the 49 townships reviewed for this study, certainly some valley areas and adjacent uplands would have been significantly altered during the first decade of the GLO record. However, most of the impacts made during early settlement were highly localized around developments and mining sites. We hope these impacts, although real, were small enough in extent to not significantly alter our interpretations of historical landscapes. The vegetation mapping does reflect ecological conditions at a point in time or the decade of individual GLO surveys as they progressed across the entire project area.

Project Objectives

The initial objective for this study was to retrieve and document landscape and vegetation data from the original General Land Office rectangular survey notes for south central Jackson and Josephine Counties in Southwest Oregon. Newer "resurveys" of previously surveyed areas were not used.

The second objective was to classify and describe historical vegetation units based on the transcribed GLO dataset. Although considerable work of this type has been done elsewhere in western Oregon, this area was expected to be much different from other areas previously mapped.

The third objective was to map historical vegetation from the presettlement and early settlement dataset, based on our interpretation of local GLO data, in relation to topographic information, soil mapping, and other landscape data.

Products

The primary product specified for the BLM contract (see Appendix, Section VII) was a digital map of historical vegetation based on observations recorded at the time of the GLO rectangular survey in Southern Oregon. In order to produce the map, two other products were developed using protocols developed by OSU's **Oregon Natural Heritage Information Center** (ORNHIC), one essential for the preparation of the map, and the other needed for interpreting the map. The first was transcrption of GLO survey notes into an Access database. The second was a classification of Vegetation Types developed from the GLO data set and delineated as polygons on the map. The latter became the map unit legend for the historical vegetation map.

Viewing GLO Data and Project Deliverables

Field data and plats for the GLO surveys are housed at several locations in Oregon. County Surveyor offices in both Jackson and Josephine Counties (Court House) have copies of GLO data for their respective counties. The BLM state office in Portland and the Medford District Office maintain GLO datasets including the microfiche film used for this study. Digital GLO survey notes and plats are available at: http://www.blm.gov/or/landrecords/survey/ySrvy1.php

The transcribed GLO dataset (Access tables), historical vegetation map, and this project report are accessible on the ORNHIC GLO web pages at:
http://www.pdx.edu/pnwlamp/glo-historical-mapping-oregon

STUDY AREA

BLM Funded Project

The BLM (GLO) project, completed between 2007 and 2009, covers about 31 townships or about 720,700 acres of central Jackson and Josephine Counties, all within the Medford BLM District. Figure 3 (below) shows the geographical area and townships (green area) included in the BLM study.

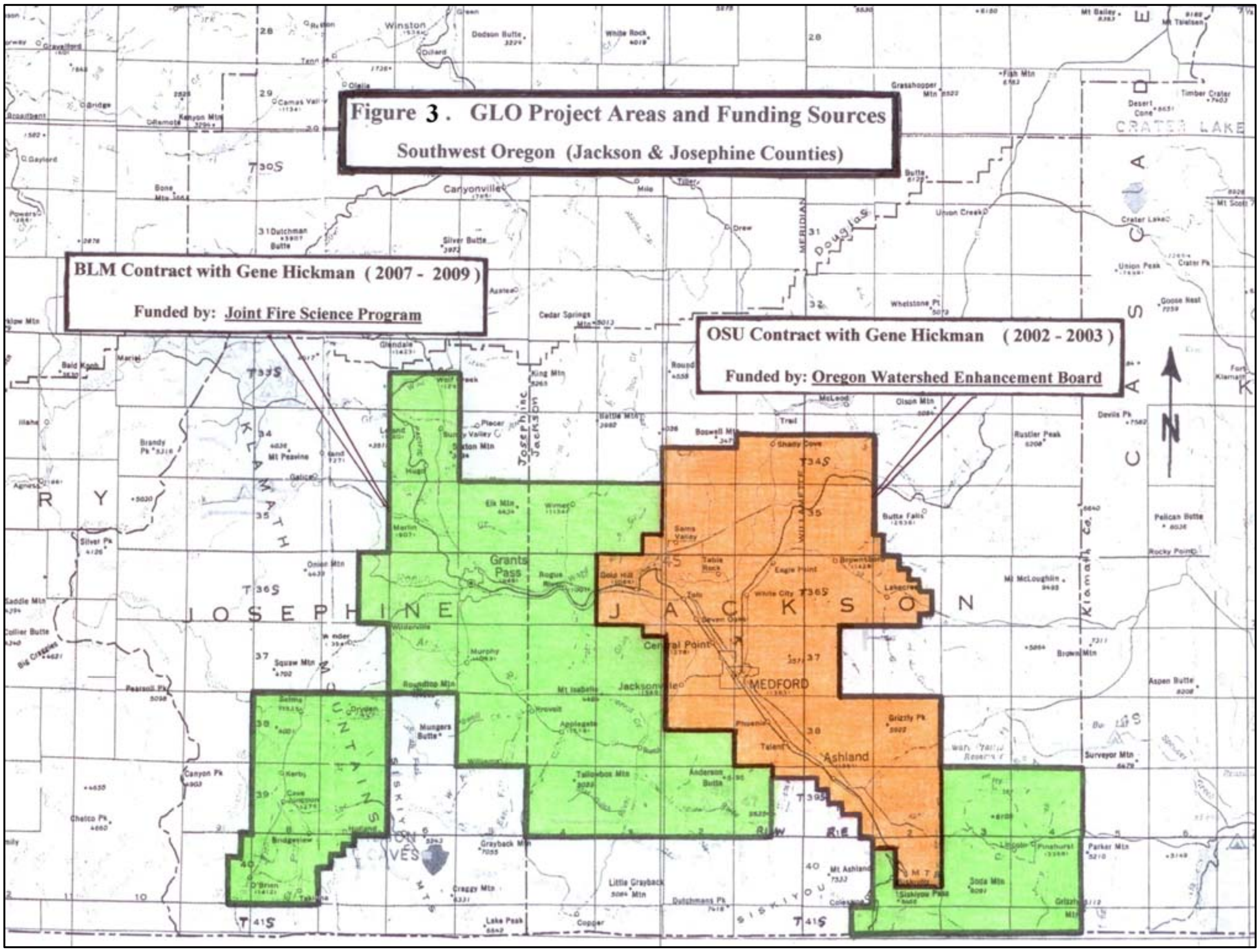

Figure 3. GLO individual project areas and sources of funding.

Most of the study area is in the central Rogue River watershed that includes the lower portions of several major tributaries. A small portion or about 12% of the BLM study area lies in the Klamath River watershed of SE Jackson County, where it borders Klamath County, and the State of California for about 20 miles. This area in the Cascade Mountain Range is isolated from the rest of the BLM project area and is characterized by two high elevation land marks, Soda Mountain and Chinkapin Mountain. Most of the project area to the west occupies the Siskiyou Mountains, the middle to lower Applegate River drainage, and a portion of Josephine County centered around Grants Pass. In addition, a block of townships surrounding the communities of Cave Junction and Selma in the central Illinois Valley constitute the SW portion, also separated from the rest of the project area.

The study area was designed to include primarily the BLM and private land ownership complex containing the major valleys, foothills and low to middle elevation mountains as shown below in Figure 4. Townships were also selected to give the project a broad environmental range and diverse set of ecosystems. Vegetation here is primarily warm (dry to moist) mixed conifer-mixed hardwood forests with associated oak woodlands and savanna. There is also a variety of shrublands (including chaparral), prairie and riparian vegetation. The project boundary was selected to include the entire Cascade-Siskiyou National Monument. Lastly, the BLM project was designed to adjoin the earlier OWEB-funded GLO study area (see “Combined Study Area” below).

Completion of the work was done in phases by somewhat contiguous subunits. These are identified for the BLM study area as the Soda Mountain Unit (Phase I), the Cave Junction Unit (Phase II), the Upper Applegate Unit (Phase III), and the Grants Pass-Lower Applegate Unit (Phase IV). These unit names will be used at times for relating local project data or results to these general locations.

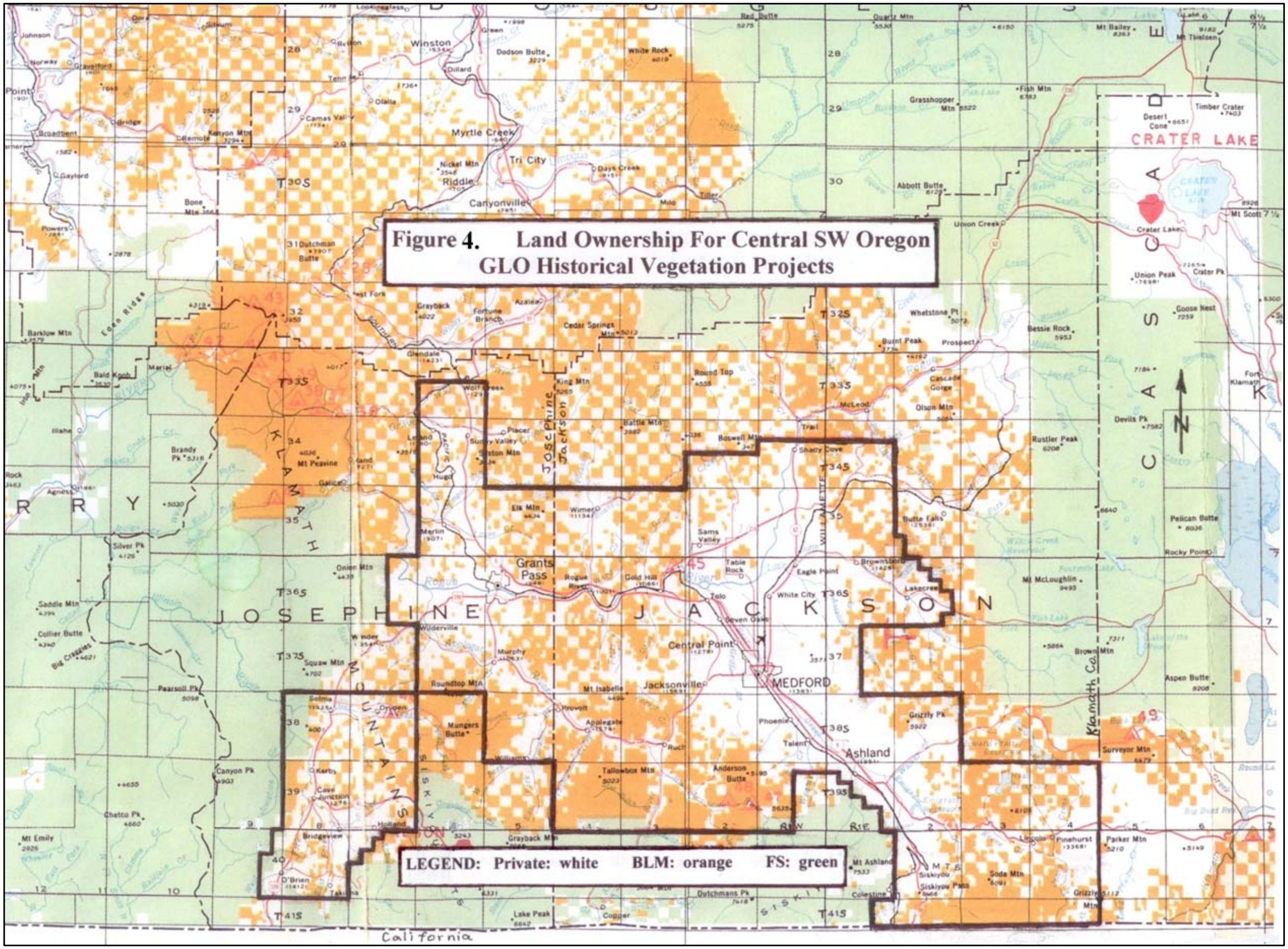

Figure 4. Land ownership in combined GLO project area.

OSU Project and Combined Study Area

The area mapped for the BLM project between 2007 and 2009, adjoins the previous OSU project area study in the central Rogue River Valley that was completed by the authors in 2004. The OSU project, funded by the **Oregon Watershed Enhancement Board (OWEB),** covered about 18 townships or about 418,500 acres in central Jackson County surrounding the city of Medford, and included all the small communities of the central valley (see Fig. 3, Project Map). Because these studies complement each other, the datasets were merged for data analysis and reporting.

The combined projects (Fig. 5, below) cover an area roughly 47 miles north to south, and 74 miles east to west, crossing diverse and contrasting landscapes. In this report we present the products as a composite of about 1,139,214 acres (49 townships), referred to as the "**combined GLO study area",** unless the individual projects are specified in the text.

The acreages given above and throughout most of the report were generated from the GIS data. However, total acreage differs significantly when compared to that reported from original GLO survey plats, about 1,126,000 acres (see: Results - GLO Survey Progress, p. 40). The difference between the two sources is unresolved, but presumably is attributable to imperfections in both the GIS linework and in the original surveys. **Acreage reported on the original surveyor plats was used exclusively for the GLO survey progress analysis reported later** on Table 3 and Figure 12 (see pp. 40 -41).

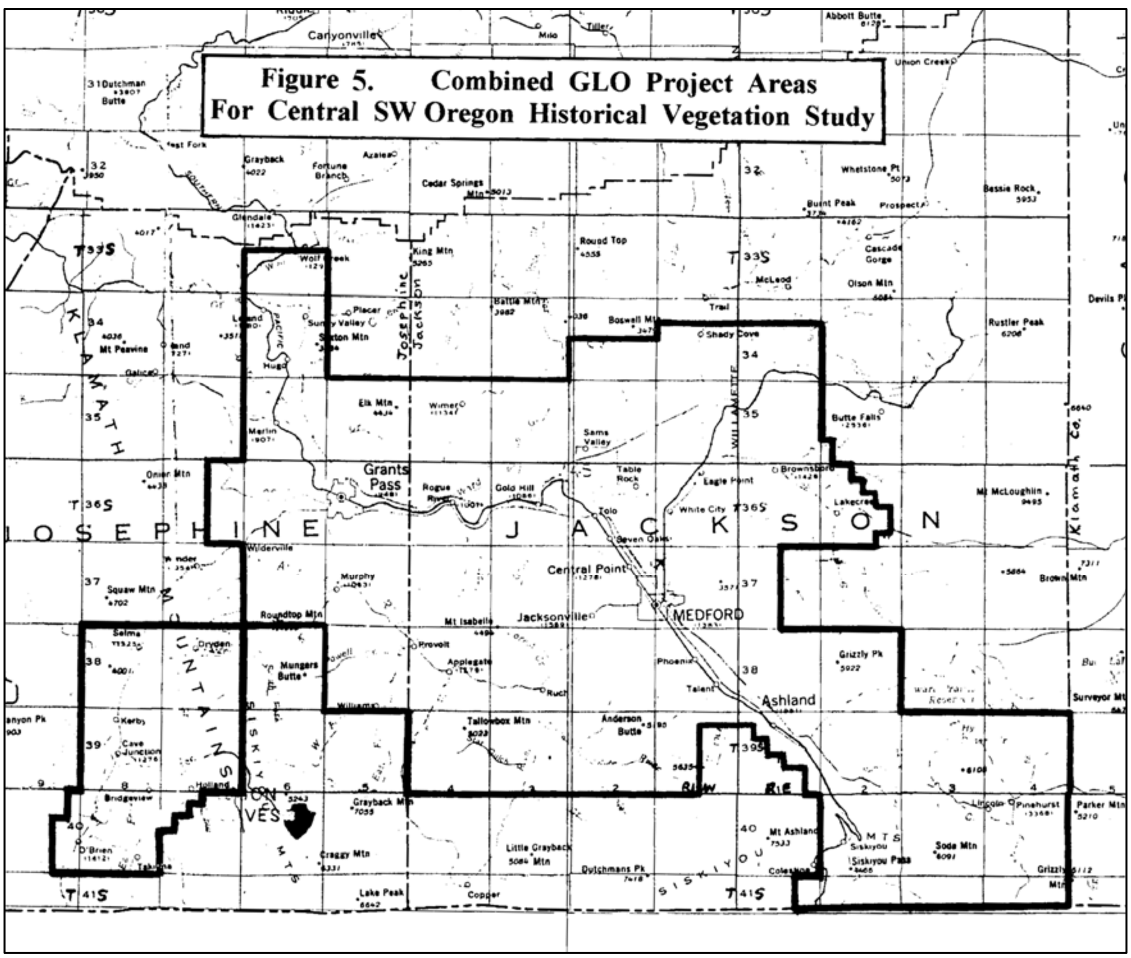

Figure 5. Combined project area for GLO historical vegetation study.

Environmental Setting

The project area has a diverse climate, topography, geology, and soils, creating a complex mosaic of vegetation. This diversity is made even more complex by variation in stand condition or ecological status resulting from the disturbance history prior to Euro-American settlement. An awareness of these features is helpful in trying to identify landscape level vegetation patterns in the dataset that relate to the broad biotic and abiotic features characterizing the project area.

Fortunately, numerous ecological and environmental studies, and years of field investigations for vegetation identification, classification and mapping have been conducted in the project area by a variety of organizations, such as NRCS, OSU, USFS, TNC and SOU. However, the level of intensity of classifying and mapping or inventorying landscape features today far exceeds the quality and intensity of historical data available in GLO records. Direct correlation of historical data with modern land classification inventories, or its use as a baseline to measure change since the historic period, is difficult because of limitations in the GLO data. Nevertheless, current knowledge of local environments and ecological relationships here is very helpful in interpreting the historical vegetative records and for discovering landscape relationships within the GLO dataset.

Ecological Divisions

Southwest Oregon is a unique ecological region in Oregon. Because of its similarity to northwestern California in climate, geology and physiography (Sawyer, 2007), it is included within the Klamath Mountains Ecoregion (Thorson et al. 2003). A similar area was delineated by Anderson et al. (1998), as the Siskiyou Ecological Province. They provide considerable detail about the unique edaphic, geologic and vegetative characteristics of this province that differentiate it from the rest of the Oregon.

Franklin and Dyrness (1973) used vegetation zones to identify broad distinctions within the Pacific Northwest. For southwest Oregon they classified the major valleys as the "Interior Valley Zone (Rogue) of Western Oregon," the temperate uplands as a set of "Mixed Conifer and Mixed Evergreen Zones," and the colder upper elevations as the "*Abies concolor* Zone." The latter is only a minor component of our study area, occurring in the high Klamath Mountains (Siskiyou Range) and in the Cascade Mountains near Soda Mountain. The "Mixed Evergreen Zone," described by Whittaker (1960) in his discussion of the "Mixed Evergreen Forest" formation, is found only at low to mid elevations in the southwest portion of the project area, while the "Mixed Conifer Zone" occurs at comparable elevations across the center and eastern portion of the project.

These differences in vegetation are consistent with research reported by Waring (1969), who described a Western Siskiyou region and an Eastern Siskiyou Region that are environmentally and floristically very distinct. In the Western Siskiyous, coastal climatic influences increase richness of the local flora, decrease transpiration stress, and improve forest productivity. The Eastern Siskiyous are characterized by lower precipitation and higher plant moisture stress in the summer, along with differences in composition and distributions of key plant species. Both Waring (1969), and Franklin and Dyrness (1973), provide an extensive treatment of vegetation and environmental conditions for our study area. The unique climatic and vegetative diversity of this area in relation to the adjacent regions is also discussed by Todt (1989).

Portions of the region have been characterized as Ecological/Climatic Zones by Hickman in various published and unpublished documents (Hickman 1977; Hickman, Gene 1993: Hickman 1995, Hickman 1999; RV Council of Governments 1992). These add refinement to the broader vegetation zones of Franklin and Dyrness (1977), and are consistent with the ecological division proposed by Waring (1969) between the Eastern and Western Siskiyou Mountains. The earlier inventories by Hickman have been adapted and combined to provide a more detailed Vegetative Zone map of the study area as shown in Figure 6.

Zone mapping is based on a landscape classification system described by Daubenmire (1968, p. 240 and 261). He summarized the concept by stating that "all the area over which one (plant) association is climatic climax represents a vegetative zone of essentially uniform macroclimate insofar as vegetation is concerned." Although zones are controlled primarily by macroclimate, there is some influence from soil and topography in complex landscapes, which must be recognized to make mapping practical and feasible. The mapping procedure used by Hickman is based on the more stable, low disturbance examples of existing vegetation (primarily on flat or northerly positions), and zones are delineated by the geographical range of the associated plant types or site groups. "Vegetative sites occur on the landscape in combinations and positions that are predictable and are repeated throughout a given area of similar soils and macroclimate. Geographic areas that have a significantly different macroclimate represent different vegetative zones that are made up of different vegetative sites or different combinations of sites. Consequently, soil (landscape)-vegetation relationships...are much better understood if they are related to the major geographic areas," delineated here as ecological zones (Hickman 1993).

Brief descriptions of Ecological /Climatic Zone Map Units (see next page):

Dry Interior Valley: mixed oak woodland, pine forest, prairie, riparian; 1100-2300 ft; 18-25 in. ppt.
Dry Oak-Prairie Clayey Ridge Slopes: south aspects above Bear Creek; 1600-4700 ft; 18-25 in. ppt.
Dry Warm Oak-Conifer Interior Mts: Cascades-Siskiyous geology; 1600-4000 ft; 25-35/40 in. ppt.
Dry Cool Oak-Mixed Conifer-Juniper Transition: western Cascades; 3300-4500 ft; 20-35 in. ppt.
- North Unit (Transition): higher ppt; composition is more strongly mixed conifer, fewer dry sites
- South Unit: low ppt; shrubland, mixed oak-grass, juniper, prairie, dry forest; less mixed conifer

Moist Illinois Interior Valley: mixed conifer, mixed hardwood, riparian; 1200-3000 ft; 45-60 in. ppt.
Moist Interior Tanoak: Douglasfir, mixed hardwood; coastal climate; 1200-4000 ft; 40-75 in. ppt.
Moist Douglasfir-Chinquapin: grand fir absent/minor, black oak, madr; 1500-4000 ft; 35-50 in. ppt.
Moist Mixed Conifer–Madrone: grand fir common; assume cooler; 1500-4000 ft; 35-50 in. ppt.

Cool Mixed Conifer-Oceanspray: madrone, maple; intermittent snow; 3800-5000 ft; 35-45 in. ppt.

Cold White Fir Snow Zone: Mtn. ash, D-fir & Cedar on warm slopes; 4800-6100 ft; 35-50 in. ppt.
Cold Mixed Conifer-Pacific Yew-Huckleberry: west Cascades, snow; 4600-5400 ft; 40-50 in. ppt.
Cold Mixed Conifer-Chinquapin-Sedge Mountains: snow zone; 4500-5400 ft; 40-50 in. ppt.
Cold Mixed Conifer-Sedge Plateau: lodgepole areas; intermit. snow; 3700-4600 ft; 25-40 in. ppt.

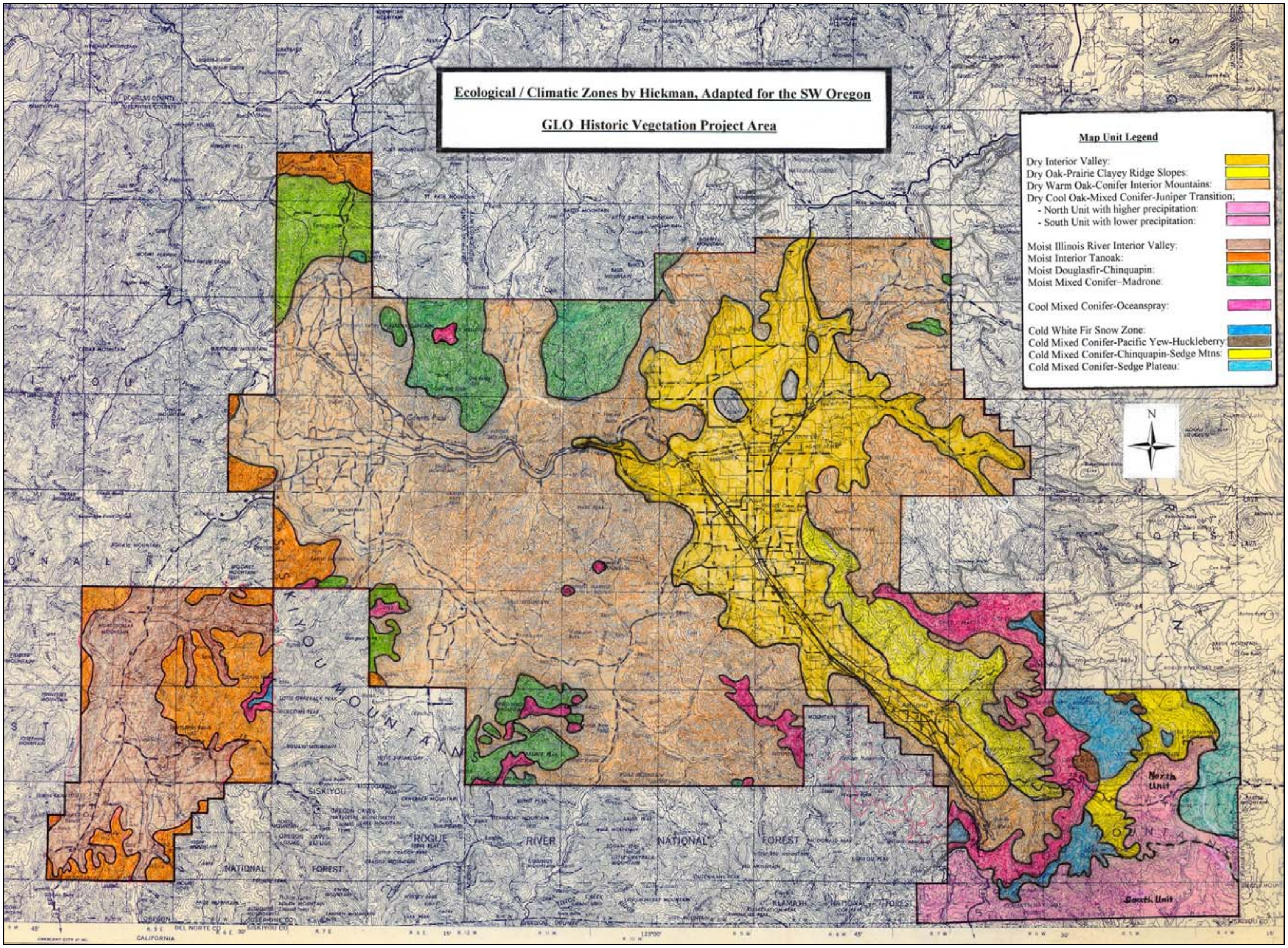

Figure 6. Ecological/Climatic Zones of combined GLO project area. Adapted from previous field studies by Gene Hickman in Jackson and Josephine Counties.

Geology

An overview of the complex geology of the very old and unique Klamath Mountains is provided by Whittaker (1960). The geology of the younger Cascade Range that occupies the eastern edge of our study area has been summarized by the Bureau of Land Management Medford District (2002b). Additional information about the geology in relation to geomorphology and soils is provided by Johnson (1993) and Borine (1983).

Baldwin (1964) and Franklin and Dyrness (1973) described two physiographic regions or provinces for the study area, the Western Cascades and Klamath Mountains. The provinces have a very different geologic history and have formed distinctly different parent materials for topographic features and soil development. A boundary separating the two provinces runs north to northwest across the study area, separating Soda Mountain and eastern Jackson County from the west side of the project area. The Cascade Range ends on the Rogue-Klamath Divide in a saddle just west of the Interstate 5 summit south of Ashland. This division separating the Cascades from the Klamath Mountains runs northerly along Bear Creek and though Sams Valley, dividing the Bear Creek Valley east to west, and separating the volcanics (basalts, volcanic ash, andesitic tuffs, breccia, etc.) from the very old metamorphosed, folded and uplifted marine formation of diverse geologic materials comprising the Klamath Mountains (Whittaker 1960).

The large valley surrounding Medford straddles this geologic boundary and has its own unique geomorphic history. Geologically, it is very distinct from the Grants Pass basin and central Illinois Valley. The Payne Cliff Formation, a very old deposit of alluvium from the surrounding mountains, underlies the entire valley floor, except where exposed at present. It grades upward from conglomerates to sandstone and siltstone interbedded with mudstone. This was followed by more recent volcanic activity in the Western Cascades that sent lava flows across the valley, evidenced today by the basalt cap remnants that form the Table Rocks of the northern valley (Kennedy and Capps, 1994). Large alluvial fans, high old stream terraces, gravel hardpan plains with a biscuit-scabland surface, diverse types of recent stream alluvial deposits from both provinces, small basalt foothills, outcrops of marine deposits, and old elevated lava plain remnants, all make this valley geologically complex (Johnson 1993).

Through its ultimate effect on topography, microclimate and soils, geology indirectly helps produce the complex vegetation patterns seen today in southwest Oregon. The GLO data do not provide a comparable level of detail of vegetative composition necessary to fully reconstruct historic cover on these complex landscapes. However, even though the historical data is coarse and limits our interpretation of presettlement vegetation patterns, very broad landscape relationships are apparent, and in some places appear to be directly correlated with abiotic features.

Topography

Southwest Oregon is characterized by complex topographic patterns, a product of its unique geologic history. The study area consists of primarily of low to mid elevation mountains with some broad interior river valleys, especially along the Applegate River, Illinois River, Bear Creek, and the central Rogue River. The lowest elevations range to about 800 feet along the Rogue west of Grants Pass. Each valley floor has numerous active, narrow flood plains bordering the rivers and along many small tributaries. There are high, old alluvial terraces, broad plains of older alluvium joining low foothills, and wide, very gentle fans on the perimeter.

Mountains surrounding these valleys range from low gentle slopes to steep rough terrain. They are mostly below 4000 feet, with only small areas extending into the upper elevation zone within the project area. Except for these high ridges in the Klamath Mountains, most of the upper elevation area occurs in the Cascades, especially in the Soda Mountain Unit of the project where elevations reach about 6100 feet. This portion of the Western Cascades Geologic Province includes an area of high peaks and ridges that drop either toward the Klamath River or to a large undulating plateau. The plateau is mostly above 3500 feet elevation, extending eastward and bordering the California state line.

Topographic position is a critical element in landscape analysis and is key to understanding ecological site potential. Topography determines aspect, a major environmental factor in the mountains of SW Oregon. Both north and south facing aspects strongly influence plant cover types and productivity throughout the region.

Elevation is another product of topography that has great impact on ecosystems. At about 2800-3000 feet elevation in the vicinity of Cave Junction and westward through the Coastal Mountains, vegetation grades into mid-elevation plant cover types representing a cool, moist/ intermittent snow zone (Hickman 1999). Eastward from the Cave Junction unit, across the warmer and drier eastern Siskiyou Mountains to the southern Cascades, the equivalent ecosystem change occurs much higher at about 3800-4000 feet elevation. Above this, a major elevation break occurs at around 4800-4900 feet, very evident in vegetation of the eastern Siskiyou Mountains, and again in the western Cascades around Soda Mountain.

During the historic period of Euroamerican settlement, the large valleys were quite accessible, very attractive for development, and the focal point for GLO surveys. The adjacent uplands and mountains were mostly well dissected, complex relief, with moderate to steep slopes, sometimes with dense forest. Rough inaccessible topography was often encountered by GLO land surveyors who cited this situation as an obstacle for timely completion of numerous township surveys, delaying their completion, sometimes for decades.

Climate

Significant climatic variations occur across the range of this study area that influence vegetation and will explain some of the results from our GLO work (Froehlich, et al.1982; Johnsgard 1963; Owenby and Ezell 1992, Taylor 1993, Taylor and Hannon 1999). The Cave Junction and Selma portion of the Illinois Valley, ranging east almost to Williams, is a warm, moist climatic area with more marine influence than the interior. This area is characterized by the Interior Tan Oak Zone (Hickman 1999), also referred to as the Mixed Evergreen Zone (Franklin and Dyrness 1973). It is related ecologically to the adjacent mountains of northern California and the Coast Range of Oregon. And it is similar to several small moist localities west and north of Grants Pass within our project area. Average annual precipitation for the moist interior valley lowlands surrounding Selma and Cave Junction is 45-60 inches, occurring mostly between October and June. However, precipitation in the adjacent uplands is estimated to average at least 65 - 80 inches. Summer precipitation is negligible, and average monthly temperatures are less extreme than in other parts of our study area (Fig. 7).

Except for a few high peaks and ridges, and the low moist islands north and west of Grants Pass, the interior of the study area represented by most of the Applegate drainage and central Rogue River watershed (south of Sunny Valley and the Wimer area) is a much more environmentally severe climatic zone. It has a dry, warm/hot climate with high summer moisture stress for trees and more extremes in weather conditions than in the Illinois Valley. This area, identified by Hickman (1977, 1993, 1995) as the Dry Uplands (Rogue) Zone or Dry Warm Oak-Conifer Vegetation Zone, has increasing similarity with the Mediterranean climatic conditions typical of the margins of central California. Average annual precipitation is estimated to be 25 to 35 or 40 inches, depending on location. Within the west center of the Zone is the large valley of Grants Pass that averages about 30 inches precipitation annually, with a seasonal distribution pattern much different than the valley at Cave Junction (Fig. 7). With about half of the precipitation and cooler winters than in the central Illinois Valley, there is much contrast in vegetative composition and productivity between these two valleys.

In the higher mountains, elevation changes at nearly 4000 feet and again at about 4800 feet (discussed above under Topography) are examples of very important climatic thresholds where major shifts in vegetative composition occur. Compared to the lower mountains and valleys, the mid elevation climate representing the Cool Mixed Conifer-Oceanspray Vegetation Zone (Hickman 1995) is cooler, receives higher precipitation, has a shorter growing season and is a temporary winter snow zone. However, landscapes in this climatic zone have a richer flora and higher tree growth rates on the better soils than in the lower elevation Dry Oak-Conifer Zone. The highest elevation zone, not as common the study area, is strongly associated with cold tolerant ecosystems, a short growing season, and a distinct snow zone. It is also characterized by summer drought with a mostly forest potential, primarily white fir.

Medford is located in the largest valley in the project area, extending from Shady Cove to Jacksonville and from Gold Hill eastward well beyond Ashland. Its large size is derived from joining of the central Rogue River valley with several tributaries, particularly from the Bear Creek drainage extending SE past Ashland. Like the Grants Pass basin, this valley is surrounded by the Dry Oak-Conifer Climatic Zone. However, the physiography, climatic data, and vegetation of this area support its classification as a distinct climatic zone (Fig. 6), the Dry Interior Valley Zone (Hickman, 1977, 1993). Climatic extremes are the greatest here where summer moisture stress is expected to be the highest in the project area. Average annual precipitation ranges from 18-19 inches, south of Medford, to about 25 inches at some margins of the valley (30 at the moist north end by Shady Cove), making this the driest valley west of the Cascades in the Pacific Northwest. Summer temperatures can be very hot and winters are usually colder than other areas on the west side, having an increasing similarity with the Mediterranean climate to the south. As a result, the natural vegetation of the Medford valley is unique among the three valleys of the project area and different from all other areas west of the Cascade Range in the Northwest.

Hickman (1997) contrasted average monthly precipitation and minimum monthly temperatures of these valleys, (Fig. 7). The absolute seasonal differences are striking, as shown on the graphs. Modern vegetation surveys in these locations reveal major ecological differences among these valleys, even when discounting the effects of soil differences. Consequently, we anticipated that GLO vegetation data would also be correlated with the unique climatic diversity of these locations.

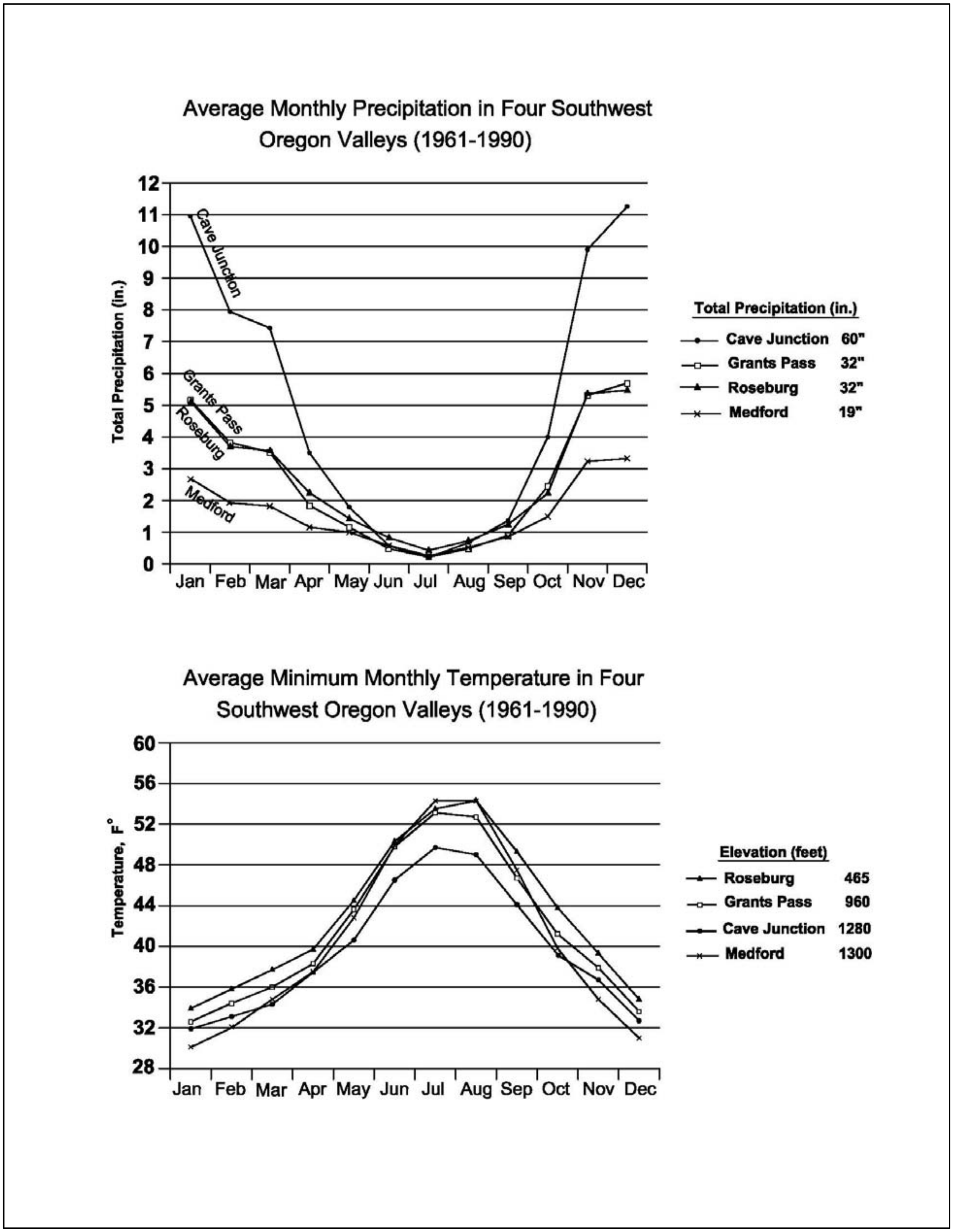

Figure 7. Average monthly precipitation and minimum temperatures for valleys in southwestern Oregon.

The southern Cascades are a crossroads for two major climatic transitions, and vegetation zonation here is related to these environmental gradients. Eastward across the gentle south end of the Cascades there is a rapid transition toward the distinctly continental climate of south central Oregon. Even more dramatic is the change from north to south as the Cascades dip, in a series of topographic steps, from the high cold alpine zone to the low, warm dry Klamath River canyon of northern California. With few barriers to species migration, the area is a crossroads for both wildlife and vegetation, much like the Columbia River Gorge, and the entire area is an ecological transition between major ecoregions.

Because of these environmental gradients and the resulting climatic zonation, the Soda Mountain unit of our study area has a great deal of ecological diversity. It forms a mid to high elevation divide between Rogue and Klamath watersheds, and is characterized by several climatic zones. Annual precipitation ranges from about 20 inches along the state line, to at least 40-45 inches in the high cold snow zone surrounding and northward from Soda Mountain. Here, species composition ranges from high cold white fir forest to warm dry pine, oak or mixed conifer stands along with a variety of brushfields and grassland types. Some of the species combinations found here are unique for southwest Oregon due to the overlapping distributions of species from adjoining ecoregions.

Soils

Throughout the study area, soil influences can be cited that strongly influence plant cover. This makes soil features a valuable tool at times for interpreting GLO vegetation and for aiding in the creation of boundaries for vegetation polygons. Soils have been mapped by NRCS across the entire project area (Johnson 1993, Borine 1983), and we often used them along with topography to delineate GLO map units. The coarse resolution of GLO records was rarely compatible with the more detailed soil surveys. Careful judgment was needed to merge soils data with the historic vegetation maps without distorting or overstating the information documented by the GLO land surveyors.

The western Cascades have less geologic diversity than the Klamath Mountains, but have an abundance of soils developed from basalt, andesite and tuffs or breccia. The basalts are associated with both productive forest loam soils such as on the Pokegama Plateau in the Soda Mountain Unit, and with more clayey soils or claypan subsoils so common in the Cascade Mountain foothills. Dense clay soils (vertisols) are abundant in the dry east side of the Bear Creek Valley. These poorly structured clays, known for their shrinking and swelling as they wet and dry, have very contrasting plant cover types including mixed oak or oak-pine woodland, white oak savanna, and both wet and dry prairie.

The Klamath Mountains contain very diverse parent materials that form distinctly different soil types and have unique relationships with the vegetation matrix, i.e. plant composition, tree site quality, productivity, plant succession, and regeneration. Whittaker (1960) describes the vegetation along both moisture and elevation gradients, and he explained (p. 282) that “different parent materials also have striking effects on floristic and vegetational diversity.” Some of the more common examples of unique soil-parent material influence on vegetation are found on both granitic and peridotite or serpentine geology. Soils from these rock types strongly influence plant composition and site productivity.

In all the major valleys there is a variety of alluvial fan, foothill, high terrace and active floodplain soils which affect plant cover. However, there are some notable soil features in the unique central valley of Jackson County, which is drained by Bear Creek on the south and traversed by the Rogue River on the north end. Elevations vary across the valley floor but range roughly from 1100 to 2000 feet. Numerous small creeks dissect the bottomland forming narrow floodplains which meander through the valley. The area now includes nine communities including Medford, Ashland and historic Jacksonville, the first settlement in southwest Oregon.

This valley is an old alluvial plain with fans, young and old creek terraces, low foothills with non-marine sandstone outcrops, and steeper toe slopes of the mountains surrounding the valley. On the Cascades side of Bear Creek, the young volcanics have developed into large areas of dense clay (vertisol) soils on the valley floor and extend up the long droughty open east slopes. Several areas of very sandy soils that formed from sandy granitic outwash occur on the south and west side of the valley, and are related to the adjacent Klamath Mountains geology. Local deposits of pumice and ash alluvium occur on river terraces along the Rogue River as outwash from Mt. Mazama.

An area of compacted alluvium, now known as the Agate Desert, formed a thick gravel hardpan covering a large area north of Medford. Above the hardpan is a distinctive landscape feature called mound and swale topography, or patterned ground. This extensive flat plain of low, moderately deep, mini-mounds is interspersed with non-stony scabland in the swales. These become wet drainageways in the spring, or flood to form vernal pools, and then become very dry for the remainder of the season. A similar landscape (patterned ground), except with stony swales and different soils, is repeated nearby on basalt tableland forming the Table Rocks, and again on basalt plains in the extreme SE corner of Jackson County (lower Jenny Creek).

Local Survey Procedure

GLO field work began by surveying a township grid for a large area. Later, separate contracts were issued for subdividing each township. Field work to subdivide a township typically began near the SE corner (on the previously surveyed township perimeter) between sections 35 and 36 (line 35-36), running north and including all E-W lines on the right (east tier of sections). Upon reaching the north boundary of the township, the surveyors moved south and west to begin the next tier of sections as before, advancing north again, and so on, until they eventually ended near the northwest corner of the township. See Figure 8 (below) for a typical township diagram used to illustrate important features of GLO surveys.

Having concluded the survey, the GLO surveyor was required to create a plat (map) and write a "General Description" of the entire township, describing vegetation, topography, settlement taking place, agricultural and mining development, and its value or lack of value for further settlement. Later, field notes were finalized and the plats drafted by office staff to visually display survey data. The completed GLO records were submitted to the Oregon Surveyor General for contract approval and payment.

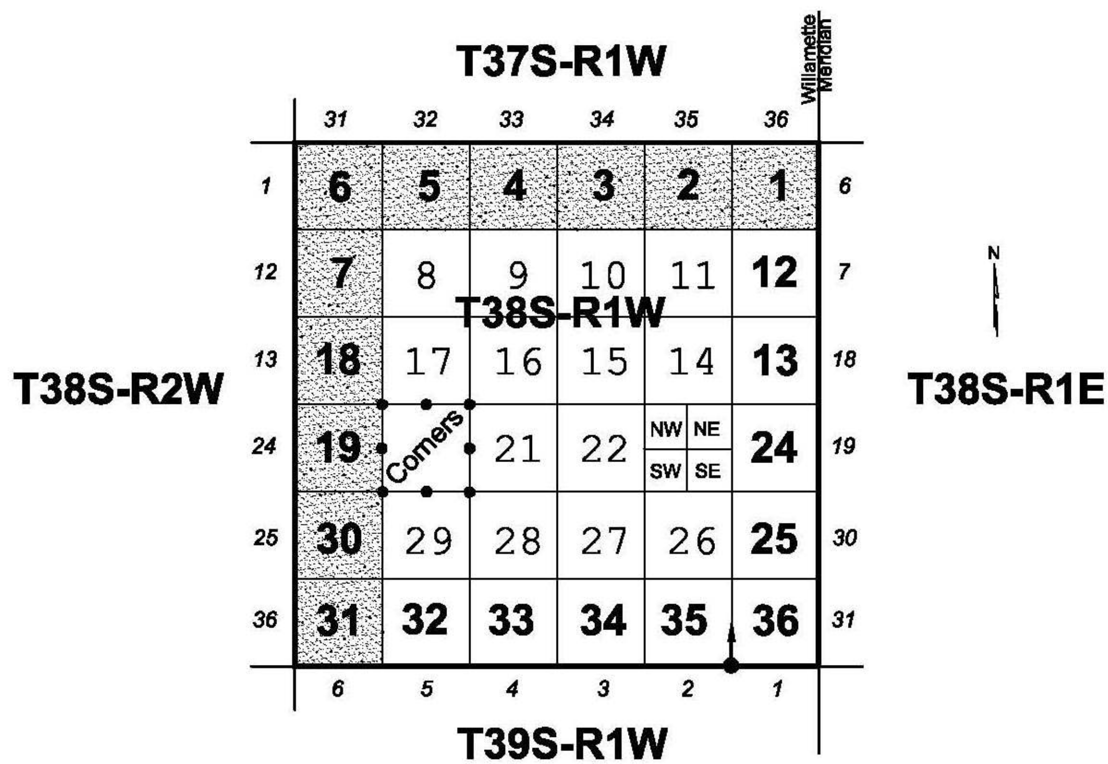

Figure 8. Township and section schematic. In general, each section encompasses 640 acres, and a township contains 23,040 acres. The shaded sections are where adjustments are usually made in order to close survey corners with adjoining surveys, and the length of section lines may vary from the usual 80 chains. A township subdivision survey usually begins at the arrow between Sections 35 and 36. Four section corners and four quarter section corners are established for each section, as shown in Section 20.

GLO RECORDS

Surveyor data was available in two forms, field diary notebooks and township plats (survey maps). Five kinds of landscape data are found in the field dataset. (1.) **Bearing or witness tree data** at section corners and at quarter corners midway between the section corners. (2.) **Section line measurements, intercepts and references** made along the survey lines, to features noted by the surveyor. (3.) **Descriptions of section lines** which briefly described each survey line and often included more detail such as additional species. (4.) **General descriptions of townships**, with landscape, settlement, and development information for the interior of the township, after surveying the township's exterior boundary or subdividing the township. (5.) **Township plats** or maps drawn to scale for each township, that were based on the GLO survey notes. These components are further described and discussed below. See the Appendix, Section II, for examples of Line Tables from this study, displaying the GLO data discussed below.

Bearing or Witness Tree Data

The most precise GLO records other than those with distance measurements from the corners or defined boundaries (entry or exit points), are witness tree data at corners. Section corners usually had four trees documented, if trees were present and suitable for blazing, to serve as references or witnesses to the corner location. Bearing trees were supposed to be sizable, durable and healthy trees if available, and one was selected in each quadrant adjacent to the corner monument. Each tree was identified by species, and its diameter, bearing and distance from the corner was recorded. Midway between section corners, a quarter corner was established with two witness trees, if available. With four section corners and four quarter corners per section, up to 24 trees per section were documented when enough trees were present. If no suitable trees were available, a mound and pit or large rock was used instead to witness the corner.

In this study, species of witness trees helped us to classify vegetation into plant communities or vegetation types. Tree diameters provided some general information about stand age. Distances to corners from witness trees were used to estimate stand density and were helpful to classify stands into coarse cover classes of forest, woodland, savanna or prairie (Christy et al. 2011).

Section Line Measurements, Intercepts and References

Each section line survey ran between two section corners. The line at the point of beginning (section corner) began at zero chains and a direction or azimuth was stated for the line. Measurements in chains and links were recorded when objects were intercepted such as topographic features like ledges, bottoms, ridgetops or steep slopes. These included stream crossings with their widths, and changes in major vegetation types such as transitions from prairie to timber. Large trees (species and diameter) were documented when directly intercepted by the section line.

Also, surveyors recorded cultural features encountered such Indian trails, settler roads, homesteads, fields, fences, saw mill sites, flouring/grist mills, early town sites and mining locations with ditches (traces) for water conveyance. At times they recorded bearings and distances from a point on the line to features noted along the route such as a nearby settler cabin, sawmill, field corners, or distant mountain peaks.

Descriptions of Section Lines

Line descriptions recorded information about the landscape, plant cover, forage productivity, special features such as cultural activities and development, including mining, written at the end of each section line survey. They described soils, topography, sometimes geology, and a summary of vegetation, ending with a short plant species list, primarily trees and shrubs. Recent burns were sometimes noted, and tree regeneration or shrub cover sometimes included density notes like "thick or brushy." Forage value for grazing was often indicated by terms like "good grazing" or "good grass." Soil class ratings reflecting productivity and site limitations were always given but were quite crude, such as the following descriptions: "first-rate loam, second-rate clay loam & gravelly, rough and stony," or "black garden loam."

General Description of Townships

General descriptions were written after township boundaries (six miles on a side) were surveyed, but before contracts were issued to subdivide the interior of townships into sections. The general description was not very detailed, and was less helpful than other GLO data reviewed for this project. It usually recorded the surveyor's impressions including a topographic and vegetative overview of the township, and its value for development and settlement, but sometimes contained considerable cultural information.

Township Plat

Plats were maps drawn to a scale of ca. 1:31,000 after the subdivision survey, based on the section line and township boundary field notes. Examples of GLO plats from this survey, are displayed in Appendix, Section III. They are very helpful at times, to display such features as the section line grid, topography, road systems, stream systems and other water features, vegetation boundaries which have an entry and exit point on the line survey, and other cultural features. Usually, any feature noted on the section line survey with a distance measurement was also drawn on the plat. Surveyors sometimes extended these features as sketches across the interiors of sections. These renderings were frequently inaccurate, especially when showing topography and drainage systems.

Lastly, the plats indicated which portions of the townships had been surveyed, and if they had been surveyed in stages at different time periods. Portions of some townships were not surveyed in the first decade because of surveying challenges or due to the lack of economic value for mining, agriculture, timber or settlement. Areas that were rough or too difficult to survey were often labeled on the plats as "rough mountains and unfit for settlement." These isolated blocks of land were left unsurveyed, sometimes until many decades later, and were often delineated on a new plat.

Comments Regarding the Use and Interpretation of GLO Records

Changes in vegetation types occurred where surveyors indicated that they entered or left different types of cover, usually prairies, timber, meadows, valley bottoms, or brush thickets. Sometimes reference was made in the Line Description to a vegetation feature that could be mapped, (e.g., "west 30 chains are level prairie," while the remainder of the line was described much differently ("east 50 chains are low timbered mountains of oak and pine").

Both witness tree records and section line descriptions provided the primary data to characterize stand composition or contrast different locations in the project area. In section line descriptions, overstory and understory species were assumed to be listed in the order of dominance or prominence along the line, but this was not always the case and sometimes is an unavoidable source of error for modern interpreters (Bourdo 1956). Unfortunately, plant lists were a composite for the entire line (unless restricted by the surveyor to a line segment), regardless of topographic or stand differences encountered, and presumably masked many true differences in historic plant cover.

It would take considerable time and effort to do extensive interpretation of the GLO data set, which was not part of the initial project objectives. To illustrate, a careful reading and analysis of selected stand data in conjunction with other landscape information, might improve our understanding of stand structure and history. One line description, for example, reads “Timber fir, pine, oak and laurel; undergrowth manzanita, oak and lilac.” It contains all black oak (4-15 inch diameters) except for two large yellow pine (20 - 24 inches in diameter) cited as witness trees (T35S, R4W, line 22 - 23). Spacing of nearly all trees in this stand is under 70 links at the corners, which classifies it as having a “forest” density class. These data appear to describe somewhat open regeneration dominated by younger Douglasfir poles, codominant with similar aged pine and/or some older pine relics from an older stand. Younger black oak regeneration is common with some madrone also present. The stand is probably a younger fire regenerated stand that has not yet developed a dense canopy, retaining a rather shade intolerant understory containing significant whiteleaf manzanita with both young oak sprouts and lilac. The shrub stand cited is probably the remnant of a former brush field that served as a nurse crop for the current Douglasfir stand, but which can only be in decline as the canopy of conifers and hardwoods expands and shade increases.

Some GLO studies use quantitative procedures to analyze corner records and interpret tree data for stand density studies, making comparisons between the historic cover and recent inventories of stand structure (Peter and Harrington, 2010). Using these methods, it is possible to use tree diameter and spacing to estimate stand density classes within Vegetation Types. This was not done here but could be a future use of this dataset. Some potential difficulty always exists in the accuracy of analyzing historic stands using corner data, because of surveyor bias or prejudice in tree selection. Even with rules to guide GLO surveyors, selection of trees was not random or always in accordance with the instructions. However, their intent was to provide a visible, easily relocated and long lived monument for marking and witnessing the corner. The above procedures and problems were reviewed in detail by several authors (Bourdo 1956, Galatowitsch 1990, Williams and Baker 2010, Williams and Baker 2011).

METHODS AND PROCEDURES

Introduction

The first step in the study was to retrieve all the landscape information from the handwritten GLO field notes which were sometimes hard to read and often included unfamiliar words from archaic American dialect (Fig. 9). Field notes were transcribed into a Microsoft Access database using protocols developed by Christy et al. (2002). Data is organized by township and usually includes all sections in each township, regardless of survey date. The data was transferred to ORNHIC in Portland, Oregon, where it was added to the GLO database for Oregon.

Next, it was necessary to review and classify the GLO vegetation data along each section line into vegetation types or plant communities. Key GLO notes were transferred or copied to their corresponding locations on mylar overlays of 1:24,000 USGS quad base maps to identify their distribution and detect patterns of similar data that could be grouped into vegetation types and delineated as map unit polygons. The composition of these groups needed to allow for considerable variability but be distinct enough to be mapable. Because grass and forb species were generally not documented by name in plant lists, only trees, shrubs and references to plant types like bunchgrass, prairie, creek prairie, etc. were useful for classifying historic vegetation groups and for writing descriptions.

Mapping vegetation and creating map unit polygons required the use of several sources of information. The author's personal experience in local field inventories, and any landscape or topographic feature that appeared related to GLO vegetation type distribution was utilized for mapping, such as contours, aspect, elevation and USDA soil surveys. Vegetation boundaries were then drawn on the mylar overlays (over quad base maps) where contour lines could easily be used as an aid in map development. Some vegetation breaks were precisely recorded at points on the section line by GLO surveyors. Most vegetation boundaries were not delineated on plats for the interiors of sections, so we had to extended polygon boundaries beyond known points on section lines by using landscape information and professional judgment. Topography and modern soil surveys were the most important supplemental information used for this purpose.

At times the data were too variable or coarse to delineate pure (single) vegetation types. When plant communities were un-mapable, we combined vegetation types into groups or "complexes" of vegetation types to create map units or polygons. In all cases, we recognize that small inclusions of other units, named or un-named, are were probably present historically.

The mylar overlays with the vegetation polygons were then digitized and merged to create a single GIS map data file. Review and editing of the mylars was needed prior to digitizing, to check edge matching between maps and to assure accuracy of the map unit labels. The GIS dataset included abbreviated descriptions of map units attributes, and a separate Word document contained detailed descriptions of the vegetation map units.

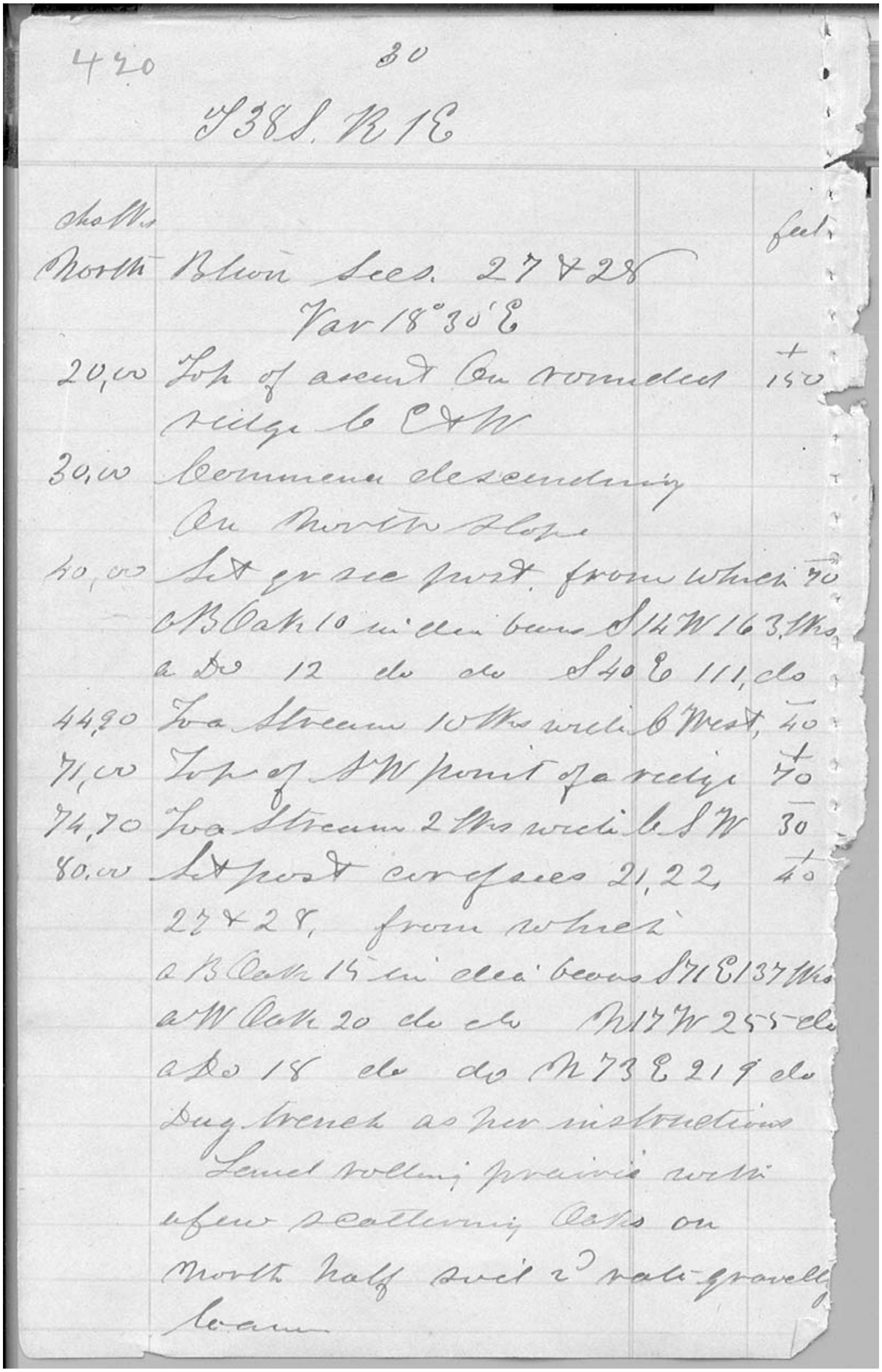

Figure 9. Original GLO field diary notes (T38S, R1E) for a line survey running north between Sections 27 and 28. A general description is at end of line. Figures in left column are distances in chains and links. (Source: USDI Bureau of Land Management)

Preparation of Access Database

Overview

Our GLO information was transcribed into two types of Access tables, one called a **Township Table** and the other called a **Line Table**, using a standardized format and procedure developed by Christy et al. (2002). This study procedure involved transcribing the original handwritten diaries from a set of micro fische film using a viewer with magnification, at the desk beside the computer station. Surveyor notes were usually transcribed verbatim, sometimes with added editorial comments in square brackets [ ]. These bracketed notes were used to add clarity, an explanation, or supplemental notes as needed, or to speculate on wording where the handwritten text was illegible. Some original survey data was omitted from the transcriptions, such as equipment calibration notes, meanders, random line surveys, and voluminous unimportant repetitive topographic notes. However, all vegetation data, stream data, soil/geology notes, cultural resource information, and most topographic data were included.

Township Table Preparation

A single or master Township Table was produced for the project, listing general township information for all townships in which data was collected. It is primarily background data recording the surveyors' names, the portion of each township that they surveyed (perimeter or subdivisions), the date of each survey, the General Description for each township, and occasionally brief exterior boundary descriptions. Townships were identified by their number, according to Township and Range (e.g., 36S-05W). See Appendix (Section I) for an example of the contents of this table.

Line Table Preparation

A set of Line Tables was produced for the project, since the transcribed data is displayed on separate Line Tables for each township. Line Tables contain GLO survey data transcribed from the field diaries, with editorial notes, for each township, and most were 15-30 pages in length. Formatting for the database was different from that found in the original GLO notes, so that the information can be sorted, viewed in columns, or queried if desired. Transcription of the survey data into the database proceeded in the order in which it was surveyed, from one section corner to the next along the section line, covering one mile segments or 80 chains.

Each section line was identified by a number derived from the adjoining sections (e.g. 11-12, 35-36, 01-06). Direction of the survey along the line is critical to relating data to the correct landscape features, and this is identified in a data field as N, S, E or W. All features described along the line or intercepted by the line were coded and identified with their distance, in chains, from the starting point of that line. Each record in the table was coded to characterize the data, i.e. topography, vegetation, cultural, corner, etc. for easy review, sorting and queries. Any trees intercepted on the line were entered in the species field, along with its diameter.

Section corners and quarter corners are entered in the intercept field, and their witness trees were entered in the species column along with diameter (inches), azimuth or direction to the tree, and distance from the corner in links (7.92 inches/link). The lines were usually one mile or 80 chains long. However, any adjustments needed in distance measurements for the township were only made in the western and northern rows of sections (see Fig. 8). These sections were often longer or shorter than one mile in order to close the survey at the established township perimeter boundary. At the end of the mile a general (verbatim) vegetative and landscape description for the line was transcribed with the original spelling. There was a great deal of variation in the amount of detail provided in the line tables, depending on the surveyors. Some surveyor notes were quite detailed, while others were very brief, almost inadequate for analysis.

Completed Line Tables

A complete Line Table contains data for section lines along the north and east exterior boundaries of the township, and all the interior section lines for the township, even if surveyed under different contracts at different dates. South and west boundary data are always found with the adjacent Line Tables as either their north or east boundary. The year showing when each mile was surveyed is derived from the Township Table, which also indicates the deputy surveyor responsible for the survey.

Although the Combined Project Area covered the equivalent of 49 full townships, the raw GLO data was collected from a composite of many more full and partial townships (see Combined GLO Project Area map, Fig. 5). This required the preparation of 76 (partial and/or full) Line Tables to record the entire data set for this study. Due to the volume of material, the transcribed data is not included in this report, but examples of Line Tables are included in the Appendix (Section II). A legend defining Line Table codes is also included.

Preparation of Historical Vegetation Maps

Overview

Mapping of historical vegetation required the use of several sources of information. Most important was our completion of the vegetation classification from raw GLO survey data followed by the development of vegetation type (map unit) descriptions. Mapping also involved the use of all landscape or topographic features that were consistently related to the vegetation, and these were all utilized for delineating vegetation polygons.

The primary product of this study was a map and descriptions of "historical vegetation," displaying vegetation types interpreted from GLO survey notes for the nearly 1.14 million acre project area. The product was developed on clear overlays for a set of individual quad maps, and merged in GIS to cover the study area (see Fig. 24, p. 69).

Development of Fine-Scale Map Units (Vegetation Subclasses)

Delineation of vegetation polygons began win identification of fine-scale map units ("subclasses") based on discrete vegetation types described from the surveyors data. Creating and delineating polygons of similar plant cover was sometimes difficult because the GLO data was coarse, incomplete and sometimes inaccurate. Mapping is much like trying to put a puzzle together with less than half of the pieces present, and trying to extend the lines between the pieces to complete the correct but unknown picture. Therefore, the GLO historical vegetation map is our attempt to interpret the main picture from the limited dataset, but without some of the finer details. Local experience conducting ecological inventories throughout the project area (Hickman), has been extremely valuable in interpreting the GLO records. However, it was difficult to refrain from upgrading historic map quality to current knowledge levels about these landscapes, based on the modern ecological inventories and classification work done here.

The GLO dataset was recorded at the beginning and during early settlement of the study area. Therefore, the goal for this study was to produce a historical vegetation map based on the early settlement period, reflecting the least amount of disturbance or change from presettlement conditions. We made every attempt to represent and interpret the surveyor's records as accurately as possible to reflect the historical picture for the period of record. In many cases, the earliest survey was replaced by a later dated survey (**resurveys**) where more permanent monuments were established for the corners and new witness tress were established if necessary. Although the information is available in the diaries, <u>only the first or original GLO survey</u> was transcribed here and used as a data source for map making (see "Project Objectives" section).

Classifying GLO data as described above is simply a process of identifying all significantly different vegetation groups that have enough acreage to justify their delineation as vegetation map units. Completed Line Tables (above) were essential for the review, analysis and classification of GLO data into vegetation types or plant communities. It can be difficult at times to compose unique substantive descriptions from the broad characterizations surveyors provided for each section line. The survey notes were usually inadequate to identify the subtle detail and variety of vegetation often present within local landscapes. After similar fine-scale vegetation data was grouped together to represent a subclass, a Type description was created, based on both dominance and the presence or absence of species. Witness trees can be helpful for developing the species list but do not necessarily indicate dominance in the stand. Our descriptions sometimes included geographic, topographic and climatic parameters which were not part of the original dataset, but were inferred from modern environmental data. This was done when enough area had been mapped to make inferences about the landscape setting including soils, geographical distribution, and associations with other subclasses. Although this procedure was subjective, our professional judgment was based on lengthy field experience in SW Oregon.

A disturbance category called "Burned" was used when there was clear evidence of a recent fire. . Burned tree stands were delineated as map units, with a modifier "Bu" added to the map symbol of the disturbed vegetation subclass. These important disturbance units are discussed later in the "Results" (see "Fire Disturbance and Historic Burn Mapping"),

<u>Development of Coarse-scale Map Units (Vegetation Classes)</u>

Once fine-scale map units were identified and described as subclasses, these were aggregated into coarse scale-scale map units called "Classes" based on general stand structure (as defined below for GLO analysis). Vegetation classes provide a way to summarize specific stand characteristics, and to display broad distributions of these vegetation groups. As an overview of a large landscape, classes may have future use for comparing changes in tree cover, over time, between presettlement and the present.

One component of plant community structure is "stand density," an important attribute of historic vegetation which can be estimated from GLO data. Stand density is determined from both the line description and from witness tree distances at the corners (Christy et al. 2011). As the fine scale subclasses were identified and described, each was assigned to a Vegetation Class, based primarily on criteria described below. Classes included: upland forest, riparian forest, woodland, and savanna, with treeless (or nearly treeless) areas falling into prairie or a shrubland cover class.

Forest. The greatest canopy density class occurred in closed forest, where the composition was dominated by either conifers or hardwoods. Witness tree spacing or distance from corners generally averaged less than 1 chain or 100 links (66 feet). Also, the wording used in the line description, such as "timber," timber "thick," "heavy" or "dense," suggested a forest class. Understory was irrelevant to class definition here, but ranged from dense or brushy to sparse, or it may not have been described in the dataset. Both upland and riparian/wetland forest classes were recognized.

Woodland. The woodland class was referred to in a variety of ways in line descriptions, namely "open," "scattering," "scattering timber," "thinly timbered," or "sparsely timbered." Witness trees were generally spaced at 1 to 2 chains or 100 – 200 links (66-132 feet) from the corner monument, with an occasional tree up to twice that distance. Understory varied from dense brushy to sparse or was undescribed. It was often difficult to classify some stands as either forest or woodland because of excessive variation in the dataset. This was especially true in the mixed conifer-mixed hardwood stands of central Jackson County. When in doubt, the Woodland Class was generally selected.

Savanna. The most open tree stands were classed as savanna. Witness tree spacing or average distance from the corner typically ranged from about 2 to 4 chains or 200-400 links (132-265 feet). However, occasional trees were recorded at only half that distance. Line descriptions that described stands as "Openings" have long been thought to represent savanna. Understory was not always described but may have been given as "open," "good grazing," "good for stock," or "grass in abundance." Open stands that met tree density standards for savanna, but were brushy or had dense chaparral understories were difficult to classify if savanna was not justified.

Shrubland. A stand that was primarily described as shrubs with few or no trees, and with few or very widely spaced witness trees, represents the "shrubland" vegetation class. Stands were sometimes described as "brush," "brush fields," "thickets," "thick growth," or "chaparral." Very young tree regeneration reported within thickets or dense brush was classified as shrubland. When any larger trees were present, such as witness trees, spacing was similar to that of prairie (above).

Prairie. Line descriptions describing prairie included terms such as "prairie," "rich grass," "grass plenty," "covered with grass," "good grazing," "good bunchgrass," "meadow," "creek meadow," or "open plains." Grass species were not identified in SW Oregon records , but woody species were sometimes noted. Corners were usually treeless, sometimes with descriptors added such as "no trees in a convenient distance" or "no tree near" or "dug trench and raised mounds as per instructions." However, in a region like western Oregon where environmental conditions so strongly favor trees, it was unusual to find large areas prairie without occasional trees or clumps of trees. Historically, landscape burning by Indians probably reduced the occurrence of trees in these settings from what they may have supported without fire. Where trees were cited as witness trees, spacing of 2 to 8 chains or 200 to 800 links (132 -528 feet), or even further were typical. In our dataset, prairie "undergrowth" included minor shrubs, patches or clumps of shrubs, no shrubs, or was undescribed.

RESULTS: GLO SURVEY, PRODUCTS AND DISCUSSION

Southwest Oregon GLO Surveys

Surveyors

Historic land survey data was transcribed for the equivalent of 49 townships within the combined GLO study area. The field records were developed by many private surveyors and their field crews through contracts issued by the Survey General for the Oregon Territory, or for the State of Oregon after 1859. The original surveys were completed by 38 Deputy Surveyors (Table 1), over the period of record for this study.

The earliest surveys were conducted during the 1850's under the direction of seven Deputy Surveyors, all new residents to Oregon from the East. During this decade, nearly three-quarters of the survey contracts used for this study were awarded to: George Hyde, Butler Ives, David Thompson, Sewall Truax, E. Fischer, Nathaniel Ford, and Wells Lake. Of these surveyors, Hyde and Ives had the most experience and had worked on the first Willamette Valley surveys three years earlier. They also completed the majority of contracts in the study area. Thompson and Truax were assigned several contracts, while the fewest number of surveys were given to Fisher, Ford and Lake.

It took six more decades to authorize and survey the remainder of the study area, using a new group of contractors. Nine surveyors were assigned GLO contracts within the OSU project area between 1860 and 1895, and 29 surveyors worked within the BLM project area between 1860 and 1919. See Fig. 10 to view a road or land surveyor team and campsite in the Siskiyous.

Table 1. Deputy Surveyors for Southwestern Oregon GLO Study Area

OSU STUDY	BLM STUDY
(1854 – 1859 Surveys)	(1854 – 1859 Surveys)
E. Fisher	E. Fisher
Nathaniel Ford	Nathaniel Ford
George Hyde	George Hyde
Butler Ives	Butler Ives
----	Wells Lake
David Thompson	David Thompson
Sewall Truax	Sewall Truax

OSU STUDY --(1860-1895 Surveys)--	BLM STUDY (1860-1919 Surveys)		
___ Chitwood	Homer D. Angell	William Gibb	Henry C. Perkins
Albert Eckelson	Peter Applegate	W. L. Hemphill	Norman D. Price
Ormond Fletcher	W. F. Briggs	James Howard	Earnest Rands
James (? James Howard)	W. Bushey	Charles J. Howard	Fred W. Rodolf
M.L. McCall	William Byars	Sammel Lackland	Eugene Schiller
___ McKin (? McKinzie)	Roy Campbell	Daniel Major	F.H. Sharp
Rufus Moore	Thomas D. Daley	____ McKenzie	Elmer Strickler
Fred W. Rodolf	Albert Eckelson	Fred Mensch	William Turner
William Turner	Ormond Fletcher	Rufus Moore	Marshall Wright
	Joseph Ganong	Jason Owen	

Figure 10. Survey team: an engineer's camp in the Siskiyous, 1887. (Source: Southern Oregon Historical Society, #1171)

Quality of the Historic Records

The quality of GLO records was limited by a number of factors such as the early instruments in use and the early methods used for surveying. It was also closely related to the integrity or honesty and dedication of the individual surveyors and their crews. Deputy Surveyors signed oaths with each new contract, and it is reported that "they were appealed to for producing a proper survey" by the first Surveyor General, John B. Preston, issuing these contracts (Atwood 2008). A second document was signed by the surveyor and crew upon completion of a survey, attesting to the correct and faithful execution of their assigned work, according to law and the instructions of the Surveyor General for Oregon (General Land Office 1851).

Portions of some early land surveys across the eastern United States have been questioned as to their validity). Some individuals in other states have been reported to have committed fraud, supplied false data, performed sloppy work or may not have set the required corner monuments (Bourdo 1956; Galatowitcsh 1990). More recently there have been questions about whether survey teams actually visited some areas for which records were reported (Roberts 2007).

It was hard to identify any malpractice, errors, or mistakes by Oregon GLO surveyors (willful or unintended) unless the data did not conform to the GLO system of documentation, or was totally inconsistent with the related topographic and recent ecological information. Where we found obvious errors, we sometimes added editorial notes in brackets to the transcribed data, noting the possibility of an error and often suggesting a correction to the field notes. This happened on a number of occasions the project area, but no analysis was made to determine if these mistakes were more prevalent for certain surveyors. Plants were sometimes misidentified and we attempted to correct these errors whenever possible (see Plant Name Cross Reference in Appendix, Section IV).

A second and more troubling fault that we observed was the occasional omission of required vegetation data, including the very brief plant lists provided by some Deputy Surveyors compared with the more extensive notes recorded regularly by most other surveyors. Sometimes the lack of intercepted trees on the section lines that ran through miles of forest seems an obvious violation of policy and potentially an avoidance of work that would slow down the survey.

In the first decade, both Hyde and Ives were most consistent in providing the best records. Surveyors who sporadically or regularly provided less vegetative data were: Fisher, Ford, Lake, Thompson and Truax. In the final six decades, all of the new surveyors except three seemed to provide equally detailed or even more extensive plant lists in their notes, which may be due to better instructions and supervision, or more experience in identifying local vegetation. The three surveyors with poor vegetative data sets were James Howard, Jason Owen, and M.L. McCall, all of whom worked in the early 1870's. Townships assigned to the Deputy Surveyors are identified on the Access Township Table. This table can be used, if needed, to identify geographical areas where there is a weakness in the amount or quality of supporting data for the study.

GLO Survey Progress

The time period for GLO surveys reviewed here extended from 1854 through 1919, only about 9 years ago. Difficult topography and low value landscapes, avoided during the first decade of surveys, were eventually completed under new contracts over the next 60 years.

The highest priority included areas of settlement, mining, and agricultural development. All were surveyed in the 1850's, enabling settlers to initiate legal claims for property. The earliest community established in Josephine County was the mining town of Waldo, in T40S, R8W. In 1855, the GLO township subdivision survey reported that a section line passed through the center of Waldo (line 27-28), noting a "house on line," a "mining sluice" crossing the line, and that the surveyors had "set quarter section post in the mining town of Waldow [Waldo]." Their line description reads "Waldow contains 12 to 15 buildings with 1 street running E & W. The quarter post sets in said street." One of the earliest pictures of Waldo, located about 7 miles south of Cave Junction was taken about 1859 (Figure 11).

Figure 11. Early mining town of Waldow (Waldo), about 1859. Here, in 1854-1855, a GLO survey crew set a quarter section post in Main Street. (Source: Josephine County Historical Society)

The actual progress of the SW Oregon survey in terms of **contract completion** dates by decades, is shown below in Table 2. About 50 % of the all contract segments were issued and surveyed in the first two years (1854-1855), reaching 73% by the end of the first decade (1859) and year Oregon became a state. During the 1860's another 2% was completed, mainly the State Line survey east of the Siskiyou Mountains. During the next fifty years, about 25% of the GLO contracts were awarded, when new portions of the project area were surveyed each decade.

Table 2. GLO SURVEY PROGRESS (%) BASED ON CONTRACTS ISSUED

185O'S	1860'S	1870'S	1880'S	1890'S	1900'S	1910'S
73% (1854-59)	2%	7%	5%	6%	2%	5%
50% (1854-55)						

Survey progress was also analyzed by **acreage** reported, as contracts were completed each decade. The gross acreage tabulated from actual GLO records (plats) was about 1,126,000 acres. Contract acreage was displayed on most GLO plats submitted with field data for payment. The first two years of surveys (1854-55), based on acres completed, are combined below for reporting as in Table 2 (above). However, no acreage was actually completed in 1854, since these contracts were primarily for surveying the township boundary grid in a large part of the region. In 1855, about 36% of the project acreage was completely surveyed (see Table 3, below). The next four years resulted in the completion of an additional 42%, for about 78% of the project being surveyed in the first decade. Figure 12 is a map of the completed acreage by contract locations, and by decades, for the entire project. No acreage was reported in the 1860's as completed, since the only contract issued was for the State Line Survey, covering 20 miles of the Soda Mountain unit (southern boundary).

Table 3. GLO SURVEY PROGRESS BASED ON ACREAGE COMPLETED

185O'S	1860'S	1870'S	1880'S	1890'S	1900'S	1910'S
77.5% (1854-9)	0	3.6%	5.2%	5.7%	2.6 %	5.4%
35.5% (1854-5)						

Unfortunately, the time period for nearly a quarter of the dataset extended well beyond the initial settlement period during which we had hoped to document historic vegetation. It is not known if any of these scattered, remote or less accessible pieces had recent disturbance (i.e. fire, logging) related to early settlement activities, by the time they were actually surveyed. Regardless of GLO contract date, all surveys were transcribed, merged into the same dataset, and included for historic vegetation map preparation. But because later surveys were always in remote, or difficult areas to utilize or develop, there is less likelihood of major land treatment impacts and changes that could greatly alter the character of the landscape from that of a presettlement setting.

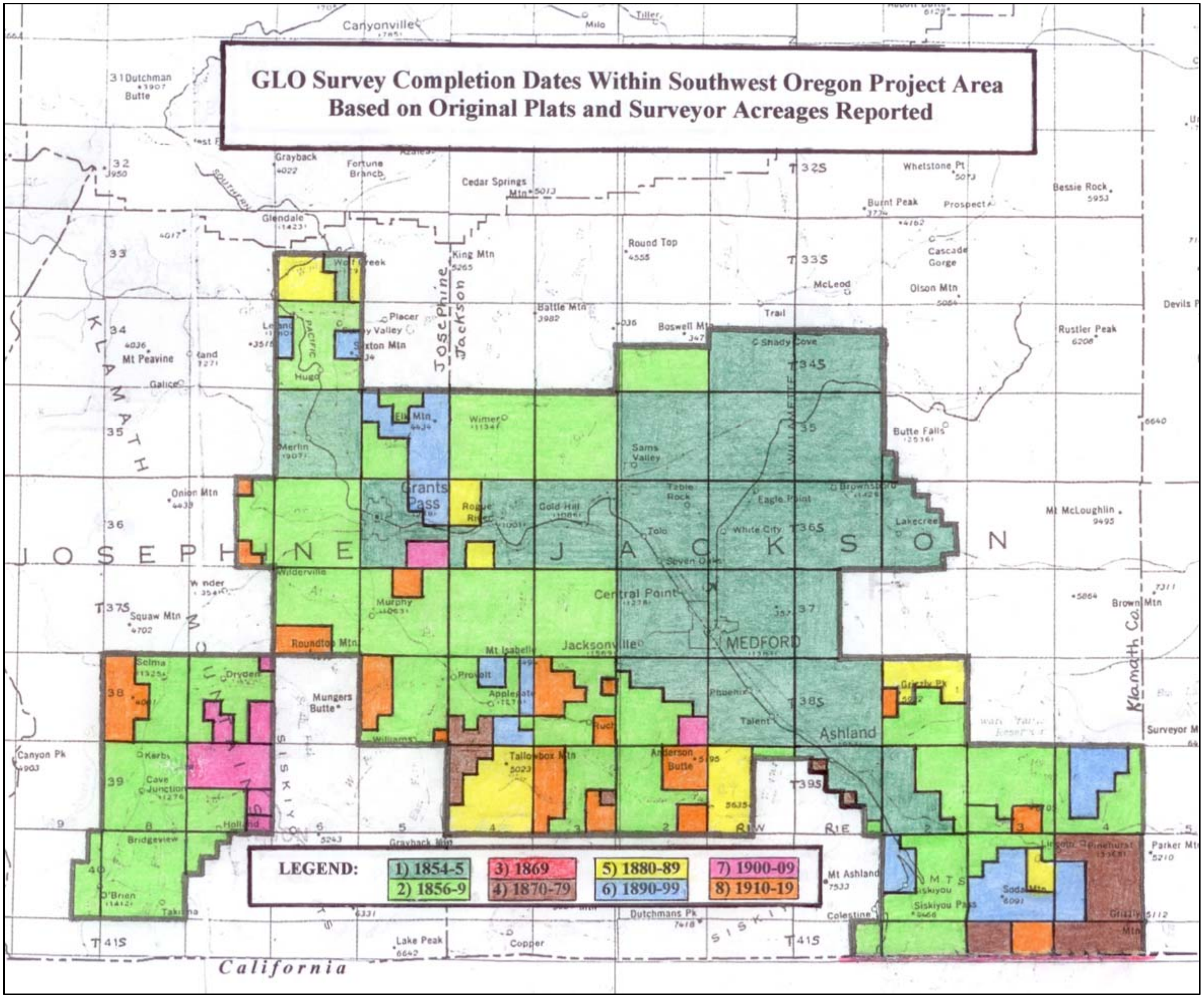

Figure 12. GLO survey progress in the combined project area, shown by decade, and based on original GLO plat acreage.

Soil Classes and Soil Features Reported by GLO Surveyors

GLO records were no doubt the first soil assessment and survey of the nation. All townships in the project area, regardless of surveyor, contained comments about the geology, topography, surface rocks and/or soil types encountered. Terminology was sometimes technical but normally very general descriptive terms. This information cannot be queried in the data base but can be read in the line descriptions provided throughout the transcribed datasets.

Both township and section line descriptions refer to soil classes designated as 1st rate, 2nd rate, 3rd rate or 4th rate. These were used to describe soil suitability for agriculture. No published guidelines or GLO instructions are known to define these classes (Frederick 2007). In this study it was obvious that a 1st rate soil was always applied to outstanding valley prairies and level bottoms with the best soils for crops and gardens. For example, GLO soils data for T37S, R2W, line 14-15 was described as "soil 1st rate, black vegetable loam." The 2nd rate soils were merely the next best of everything else in the valleys. Both 3rd and 4th rate classes were used in the hills and mountains, and some surveyors seemed to use one class almost exclusively over the other. Generally it was hard to see any consistent correlation with the landscape information or logic for the use of these two classes.

GLO soil notes were seldom useful for vegetation classification, but occasionally soil color and texture comments were helpful. Soil surface descriptions, for example, included clay loam, clay, sandy, granite, stony, gravelly and rocky. Sometimes a soil color was also given like "reddish, brick red," or "black garden loam." A very descriptive quote and the most emphatic expression of poor soil quality in the entire study was "surface very rocky, a poor good for nothing soil" reported on serpentine bedrock (T38S, R9W, line 13-18).

Related physiographic data usually provided useful information: Topographic notes included common terms such as steep, rough, surface broken, mountainous, hilly, rolling or land level. Geology and common rock types were sometimes given such as sand rock, scoriaceous rocks, serpentine stone, trap rocks (basalt), "trapean hills" and granite. Soil and rock type were sometimes combined in their descriptions such as "decomposed slate and redshot clay, 3rd rate" and "shaly clay loam."

GLO topographic boundaries between the valley floor and uplands are soil related, along with slope aspect, ridgetops and drainages. These were important at times for mapping decisions. Equally important was the availability of modern USDA soil maps for the project area. These were used extensively by the authors, along with topographic maps, to relate GLO data to landscape features as part of the vegetation mapping process.

Cultural Resource Information Transcribed from GLO Diaries

Cultural features, development activities and other settlement information were often reported by the surveyors, which was transcribed and documented in both the Township Tables and Line Tables. Cultural features were not transferred to a data layer as a map product for the study. However, the Line Table can be queried for cultural information recorded on the line survey, such as man-made features with an entry and exit point (i.e. a field crossed by the survey), and man-made features representing point data (i.e. trail, fence or point of reference to a nearby cabin or barn). Also, these features were usually drawn on the plats that were prepared from survey notes after the field work. General comments about the extent of settlement, descriptions of mining activities, surveyor opinions as to the worth of the land for development, and the economic value of settler investments in existing improvements are examples of information available by reading General Descriptions in the Township Table, and the set of line descriptions for each Line Table.

A variety of features were recorded in this study as settlement was rapidly taking place throughout the early years of the GLO survey. Indian trails were noted which frequently became early travel routes for settlers; also “wood” roads, local “wagon” roads, regional “stage” routes were also noted. Settler houses (often with the owner’s name), barns, fields, fences and settlements such as Waldo (Fig. 11), were identified when they were intercepted or observed along the line. An interesting reference to “extensive gold diggins” and “a small mining town of log houses” called “One Horse Town,” was made just west of Jacksonville, on Jackson Creek. Local cultural features were documented as the line survey extended south through this settlement (T37S, R 3W, 31-36).

Except for trapping, mining was the earliest industry in the area, and this was faithfully documented on all the surveys, especially along creeks that were heavily impacted by placer and hydraulic mining. Ditches or traces were noted for transporting water, not just to mining operations, but for irrigation and operating grist or flouring mills. These were noted in several locations such as the growing communities of Ashland and Eagle Point. Settlements were crude developments or shanty towns at the beginning. Accommodations for early emigrants were limited to camping in tents and covered wagons or in log cabins until sawmills were established (Atwood 2008, pp. 121, 173).

A look at the early survey plats showing the central valleys being developed and reveals the large number of claims already converted to agricultural fields. Prairie was frequently sought after by settlers for a variety of reasons. Homesteads were usually located to include prairie for livestock pasture and/or for developing farmland. No clearing was required prior to farming. Although there is no pre-settlement vegetation to document the original cover of converted fields, we believe that most of the earliest fields were originally prairie or possibly oak savanna types for two reasons. First, these locations usually had good soil, and were the easiest and quickest to prepare for cultivation when farming was in its infancy and food was in demand by the growing population. Second, many of these fields still had remnants of native cover adjacent to the fields, which aided in assigning pre-settlement cover classes for the field areas. It is evident that in later development periods, some of the more open mixed hardwood and logged over conifer woodlands were being cleared for farming.

Vegetation Products and Discussion

Native Plant Check List

Vegetation notes were a mandatory component of GLO surveys. A standard format for recording plant information helped keep the field records uniform, especially when many different surveyors were doing field work. However, we have reported earlier (Results: Quality of the Historic Record), how the plant records of some surveyors were extremely brief. For example, a section line description about 3 miles S.W. of Sunny Valley (T34S, R6W, line 20-21) reads “dense fir with all kinds of undergrowth,” giving only the overstory but no names for the many understory species present. Frequently, only general terms were used for vegetation such as “brush,” “grass” or “chaparral,” and it was common for some surveyors to greatly shorten the amount of plant data by ending their list with: “and etc.” or “and etc, etc, etc.” Occasionally, they would finish a line with the comment “same as last mile,” to avoid having to repeat a list of species. Furthermore, forbs and grass types were rarely mentioned so that representation of herbaceous species is poor or completely absent.

Deputy surveyors had three obvious problems in describing landscapes and recording plant data. At the beginning of GLO work in Oregon, the surveyors were new arrivals from the East and unfamiliar with the local Western flora. Second, early surveyors were usually engineers or land surveyors who probably had no training in botany, soils or geology. Third, the shrubs or trees that they were familiar with in the East, sometimes resembled Western species which resulted in naming errors. The inevitable use of incorrect names from other regions, plus the use of archaic vegetation jargon from 150 years ago has made it challenging to interpret all of the plant data and identify the correct modern plant names for some GLO species.

The native plants list generated from the GLO data for this project area of well over a million acres is extremely short compared to what would be identified in a modern landscape inventory. The original OSU project covering about 418,500 acres produced a list of only about 33-35 plant names. The BLM project of roughly 720,700 acres added about 80 more names, for a total of nearly 115 different plant species or general plant types. Line Tables can be queried for all plant names intercepted on the line survey and those recorded in the line descriptions (Christy et al. 2002). The complete plant checklist for the project is found below (Table 4).

Table 4. Native Plant List and Name Variations Used in SW Oregon GLO Surveys (Jackson & Josephine Counties)

TREES

- alder
- ash
- balm, balm gilead, balm of gilead
- balsam
- black oak
- bull pine
- bur oak
- cedar, ceder
- chinquapin, chincapin, chinkapin, chinkopin, chincopin
- chitamwood, chitam wood, shittim
- cottonwood
- crab apple
- dogwood
- eucallypcus, eucalyptus
- fir
- hawthorn, thorn, haw
- hemlock
- jack oak
- juniper
- laurel, laurrel, laurell
- live oak, live-oak, liveoak
- madrone, madrona, matherone
- maple
- mrytle, myrtle
- oak
- pine
- poplar
- quaking aspen
- red cedar
- red fir
- redwood
- scrub oak, schrub oak, shrub oak, small oak
- scrub pine
- shore pine
- soft maple
- spruce
- sugar pine
- sweet oak
- tamarack
- tan oak
- timber
- white fir
- white oak
- white pine
- willow
- yellow pine
- yew, Pacific yew

SHRUBS

- annis, anis (see laurel-annis)
- aroma balm
- arrowwood, arrow-wood Indian arrowwood, arrowood
- balm (shrub form)
- bearberry, bear berry
- bear brush
- briars
- brush
- buckbrush, buck brush, buck bush
- buckhorn, buck-horn
- bugwood
- ceanothus
- chaparral, chapparral, chaparrel, chaparal, shaprell, shaperal
- cherry, wild cherry
- chimesal, chemesel
- chincapin, chinquapin, chinkapin, chicapin, chincopin, chinkopin
- chokecherry
- currant
- elder
- elkbrush, elk-brush
- gooseberry, gosse berry, goosebury
- grape, wild grape, grape vine
- greasewood, greecewood
- hazle, hazel
- heath
- honey suckley, honey suckle
- huckleberry
- laurel, laurrel, laurle, lauarel
- laurel-annis, laurral-annis, laural annis
- lilac, wild lilac, lilack, lilach
- manzanita, mancenita, mancinita, manzinita, mansanita
- mountain balm
- mountain mahogany, mahogany
- mountain maple
- mountain oak
- mulbery
- ninebark
- Oregongrape
- Oregon redroot
- plum, plumb, wild plum
- poisonoak, poison oak
- red whortleberry, red whortleberry bush
- rhododendron
- rose
- sagebrush, sage
- salal, sallal
- salmon berry
- serviceberry, service, sarvice
- shoe-make, shoemake
- skunkwood
- snowbrush, snow brush
- spice
- tasslewood, tasselwood
- thimbleberry
- vine maple, vine-maple
- vines
- whortle, whorttle, whortleberry
- willow (shrub form)

OTHER

- bunchgrass, bunch grass
- elk brake
- fern
- grass
- nettles
- pea vine
- weeds
- wild clover, clover

Common Name Cross Reference to Scientific Names

Because of the questionable identities of archaic plant names, a crosswalk of modern names and scientific names was developed for use with our legends and map products (see Appendix, Section IV and Table 4, above). The GLO transcriptions prepared for this study (Access Database) generally maintain the original plant names and the original spelling, at least in the section line descriptions, intercept field and general township descriptions. To improve plant query results, an attempt was made to standardize name variations in the plant "species" field of the Line Table, but these were not always consistent.

Extensive local experience in vegetation mapping and classifying landscapes throughout the study area enabled us to correlate most of the historic plant names to local species or the most likely species. Many local or regional references such as those that follow, were used to search for some unfamiliar archaic plant names, often with only limited success (Atwood 1995, p.149 -150; Hickman and Johnson 1992; Sweetser and Kent 1908; Yocum and Brown 1971). However, the primary plant taxonomy sources used here for scientific names are given at the end of Appendix IV in a reference list. Some name choices could not be finalized until the geographical location of questionable species was determined (climate, elevation soil, etc.) within our project area, to assure compatibility with the environmental setting. At times, the actual surveyor reporting the data had to be determined, or even the decade of the survey. Different surveyors often reported data using different terminology. And in more recent surveys, common names in use were sometimes different than names used for the same species in the earliest surveys transcribed for this study.

A number of unknown common names, or names most likely borrowed from other regions, were difficult to associate with a local species. For example, "Oregon redroot" used here by GLO was unknown locally. A plant manual that referenced "redroot" (*Ceanothus americanus*) in another region, was a clue that one of our *Ceanothus* species was associated, by surveyors, with this common name, and has been confirmed in other taxonomic references as well (Forest Service, 1937, p. B39). A plant name correlation list for GLO work in northwest Oregon was reviewed, but it did not include many of the unusual names encountered in this very different region of Oregon (Christy and Alverson 2011). Consequently, our species list was distributed to several botanists and others, to help identify candidate species for those without an identity. Significant suggestions and background on possible plant choices from a variety of sources were contributed by those individuals (see contributors list in the Acknowledgements). This was invaluable for resolving some name questions, which greatly improved the plant name correlation table. Our complete list of common names, cross referenced to scientific names (Appendix, Section IV) is based on traditional taxonomic references and has not been revised to conform with the USDA PLANTS data base.

Vegetation Classes: Descriptions, Mapping, and Discussion

All historic vegetation types described for the study were grouped into broad vegetation classes, based on stand density and structure. Vegetation classes were mapped (Figure 13, p. 48) and class acreage is given below in Table 5. The number of "vegetation types" or subclasses described for each class is also shown, and these subclasses are discussed later in section: Vegetation Subclasses (Appendix V, p. 111). GIS datasets and historic vegetation maps for the project area can be downloaded from: http://www.pdx.edu/pnwlamp/glo-historical-mapping-oregon.

Table 5. Vegetation Class Acreage and Number of Subclasses

Upland Forest	-	22 subclasses	(524,850 acres)	46.1%
Woodland	-	26 subclasses	(438,099 acres)	38.5%
Prairie	-	14 subclasses	(125,177 acres)	11.0%
Riparian Forest	-	5 subclasses	(15,749 acres)	1.4%
Savanna	-	5 subclasses	(23,368 acres)	2.0%
Shrubland	-	17 subclasses	(8,893 acres)	0.8%
		(vegetation subclasses = 89)		
Other (water, gravel, unk.)	-	4 subclasses	(3,078 acres)	0.3%
Total	=	93 subclasses	1,139,214 acres	100%

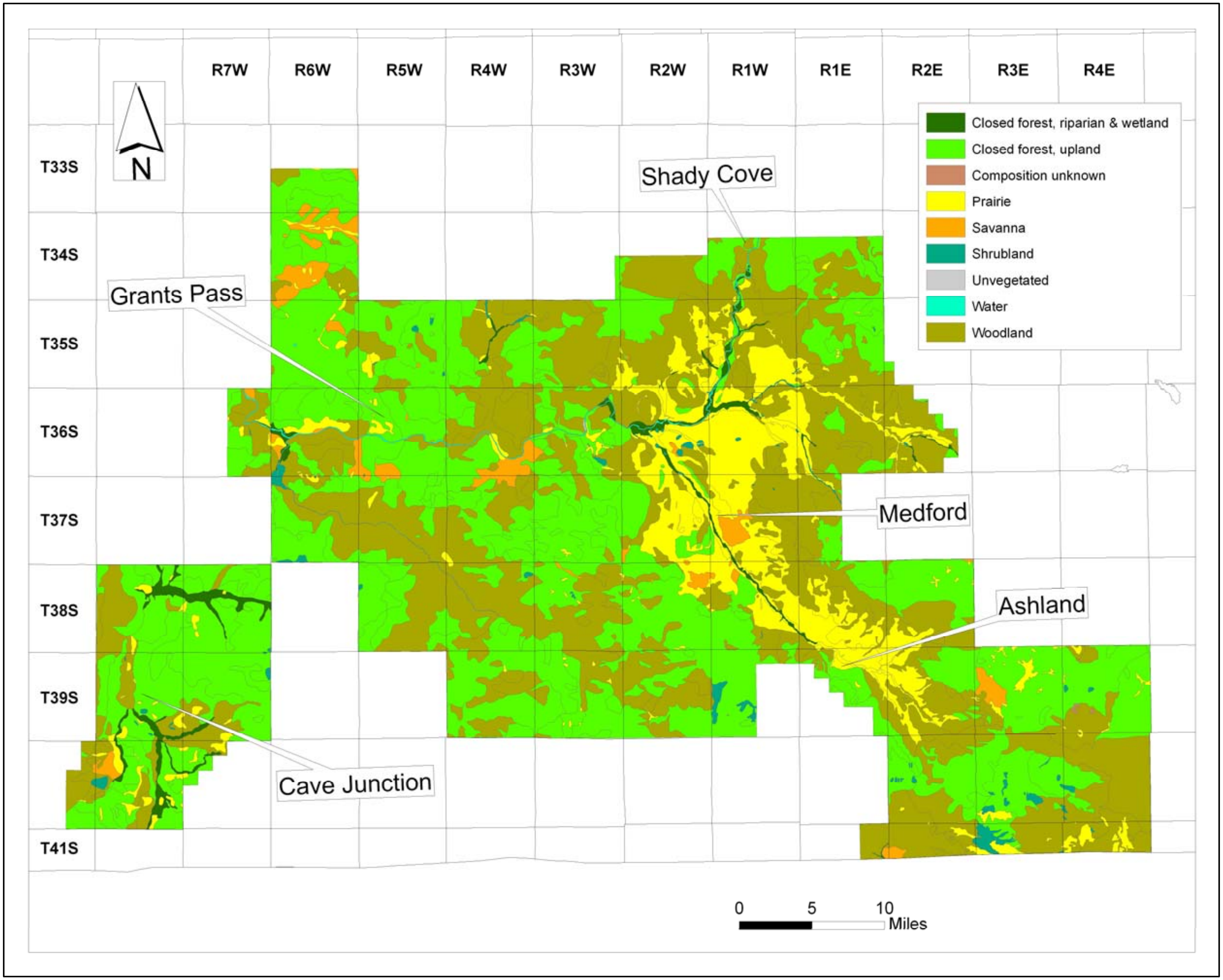

Figure 13. Historical vegetation classes of combined GLO project area in SW Oregon, based primarily on surveys of 1854-1860.

Prairie: Prairie comprised 125,177 acres or about 11.0% of the study area (see map, Fig. 13) and contained 14 subclasses. Because prairie types were noted by surveyors without naming herbaceous species, we have described them without plant composition data, being defined by the absence of most woody species, and by a few GLO descriptors (see Vegetation Classes - Descriptions: Prairie, p. 35). With the absence of herbaceous plant data, our prairie classification mostly relied on landscape position and soils (wetness), relatively stable physiographic features that would have existed historically. Three categories were recognized to further refine the very limited information about prairies in the dataset. Acreages for the prairie map units are shown in Table 6 (pp. 67-68).

Prairies that occurred on Xeric Upland Soils were associated with droughty upland soils, hot southerly slopes, or shallow serpentine sites (chemically impacted soils). This group included three subclasses and comprised **15.6%** of the map area within the Prairie Vegetation Class. Map units include: PU, PUD, PUS.

Prairies that occurred on Non-wetland Valley Soils included six subclasses and covered about **71.2%** of the Prairie Vegetation Class. Dry upland prairie (above) was separated from dry prairie on the valley terraces, toe slopes and plains because of the inferred differences in plant species composition and production between these environments. Map units include: P, PA, PABS, PAD, PBS, PBSK.

Finally, prairies that occurred on Seasonally Wet Soils found scattered throughout the project were sometimes identified as “creek prairie” or “glades”. These sites occurred on basins, swales, low terraces, springy slopes and bottoms with high watertables or floodplains, covering about **13.2%** of the Prairie Vegetation Class. Five subclasses were recognized within this group. Map units include: PASH, PB, PF, PFAT, PFD.

Discussion

Numerous brief historical accounts were recorded by early visitors and settlers in Bear Creek valley of the impressive and abundant of grass here. Some writers recalled the tall grass or grass reaching to the waist or higher, and members of the 1846 Applegate party travelling up the Bear Creek Valley floor reported “All day long we traveled over rich, black soil covered with rank grass, clover and peavine” (Atwood 1995, p. 34; Emmerson 1996, p.25). And this newspaper account was reported later about C. L. Frisby of Yreka, California, who said “I was thirty years old (1881) when Medford was waving grass, hiding the herding animals of the Rogue valley plains from the view of the settlers in their white covered wagons” (The Medford Sun, June 15,1911).

Dry Upland Prairie was also common as small scattered islands of grassland in the Siskiyou Mountains or Applegate watershed and adjacent mountains to the north. Many steep shallow, loamy slopes of upper elevation ridges were bunchgrass prairie, surrounded by forest, although most were not identified by surveyors. Larger areas of steep upland prairie occurred in the central Bear Creek Valley. On the east side of the Valley, part of the western Cascades, most of the high open ridges, clayey benches and steep south slopes between Medford and the Green Springs Highway were mapped as xeric upland prairie interspersed with patches of oak forest or woodland. These early prairie landscapes are illustrated with a historic photo NE of Ashland showing a range livestock operation on a foothill prairie-mixed oak forest complex (Fig. 14). Much of this droughty upland prairie is situated in the driest part of the Bear Creek Valley, and is well adapted to the long hot dry summers in this Mediterranean climate.

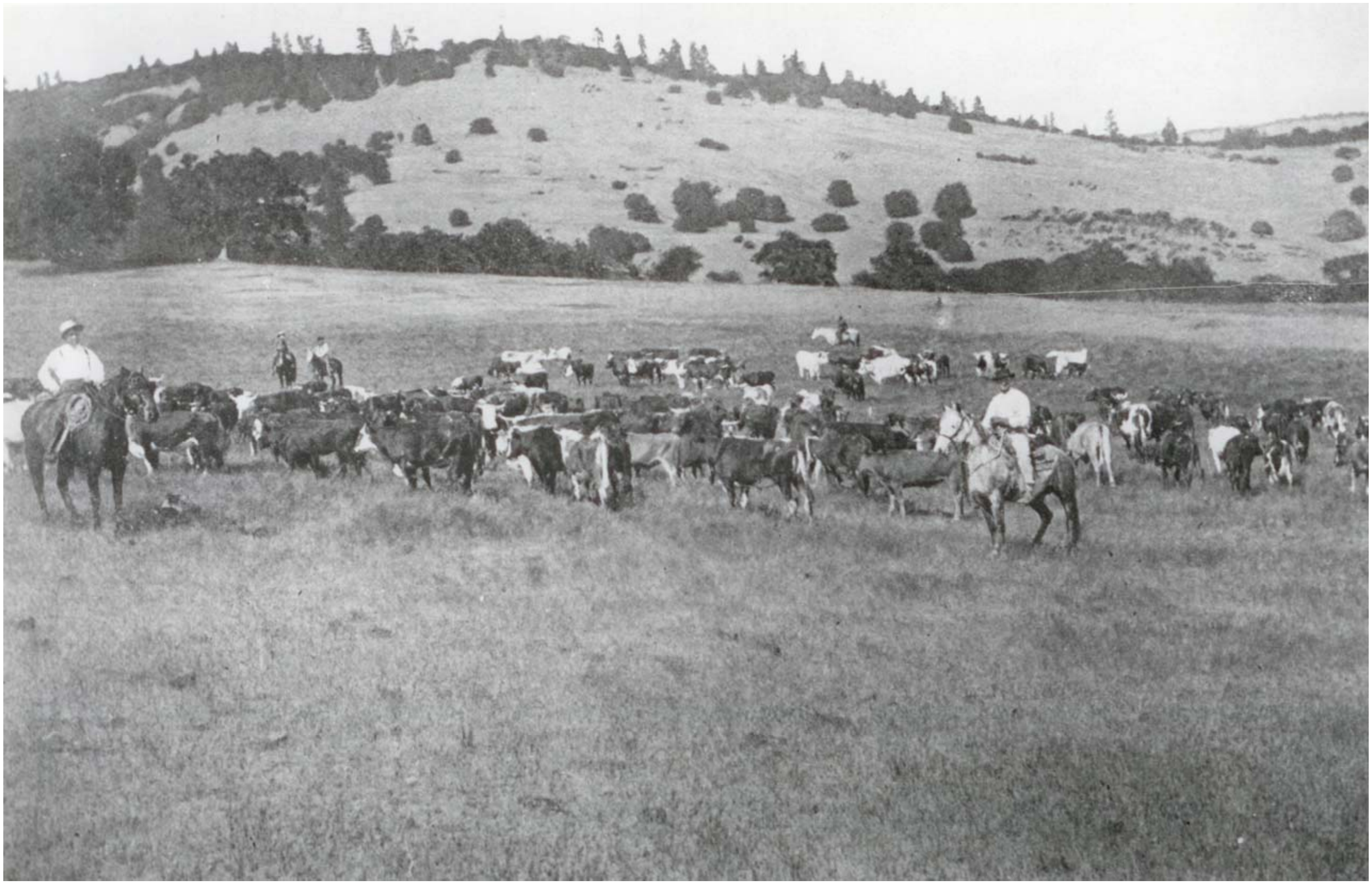

Figure 14. Livestock operation on upland prairie of Owens Ranch and foothills of the Bear Creek valley, ca. 1909. The view shows dry upland prairie on a large clayey bench and slope, with adjacent areas of mixed oak forest and savanna. Pine is visible on the horizon. The location is probably east of Bear Creek, NE or E of Ashland, in hills near the Dead Indian Highway. (Source: Ashland Commercial Club booklet, 1909, courtesy Southern Oregon University).

Valley floor prairie (non-wetland) covered considerable acreage in all the major drainage basins, but was most extensively in the dry Bear Creek Valley. Heavy clay soils on low foothills, toe slopes and plains were reported as prairie, interspersed with islands of oak woodland. Here large areas of recent basalts on the east side of Bear Creek of the Western Cascades have weathered into large areas of deep clayey vertisol soils that swell, shrink, and crack as they moisten and dry out seasonally. Soil features favor prairie on these dense clays when in droughty positions, and may actually restrict the development of oak savanna or woodland.

One unique type of historic valley prairie, although not normally distinguished from other prairie in GLO notes, was found on what is now called the Agate Desert viewed below in Fig. 15. This is a large gravel alluvial plain just north of what is now Medford, described as follows in an early brochure. "Near the center of the valley is a tract about six miles square called "The Desert." It is composed of a gravelly loam, with quantities of a small rock in the bottoms. It is covered with grass in the early spring, but otherwise is destitute of vegetation" (Anonymous 1885). Here, <u>mounded prairie</u> was mapped on a network of mini-mounds interspersed with narrow scabland (swales) that covered several thousand acres. Low mounds of soil are separated by scabland which acts as either drains or vernal pools, ponded during the spring runoff. Mounded prairie rests on a compacted gravel hardpan which creates a perched water table and warrants separation from other historic prairie types, even without GLO data to describe its vegetative composition. Sometimes surveyors did note a few scattered white oak trees on this prairie, and clumps or patches of chaparral. In a region like western Oregon where environmental conditions so strongly favor trees, it is unusual to find large areas of prairie without an incidental tree or clumps of trees.

A similar land surface consisting of patterned ground (mounds and scabland), but with different soils, is found on the basalt cap of the Table Rocks adjacent to Sams Valley (Johnson 1993). Mounded prairie was also mapped on these mesas that are underlain by volcanic rock, not with a compacted gravel hardpan as on the valley floor. Although the intermounds on this landscape are littered with basalt stones, not small alluvial gravel, the possibility of ecological differences between the mesas and valley floor did not warrant their separation due to the very general nature of the GLO dataset. The Nature Conservancy has done extensive inventories of both of these mounded prairie landscapes in recent decades (Borgias 2004).

Wet prairie types were often identified by GLO surveyors as "creek prairie, marshy swale, glades, springy swale," etc. This group of prairie types was mapped in small wet swales, drainages and low swampy ground of uplands and all the large valleys (Fig. 16). Modern soil surveys were examined (Johnson 1993) that correlate these with wetland, floodplains, or seasonal groundwater influenced sites. For this project, we separated wet soil map units from dry prairie soils in the valleys, because of the probability of large differences in plant species and production between these environments.

In a region where the ecological pressure is so great for open landscapes to shift toward woody vegetation, some explanation is needed as to why these areas have persisted as open grassland. Several environmental factors may be responsible for the maintenance of prairie at some locations, such as a dry climate, shallow soils, dense clayey soils, wet soils, and/or serpentine geology influence. In some cases, periodic burning by native Americans may have been responsible, particularly in food gathering areas and at the margin of natural prairies where the ecotone could fluctuate with the burning cycles. In the Pacific Northwest, it has been established from early settler and explorer accounts that there was frequent low intensity burning on most prairie and oak woodlands (Agee 1993, pp 354-355). Certainly, the treeless portion of the mounded prairie type (Agate-Winlow soils) on the Agate Desert north of Medford is considered here, since there are sizable oak-pine woodland remnants nearby on the same soil map unit (Johnson 1993).

Figure 15. View SE from LowerTable Rock over "The Desert" prairie and shrublands (White City area north of Medford), date unknown but probably before 1900. (Source: Southern Oregon Historical Society #11516)

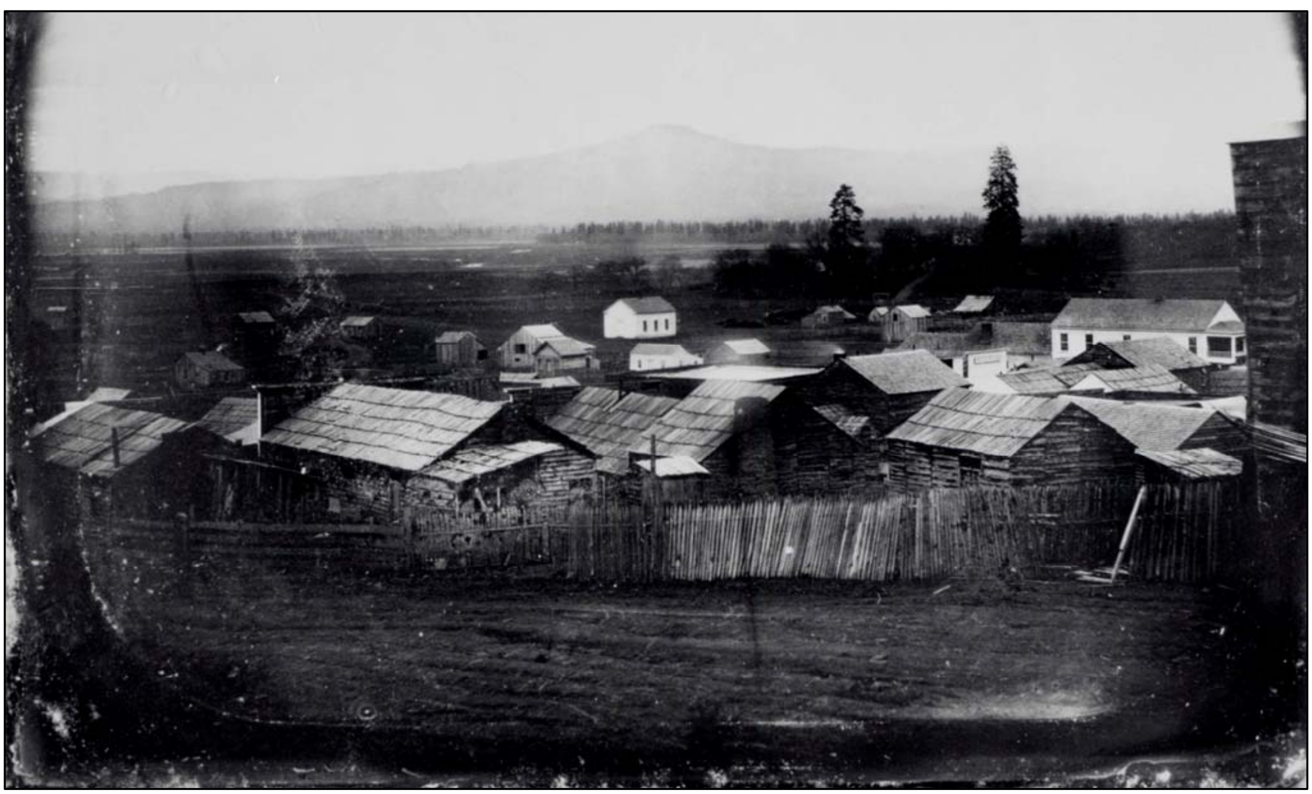

Figure 16. View ENE from Jacksonville (Britt house) toward Roxy Ann Peak, ca. 1854. Visible are valley prairie types and on the distant right is a Pine Bottomland Forest. (Source: Southern Oregon Historical Society #727)

Shrubland: Shrubland was a minor vegetation class that was not well documented. It comprised only 8,893 acres or about 0.8% of the study area (see map, Fig. 13). In southwest Oregon, GLO surveyors recorded a variety of thickets, brush fields, creek brush, brushy bottoms, chaparral, stands of thick scrub tree cover, and dense woody undergrowth. This assortment of ecologically diverse shrub communities was distributed at mostly small scattered locations that are correlated with specific climatic zones as indicated below. "Dense undergrowth" was a common GLO term for woody or shrubby ground cover and thickets. However, it is often associated with forest and woodland canopies, and if so was not reported in the shrubland class dataset.

Shrub stands were classified into 15 vegetation subclasses, not counting one map unit (HU) where the data was inadequate to classify the stands (see descriptions in Appendix, Section V). A map displaying only historic GLO shrublands is displayed in Figure 16 following this section, and acreages for the map units are shown in Table 6 (pp. 67-68).

Four of these subclasses were <u>riparian or wetland types with seasonal watertables</u>. These occurred at swales, basins and creek or river terraces and are specific to certain climatic zones. They consist of the following: (1) <u>low elevation</u> willow, briars and other shrub species, sometimes with scattered hardwood trees such as ash, white alder and/or cottonwood, and (2) <u>mid/upper elevation</u> willow swamp, sometimes with quaking aspen. Map units for the wetland subclasses include: HUR, HW, HWA.

Six subclasses represented brush fields on well drained soils of warm or hot climatic zones. These <u>low to middle elevation sites in the Rogue watershed</u> were: (1) chaparral thickets of "greasewood" (common buckbrush), or greasewood and manzanita thickets, sometimes with wild plum, poisonoak and scattered oak, (2) whiteleaf manzanita dominated thickets, sometimes with yellow pine (ponderosa) and oak, and (3) dense mountain mahogany brush, or mahogany-plum brush, often mixed with white oak. Chaparral species such as manzanita, serviceberry and possibly "greasewood" and other incidental trees may have been present. Map units for this set of subclasses include: HA, HCH, HMO, HN, HNM.

Five subclasses are found in <u>warm or cool positions at mid/upper elevations in the southern Cascade Mountains</u>. All occurred on well drained soils and consisted of: (1) dense mahogany brush or plum-mahogany thickets that may have included white oak and other species such as serviceberry; also included were dense or heavy chaparral brushfields with species unspecified but assumed to be similar to that above, (2) brushfields and thickets of cold tolerant species such as cherry, balm (snowbrush), greenleaf manzanita, sometimes including serviceberry, mahogany, plum, scrub oak, and at times minor occurrences of conifers, and (3) a mostly deciduous and warmer shrub type of oak brush or dense scrub oak, sometimes with juniper and serviceberry, and assumed to include plum, lilac, mahogany and/or common buckbrush in places. Map units for this set of subclasses include: HCHO, HED, HMO, HSC, HSO.

Two subclasses were associated with <u>cool or cold climates at middle or high elevations</u>. These were found on well drained soils and were primarily evergreen shrub communities that we believe were seral stages following old burns. (1) In the high Cascades or southeast portion of the project, ceanothus brush fields were described as dense balm or lilac brush. Additional species were generally not listed, but it is assumed that these may have also contained greenleaf manzanita and possibly shrub chinkapin. (2) In the cool middle and upper elevations of the Siskiyous, chaparral thickets of manzanita (assume greenleaf manzanita.) and other shrubs are found on ridgetops and southerly slopes. Other brush species sometimes listed were chinquapin, laurel, buckhorn, sweet oak, live oak, and hazel. A scattering of trees were occasionally present such as yellow pine, white pine (GLO accuracy of species identification is unknown), maple, madrone and fir (assume either red fir or white fir). Map units for these subclasses include: HE, HHCH.

Discussion

"Chaparral is a drought tolerant plant community dominated by sclerophyllous (hard-leaved), woody shrubs and shaped by a Mediterranean- type climate (summer drought and mild, wet winters) and naturally recurring wildfires. Chaparral dominates many foothills and mountain slopes from the Rogue River Valley in southwestern Oregon, down through California to patches in Baja California's Sierra San Pedro Martir" (Halsey 2007).

"The chaparral of southwestern Oregon, like that of northern California, apparently may be either climax or subclimax" (Detling 1961). The GLO shrub communities identified in this project, although poorly documented and not always distinct or well correlated with environment, appear to represent examples of each situation.

Most southwest Oregon shrub communities are temporary cover types created after stand replacement fires. Many of these sites, especially those in more moist environments, are seral stages of woodland or forest, expected to recover over time and convert to a characteristic tree cover type. However, some shrublands, especially in hot droughty environments, may become locked in a transitional state, remaining for an extended period as chaparral that differs from the former cover or site potential. Also, there are apparently certain long-lived chaparral types that are more stable landscape features, self–perpetuating at the present. The role of fire in the development and maintenance of these shrublands is discussed with more detail in the section titled "Fire Disturbance and Historic Burn Mapping" (p. 76).

Chaparral is a historic name (Fried 2004, p. 5) that primarily refers to greasewood (*Ceanothus cuneatus*) in SW Oregon GLO surveys. We have concluded that chaparral also referred to manzanita along with the associated species such as plum, poisonoak, deerbrush, serviceberry and mountain mahogany, common to these environments in many places, primarily the warm dry climatic zones of the study area. In the cool moist forest zones, chaparral was a less used name than "brush, thickets or dense undergrowth" that commonly included species such as manzanita, deerbrush, oceanspray, plum, cherry, chinkapin and balm. Balm is probably equivalent to "laurel or mtn. balm, and even "lilac" as used by GLO in some high cold east side locations).

The small acreage of shrubland reported for the project is surprising, given the environmental patterns and disturbance history for Southwest Oregon. However, a number of factors related to the nature of this study probably were responsible for results that failed to report more realistic acreages for shrubland. Many occurrences were part of complex landscape vegetation patterns, unmappable as separate components. For example, some "brushy bottoms" were inclusions in larger "creek timber" map units. Chaparral patches on the plains and foothills were often unmappable inclusions in the prairie class, as were small brush thickets within upland forest and woodland polygons.

Shrub cover was likely under-reported by several surveyors who may have ignored smaller areas or did not provide much understory vegetation (shrub) information. Because of the amount of variability in both landscape understory composition and individual surveyor records, shrub data was sometimes unreliable for more accurate classification of stands. And since only section lines were measured and documented, many areas of shrubland were probably missed in the survey because they were located between line surveys. Any significant brush fields completely within the interior of a section would not have been noted on the line description record.

Also, there is imbedded within the transcribed GLO data set, a very large number of tree stands characterized by heavy to dense woody undergrowth of various species. These were not identified here as shrubland because they also had significant tree canopies, unless it was clear that these trees were incidental or minor components. Consequently, even brushy areas, woody thickets and dense undergrowth reported by surveyors that were associated with tree regeneration, may have been classified as forest or woodland vegetation classes.

The lower than expected acreage of shrublands mapped in this study or low proportion of chaparral shrub types reported here, cannot be concluded to indicate a lessening of its importance, or a loss of sustainability of some chaparral types. For example, Keeley reported that “Wildfires in California shrublands pose a significant danger to humans but are usually not a threat to sustainability of this ecosystem. Most of the flora and fauna exhibit extraordinary resilience to fire....None of the species in this fire-prone landscape are adapted to fire *per se*, but rather to a particular fire regime....The primary culprit is high fire frequency” (Keeley 2007).

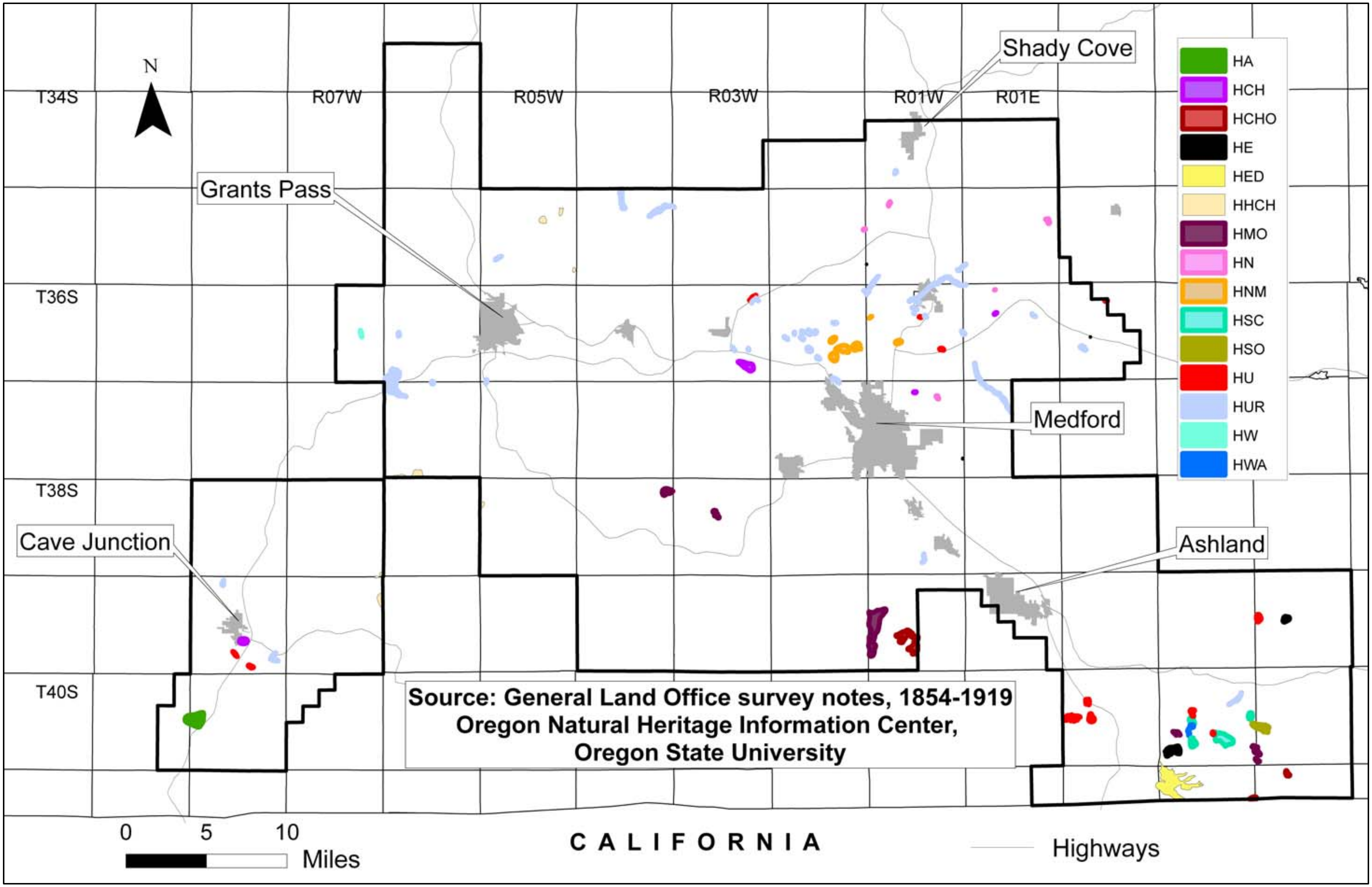

Figure 17. Distribution of historical shrub stands in the combined project area, as interpreted from GLO survey data.

Savanna: Savanna occupied only 23,368 acres or about 2.0% of the study area. Five subclasses were used to classify these very open stands of both hardwood and conifer types, although based on very limited botanical information. The geographical distribution of Savanna vegetation is displayed on the Historical Vegetation Map for GLO classes (Figure 13, p. 48). Descriptions of these communities are available in the Appendix, Section V. Acreages and map unit codes for the subclasses are shown below in Table 6 (p.67-68).

A single and unique savanna type or subclass was identified in each GLO ecological / climatic zone except one (see Table 7, page 75. In the central Bear Creek valley, a white oak savanna type (SWO) was mapped on the valley floor and foothills, while a mixed oak-pine savanna (SPMO) where either oak or pine was dominant, was common in dryer interior valleys to the west. In the moist warm coastal mountain region, Jeffrey pine savanna (SSRR), was mapped on stony droughty serpentine soils. Also, two cool, very open mixed conifer savanna communities with shrubby undergrowth (SPF, SPOC), were described for the mesic forest zone of SE Jackson County that were probably the result of major burning impacts.

Discussion

Some savanna reported here was probably a transitional cover type, maintained, temporarily by fire, as a seral state of woodland or forest. We know **savanna can be created** in these environments as the result of major disturbance patterns over time. Examples may include former burns that have revegetated with some brushy undergrowth and are poorly stocked with scattered tree regeneration or only remnants of a former canopy. Our map unit SPF used near Soda Mountain probably represents this situation in a moist mixed conifer region. **Savanna can also be converted** to prairie as a response to periodic disturbance, or to woodland (or shrubland) in certain environments, as a response to the prolonged absence of disturbance. It is assumed that both the abundance and distribution of savanna would have differed from that reported here, if it were not for periodic burning by the Indians.

Soil features may limit the potential to support more dense tree cover than savanna. Droughty, shallow, loamy soils and dense vertisol clay soils, primarily in the low dry interior valleys such as the Bear Creek Valley, supported areas of open white oak grassland (savanna). Soil chemistry can also favor low tree density and limit site productivity. Very open stands of pine are a classic example on shallow, often stony, serpentine soils of Josephine County. Today and historically, these soils supported Jeffrey pine savanna (GLO identified only yellow pine) with scattered or patchy shrub cover and prominent bunchgrass understories.

Savanna acreage reported in the study was much less than expected, and it is unclear why savanna was not more common in this project area at the time of settlement. We assume that some areas mapped as prairie had the potential to become savanna, but had been maintained as prairie by periodic burning. However, the biggest potential for development of savanna, historically, probably existed in the low elevation woodland zone adjacent to valley prairies. This would have required frequent ground fires and occasionally severe burning to suppress hardwood tree density. In a region where the ecological pressure is great for landscapes to develop and maintain woody vegetation, only fewer ground fires or less severe burning could have allowed this to happen. Perhaps periodic burning by native Americans was very light or less frequent, and had less impact in the mixed hardwood-conifer woodland zone than assumed, so that few of these stands were converted to savanna types. We know that these communities also go through a chaparral stage after stand replacement fires. This cover type would need to be suppressed as well by severe burning, to progress to savanna vegetation. Apparently this was not a common pathway for savanna development in southwest Oregon.

It is likely that there was much more savanna present than we have identified from the GLO dataset. Some small acreages were likely ignored by surveyors as they tended to generalize their line data descriptions and record the more common features. Sizable areas of savanna would have been unreported when located within interiors of sections and not intersected by the line survey. Also, other occurrences were probably part of landscape mosaics or vegetation complexes common in the study area, but unmappable and unidentified as a separate savanna type.

Woodland: Woodland, the most widespread vegetation class in the project, occupied 438,099 acres or about 38.5% of the study area and 26 subclasses were described for this study. Topographically, woodland was most common in major valleys, foothills, and lower elevation mountains. Climatically, woodland mainly occurred in the warmer positions, and was seldom encountered in the high cold snow zone. Precipitation ranged from under 20 inches to at least 60 inches for woodland across the project. However, in the Cascades and Eastern Siskiyou Mountains, nearly all woodland was found in the 20-40 inch precipitation zone. In contrast, woodland was a widely distributed vegetation class in the Western Siskiyous (SW corner of project) where precipitation ranges between 40 and 60 over inches annually.

The geographical distribution of Woodland Forest is displayed on the Historical Vegetation Map for GLO classes (Figure 13, p. 48). .Descriptions of woodland types are available in the Appendix, Section V. Acreages and map unit codes for the subclasses are shown in Table 6 (p. 67-68).

Discussion

Classification of stands as woodland, based on tree density standards used elsewhere in Oregon, was sometimes difficult. At times, GLO tree spacing data was quite variable, often straddling the criteria separating forest and woodland, so that it was not a very useful tool to classify vegetation. In such cases, particularly in xeric mixed hardwood/pine mixtures, the woodland class was usually designated over forest. In general, upland hardwood stands with very little Douglasfir fit best in the woodland class, while stands with significant Douglasfir were mostly classified as forest. However, when the "100 links" rule could be used reliably to separate forest from woodland, this standard was generally used along with the descriptive terms given in line descriptions (dense, thick, openings, open, etc.).

Ecologically, woodland composition varied greatly across the project area because woodland was defined here as a structural class, not an ecological grouping. For this reason, there is some similarity in floristics between woodland and forest classes of the **moist climatic region**. In the warm, moist precipitation zone above 35-40 inches, woodlands were strongly conifer (yellow pine and sometimes sugar pine, fir or cedar), either in combination with white oak and black oak, or without hardwood trees. Understories can be sparse or abundant with a wide variety of ecologically diverse species. Much of the variety in species reported was related to soil, geology and topography differences. In the cool moist climates where woodland was only a minor class, hardwood trees diminished with increasing elevation and were absent in the cold snow zone. Conifers were limited to fir (both Douglasfir and white fir), yellow pine and cedar. Hardwood trees occurred only in the cool western portion of the zone at lower elevations where GLO records included black oak, laurel (madrone) and sometimes chinkapin. Undergrowth was often unlisted in GLO woodland data, but thick or dense in others where hazel, live oak, chinkapin and balm were among those listed.

Throughout the moist climatic region at any elevation, and on productive soils without restrictive geologic influence, woodlands are often a seral stage with forest as the potential. Although woodland may have developed after a dense brush/thicket stage of stand regeneration following fire, it was more likely the result of very uneven, mixed severity burning, or repeated burning at short intervals. Also, stands recovering from other spotty disturbances like disease, insect and storm damage sometimes may have been reduced to a woodland structural class. On more restrictive soils influenced by unique geology, some subclasses of historic woodland were naturally more open and will remain over time with lower tree densities.

In the **warm dry climatic region** (under 35 inches precipitation), many combinations of mixed hardwood-mixed conifer woodland were encountered (see Table 7, Zone 2, p. 75). Most common in GLO records, especially at the low elevations and on southerly slopes, were "yellow pine", white and black oak, "redwood" (cedar), "laurel" (madrone), and sometimes fir (Douglasfir). Moist positions in this dry climate were often strongly fir with mixtures of the above species.

Climatic areas with less than about 25 inches of precipitation (Table 7, Zone 1, p. 75) typically supported little or no fir, except in special soil situations which compensate for the dry climate. Here, woodland tree composition was restricted to white oak, and mixed oak-pine, with or without laurel (madrone). One unique white oak woodland community was associated with "bugwood", which we have correlated to birchleaf mountain mahogany. This map unit was typically occurred on northerly hill and ridge slopes with loamy soils that are too droughty for coniferous forest.

An interesting type of pine and mixed oak woodland was found on <u>mounded soil-scabland</u> (patterned ground) southwest of what is now called White City. This historic GLO woodland community occurred adjacent to a large prairie mapped on the same compacted gravel alluvial plain called the Agate Desert (see p. 51). The same set of soils described for scabland and the loamy soil mini-mounds, were mapped by a USDA soil survey team for both the historic woodland community and prairie. Having both prairie and pine-oak woodland types associated with this low, mounded soil plain is hard to explain, unless a catastrophic fire created the large open prairie which had been maintained, subsequently, by centuries of periodic burning. The majority of this soil landscape is prairie but both vegetation types remain, even today, side by side, just north of Medford.

The largest groups of woodland subclasses were associated with the Dry Interior Mountains (Zone 2), and the Klamath River Watershed transition (Zone 3) displayed on the GLO Ecological Zone map (Fig. 25, p. 71). The great ecological diversity here (especially in zone 3), probably relates to the diversity in environmental factors, along with the influence of three major ecological gradients: (1) elevation gradients, (2) east-west regional climatic changes across the southern Cascades, and (3) a drastic north to south topographic/climatic transition within the Cascade Range, all which connect quite different ecological regions (see Environmental Setting: Climate, p. 21). Here, woodland subclasses included hardwoods, mixed conifer, or conifers with black and white oak in various combinations, ranging to yellow pine with oak and sometimes juniper in the warmest locations. Cooler upper elevation conifer sites tended to be shrubby or were undescribed, but the dryer woodland communities were often related to grass or grazing.

Upland Forest: The Upland Forest Class, including the unique subclass Pine Bottomland (see page 63), occupied 524,850 acres or about 46.1% of the study area and is a composite of 25 subclasses. Five of these subclasses were actually burned stands, significantly altered by fire but representing adjacent forest types before burning (see map unit codes with "Bu" added to label). Twentyone subclasses were low or middle elevation, mixed conifer-mixed hardwood types, distinguished by climatic differences, species composition and geographical distribution. Four subclasses were very high elevation snow zone "fir" stands, namely mixtures of white fir and Douglasfir, sometimes with other cold tolerant conifers.

The geographical distribution of Upland Forest is displayed on the Historical Vegetation Map for GLO classes (Figure 13, p. 48). Descriptions of the individual forest communities (types) are available in the Appendix, Section V. Acreages and map unit codes for the subclasses are shown in Table 6 (pp. 67-68).

Discussion

Conifer forest could potentially occupy almost all of the GLO study, if there were favorable, non-restrictive soil conditions throughout the project area. However, when actual soil properties in place are encountered, site potential is often limited to hardwood forest, woodland, prairie and other vegetation. And because of historical disturbance regimes, landscape cover may be further impacted and altered from the true landscape potential. The results for this study indicate there were nearly equal proportions of forest and woodland at the time of the GLO survey, together covering about 80% of the study area.

Classification of stands as forest, based on tree density standards used elsewhere in Oregon, was sometimes difficult. At times, GLO tree spacing data was quite variable, widely straddling the spacing guideline separating forest and woodland, so that it was not a very useful tool to classify vegetation in southwest Oregon. In such cases, the classification as forest was determined by Douglas-fir dominance over pine and/or hardwoods. Douglas-fir stands were usually placed in the forest class, while stands with a dominance of mixed hardwood/pine cover were classified as woodland. However, when the "100 links" rule could be used reliably to clearly separate forest from woodland, this standard was generally used along with the descriptive terms in the line descriptions (dense, thick, open, etc.).

The distribution of most historical forest density vegetation appears to have been related to climate. Forest was found mainly in mountains and valleys with moderate to high precipitation, and on landscape positions with low moisture stress. It was common in high elevations with cool and cold climates, but minor in the large dry hot interior valley surrounding present day Medford. At many locations where mountains approach the outer edges of drier valleys, forest occurred closest to the valley floor on more moist, cool northerly aspects, but not as often on the southerly aspects.

In dryer parts of the region with less than 35 or 40 inches precipitation, several combinations of mixed conifer and mixed hardwood cover were encountered. The most significant map units include fir (Douglasfir), yellow pine, sugar pine, cedar, laurel (madrone), white and black oak, with fir being the most sensitive species in xeric forests. From modern investigations we know that in this dry climatic zone, the status of fir (Douglasfir) is dependent on a number of environmental variables such as elevation, aspect, moisture stress, and local soil features (texture, depth, stoniness, drainage, restricting layer, chemistry). Performance and survival of the species are influenced primarily by these site characteristics.

In addition, dominance between Douglasfir and pine or hardwoods relates to past disturbance history, competition in the stand, and the time elapsed since the last disturbance. It is our judgment that Douglasfir dominant forests in the dry climatic zone, GLO data set, were mid or late seral stands as shown in this early photograph of a logging camp and virgin "fir" forest being harvested late in the GLO survey period (Figure 18). Pine and/or hardwood stands with less Douglasfir presumably were either in early seral status (fire recovery, etc.) or were older stands adapted to droughty positions and soil limiting environments. The latter is illustrated in the early photograph of virgin "yellow pine" in the Ashland City Park, also late in the GLO survey period (Figure 19).

Moist upland forest as illustrated by an old growth stand in western Josephine County (Fig. 20), was mapped primarily on the outer edges of the study area, namely the SW corner (Illinois Valley), the NW corner (Wolf Creek-Elk Mtn.), Grizzly Peak area, Tallowbox Mountain area, and in the SE corner (Soda-Chinkapin Mountains). A number of mesic species were recorded here in GLO notes that normally were absent in other locations. For example, some of the moist site indicators included bigleaf maple, yew, chinkapin, dogwood, hazel, cherry, serviceberry, balm, huckleberry, vine maple, willow, and tanoak. GLO mapping of moist forest types (Fig. 25, Tab. 7) is generally consistent with the climatic and ecological stratification of the study area by Hickman (see Ecological / Climatic Zones map and descriptions (Fig. 6, p. 18-19).

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Figure 18. Virgin fir forest and logging camp in the dry interior valleys, ca. 1902. Logs were being used for the nearby Ament Dam under construction on the Rogue River, just east of Grants Pass. (Source: Josephine County Historical Society, # 89-118-3A)

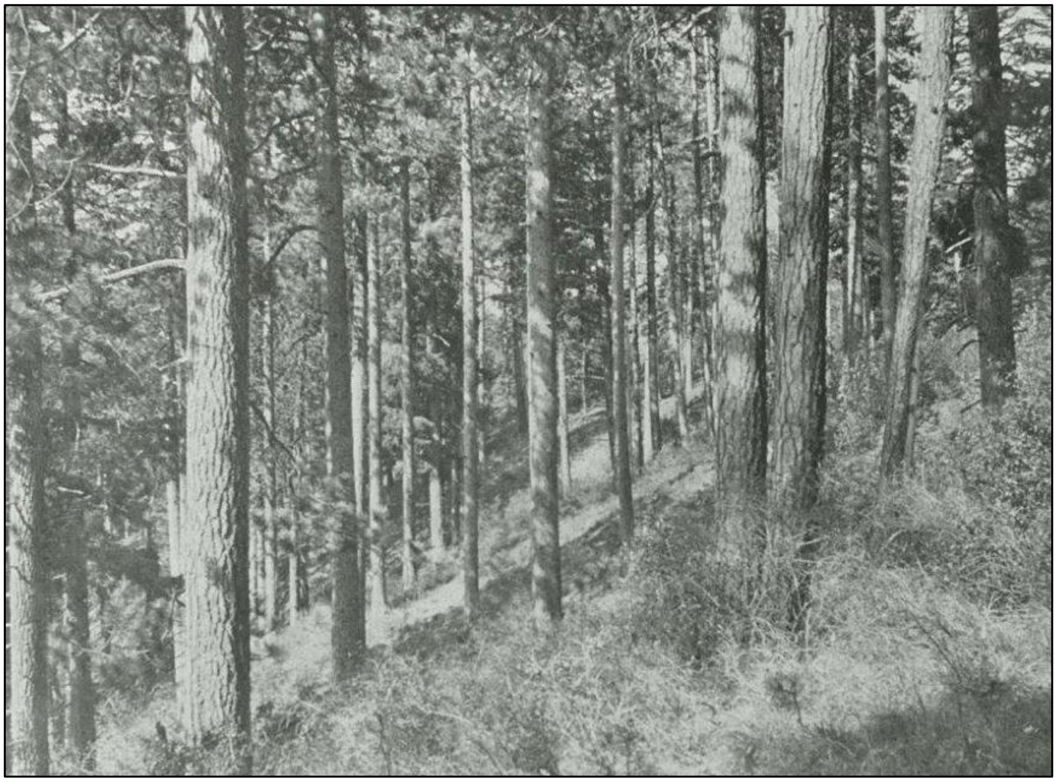

Figure 19. A yellow pine forest at Ashland City Park, late in the GLO survey period, on a droughty slope with granitic soil.. (Source: Ashland Commercial Club booklet, 1909). Courtesy of Southern Oregon University.

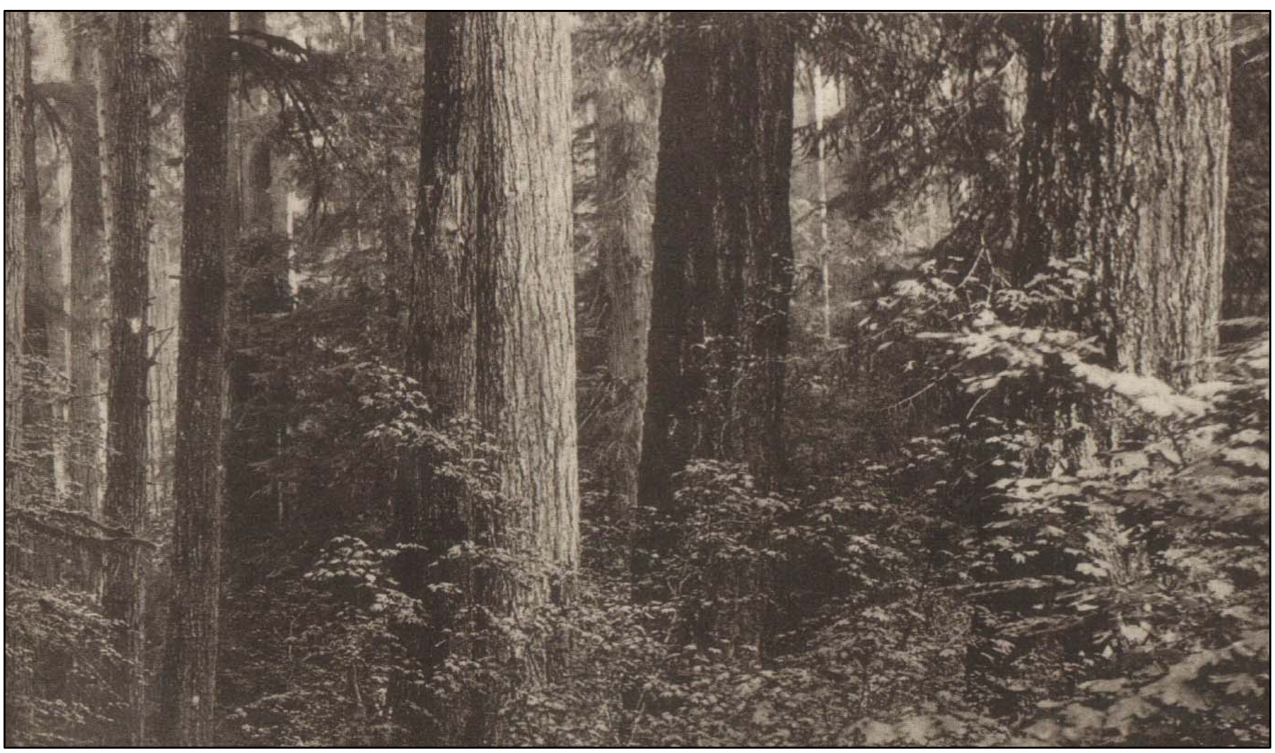

Figure 20. Moist old growth representing Mixed Conifer-Mixed Hardwood Upland Forest, western Josephine County. (Source: Grants Pass Commercial Club booklet, 1909). Courtesy of Southern Oregon University.

Upland Forest (Pine Bottomland subclass): Although it is technically a member of the Upland Forest vegetation class (above), the Pine Bottomland subclass is highlighted here because it is a unique landscape (not clearly upland or riparian) and of special interest in this study. Also, the historical records seem to range from forest to woodland density but did not warrant establishing two classes for the vegetation type. This map unit covered 12,315 acres or about 1.1% of the study area (Table 6, pp. 67-68), and was included earlier within the Upland Forest class, total acreage summary (Table 5, p. 47).

This yellow pine (ponderosa) forest community, sometimes referred to as "pine grove" in GLO records and in early historical documents, is associated with the low precipitation zone of the valley floor in central Jackson County. It occurred on deep, loamy, usually well-drained soils of valley plains, old gently sloping alluvial fans and on high river terraces, possibly with rare but brief periods of flooding. Almost all examples of historic stands were mapped on the western side of the valley, influenced by inputs from the Klamath Mountains geology. Ponderosa pine was a prominent very fast growing dominant with the potential for very large black oak, white oak and "laurel" (madrone), sometimes with minor amounts of cedar (incense) and "thorn" (hawthorn). Understories were poorly described but modern inventories of these stands have found heavy undergrowth of various deciduous shrubs such as common snowberry.

Remnants of some stands still exist throughout the valley such as those in housing developments at Medford and other locations, that contain outstanding examples of the large growth form trees produced on this site (see historic valley photo, Fig. 16, p. 52). Early settlers referred to tree locations by name (i.e. Herber Grove, Forest Grove, Ish Grove), as in this early quote: "Herber Grove……the handsome grove that beautifies our valley between Medford and Jacksonville" ("Pioneer Gone," story in Ashland Tidings, October 24, 1884). And, in the same general area on the west edge of present day Medford, a historic reference was made to either woodland or prairie, or a mixture of both as follows: "The place ….. was bought by Mr. Ish, now deceased. His widow lives there, and the home lot is part of a beautiful, high prairie covered with grand oaks the Druids might have loved." (Fruit Growers," Oregonian newspaper, October 2, 1888, page 6). The Ish place above, is believed to include the original DLC claim of "H. A. Overbeck" purchased by Ish, and the adjacent 1855, DLC claim by Horace Ish, west of Medford, settled about 1852-4 (surveyed in 1855).

Some additional comments are needed regarding this ecosystem today. The exceptional growth rate and large size of trees on this site, as determined from present day examples, is outstanding and certainly the result of inherent soil characteristics. It is probable that site productivity is enhanced in many places by a brief seasonal watertable. Secondly, this type occurs on deep well-drained bottomland and old subtle alluvial fans, plus high terraces of the Rogue River that are floodplains but rarely flood. Differences in stand compositions are expected between these landscape positions and justify two similar but separate mapping units, but GLO notes were not detailed enough to reveal the differences and separate these situations. Finally, ponderosa pine is the primary conifer in these stands, except on valley edges with higher precipitation, or on alluvial fans with more subsurface moisture, where Douglas-fir becomes a component. It is evident today that mesic adjacent valleys with similar non-restrictive valley soils, enable Douglasfir to compete successfully with pine, which is why this historic vegetation type was restricted to the dry interior valley at Medford. The lower precipitation in this valley favors ponderosa pine and restricts Douglas-fir. It is likely that heavy logging of pine along with slash burning on these sites by early settlers, would have left hardwood stand remnants and/or encouraged development of chaparral brushfields.

Riparian Forest: Riparian forest comprised 15,749 acres or about 1. 4% of the study area, and five subclasses were used to classify the forest community types. The geographical distribution of Riparian Forest vegetation is displayed on the Historical Vegetation Map for GLO classes (Fig. 13, p. 48). Acreages and map unit codes for the subclasses are shown in Table 6 (pp. 67-68). This vegetation class was mapped only in the larger valleys and occurs on the floodplain of creeks and river terraces. It was certainly under mapped, as it probably occurred along many smaller streams within the study. Most small stream riparian zone vegetation was not described in GLO survey notes, although the drainages were faithfully located. Some GLO line descriptions did mention certain tree species along the creeks. This information was helpful for map unit descriptions, but the extent of these historical occurrences was unmappable.

Riparian forest included an ash-willow swale, two cottonwood types, and a riparian zone complex of balm (cottonwood) and “creek brush.” However, the best documented and most widely mapped was “Creek Timber” that occurred on floodplains of creek and rivers in the largest interior valleys. It was composed of a mixture of hardwoods, namely, balm (cottonwood), Oregon ash, white oak, black oak, willow; and in some locations“yellow pine, white alder, and possibly others such as choke cherry and bigleaf maple (especially in moist climatic areas to the west). Composition of the stands would have varied greatly from place to place, depending on site conditions, which are quite variable in active floodplains (Fig. 21). Understories were variable and not well documented, but sometimes included wild grape, nettles, briars, hazel and hawthorn. Although not listed in the diaries, this historic 1854 account by Stearns for the Bear Creek Valley cited some additional species. “A few wild plums were to be had along the streams, and elderberries quite plentiful” (Stearns 1987).

Large size specimens of hardwoods can still be found in remnants of this “Creek Timber” community today near the mouth of Butte Creek. We believe that “yellow pine” was often present and scattered throughout many examples of this community type, although often missing from the GLO dataset. Old photos of the Bear Creek valley show that pine was present in many of these streamside riparian forest ecosystems (Fig. 22, Fig. 23). Callahan (2008) reported that Hines walnut, a native riparian tree thought to be restricted to California, occurs at numerous locations in the Bear Creek Valley. It is believed that this species was also here historically and possibly at riparian sites beyond the Bear Creek Valley. This significant hardwood was not documented in GLO data, but was certainly a member of the riparian ecosystem, probably in the “creek timber” subclass, at least in Jackson County.

Many historical accounts of presettlement riparian vegetation were reviewed by Pullen (1995, chapter 6:1-4) for specific interior valleys in southwest Oregon. For example, references by early travelers include: “dense willow thickets” and “swampland” (mouth of Applegate); “woods, clumps of willows, oak trees, brush and timber” (Forest Creek); “crossed a deep ravine that was full of brush” (Applegate valley floor near Ruch); “extensive willow thickets” (Deer Creek in Illinois Valley); “well-wooded with poplar, aspine and willows” (Rogue just below Bear Creek); “woody, oaks and pines of different kinds and a few cedar trees” (Rogue near Grants Pass); “bushy” and “thickets” (Rogue near Gold Hill); “sugar pine along the river” (Grants Pass); “the valley of this stream is thickly covered in pine, cedar and oak” (middle Rogue); “thick brush that fringed the creek” (Bear Creek and/or Wagner Creek); “fringe of willow” and “thick wood filled with underbrush” (Evans Creek); travel “over fallen trees and through the almost impenetrable wildwood tangles along Rogue River” (lower and middle Rogue); and “the poplar and poorer species of elm flourish along streams” (Bear Creek valley). The latter reference to poplar was probably balm or cottonwood, and the reference to elm is a question but was possibly white alder and/or choke cherry. These brief but revealing references to general vegetation types, and specific plant species are provided here for additional incite and documentation beyond that provided by the GLO dataset.

Figure 21. An active floodplain of Gold River (Rogue River), probably before 1900, with a balm (cottonwood) log on the gravel bar and "Creek Timber" vegetation in the background below Lower Table Rock. (Source: Southern Oregon Historical Society, Peter Britt picture # 1255)

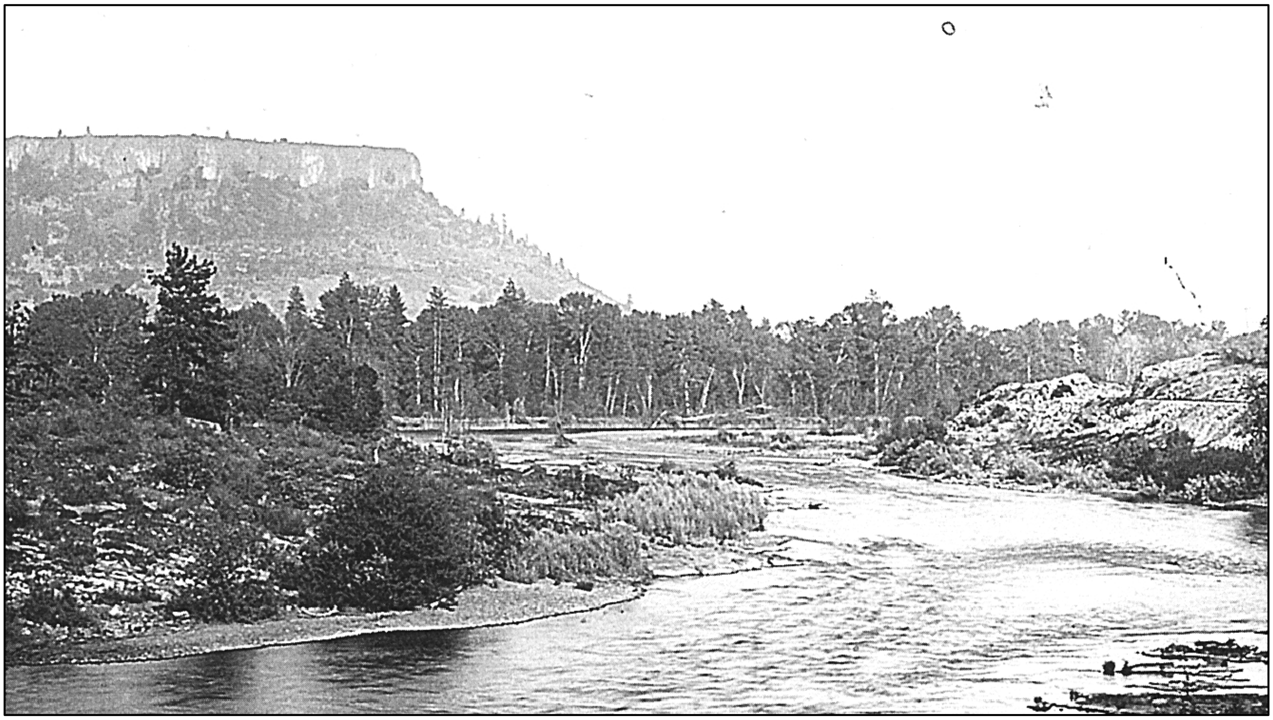

Figure 22. Bottomland riparian forest below the Lower Table Rock, along Gold River (Rogue River), ca. late 1880's. View is southeast toward the future site of Gold Ray Dam. Scattered pines are visible above the hardwood forest. (Source: Southern Oregon Historical Society, #14422)

Figure 23. View of Ashland, 1880's, with early settler and surveyor B. F. Meyer in foreground. Lower Ashland Creek riparian corridor with scattered pine is visible in background, ,just above its mouth at Stewart (Bear) Creek. (Source: Terry Skibby collection, Ashland)

Vegetation Subclasses: Type Descriptions, Mapping and Discussion

Eighty nine (89) vegetation types (subclasses) and four other subclasses (non-vegetative such as water, gravel bars, glades without species information) were identified and described in the study area (**Appendix, Section V)**. Most map units represent single vegetation types, with un-named inclusions. Others are complexes that contain two or more named types that are unmappable as single components. Vegetation type (subcass) acreage and map unit codes for the project are shown below in Table 6. See Appendix V for definitions of all map unit codes in the table.

Table 6. GLO Map Unit Codes for Vegetation Types
with acres and percent of study area (total acreage: 1,139,214 acres)

M. U. Code	Acres	%	M. U. Code	Acres	%
F (a). Forest (Uplands and High Terrace Positions)					
FFDF	157,025	13.78	FMFMP	5,759	0.51
FFDFBu	231	0.02	FMFP	58,324	5.12
FFOC	46,985	4.12	FMFPBu	1,560	0.14
FFOCBu	92	0.008	FMFW	8,232	0.72
FFON	110,838	9.73	FMFWBu	127	0.01
FFPC	4,034	0.35	FMPF	27,000	2.37
FFPO	777	0.07	FPVF	12,315	1.08
FFPOC	1,729	0.15	FSJF	1,890	0.17
FFSP	7,093	0.62	FSJFO	6,823	0.60
FFSPH	2,525	0.22	FWF	7,294	0.64
FGC	36,740	3.23	FWFC	25,108	2.20
FM	306	0.03	FWFCBu	762	0.07
			FWFO	1,282	0.11
F (b). Forest (Riparian / Low Terrace Positions)					
FAS	222	0.02	FTC	1,814	0.16
FAT	10,517	0.92	FTCC	3,128	0.27
FATK	68	0.006			
H. Shrublands and Thickets					
HA	470	0.04	HNM	468	0.04
HCH	284	0.03	HSC	600	0.05
HCHO	502	0.04	HSO	208	0.02
HE	297	0.03	HU	436	0.04
HED	1,691	0.15	HUR	1,868	0.16
HHCH	765	0.07	HW	16	0.001
HMO	1,183	0.10	HWA	52	0.005
HN	52	0.005			
N. Composition Unknown					
NG	215	0.02			
O. Woodland					
OBF	611	0.05	OPOJ	1,620	0.14
OFDF	9,693	0.85	OPOM	3,172	0.28
OFON	29,946	2.63	OPPO	11,200	0.98
OMFO	1,055	0.09	OSMPF	10,092	0.89
OMOPK	11,223	0.99	OSOP	6,061	0.53
OMPFC	16,572	1.45	OSPFJ	3,497	0.31
OOP	80,224	7.04	OSPOF	2,231	0.20
OPB	350	0.03	OSW	20	0.002

M. U. Code	Acres	%	M. U. Code	Acres	%
OPFO	869	0.08	OSYP	2,027	0.18
OPFOJ	6,015	0.53	OWB	18,218	1.60
OPFOK	1,295	0.11	OWCP	12,360	1.08
OPMO	201,247	17.67	OWFC	675	0.06
OPOFH	4,520	0.40	OWM	3,307	0.29
P. Prairie					
P	3,616	0.32	PBSK	923	0.08
PA	47,767	4.19	PF	10,394	0.91
PABS	30,239	2.65	PFAT	4,069	0.36
PAD	1,044	0.09	PFD	1,576	0.14
PASH	506	0.04	PU	15,577	1.37
PB	13	0.001	PUD	2,144	0.19
PBS	5,544	0.49	PUS	1,767	0.16
S. Savanna					
SPF	2,130	0.19	SRR	1,112	0.10
SPMO	15,666	1.38	SWO	3,763	0.33
SPOC	697	0.06			
U. Unvegetated					
UG	51	0.004			
W. Water and Wetlands					
W	2,784	0.24	WU	28	0.002

The short list of species (primarily trees and shrubs) from GLO field notes, was correlated with modern soils and topographic data in order to classify broad vegetation types that were unique ecologically and geographically. The greatest amount of information for developing plant composition descriptions was in forest and woodland habitats, followed by shrublands and savanna, since woody plants were the primary species cited in GLO surveys. Here, floristics were the most important data source for identifying subclasses. Regarding the prairie class, soil features and topographic position provided the only reliable information for classifying prairie subclasses. Since prairie is mostly composed of herbaceous species, it was necessary to describe prairie types without plant composition data.

The detailed mapping of historical vegetation displaying vegetation map units is shown below for the project area. Because of the complexity of the map unit display and large size of the study area, the map is compressed into a small scale display without the map unit legend (Fig. 24). The map and legend are available on GIS and may be downloaded from the ORBIC web site (see **Report Introduction: Products – Viewing GLO Data**, p. 12).

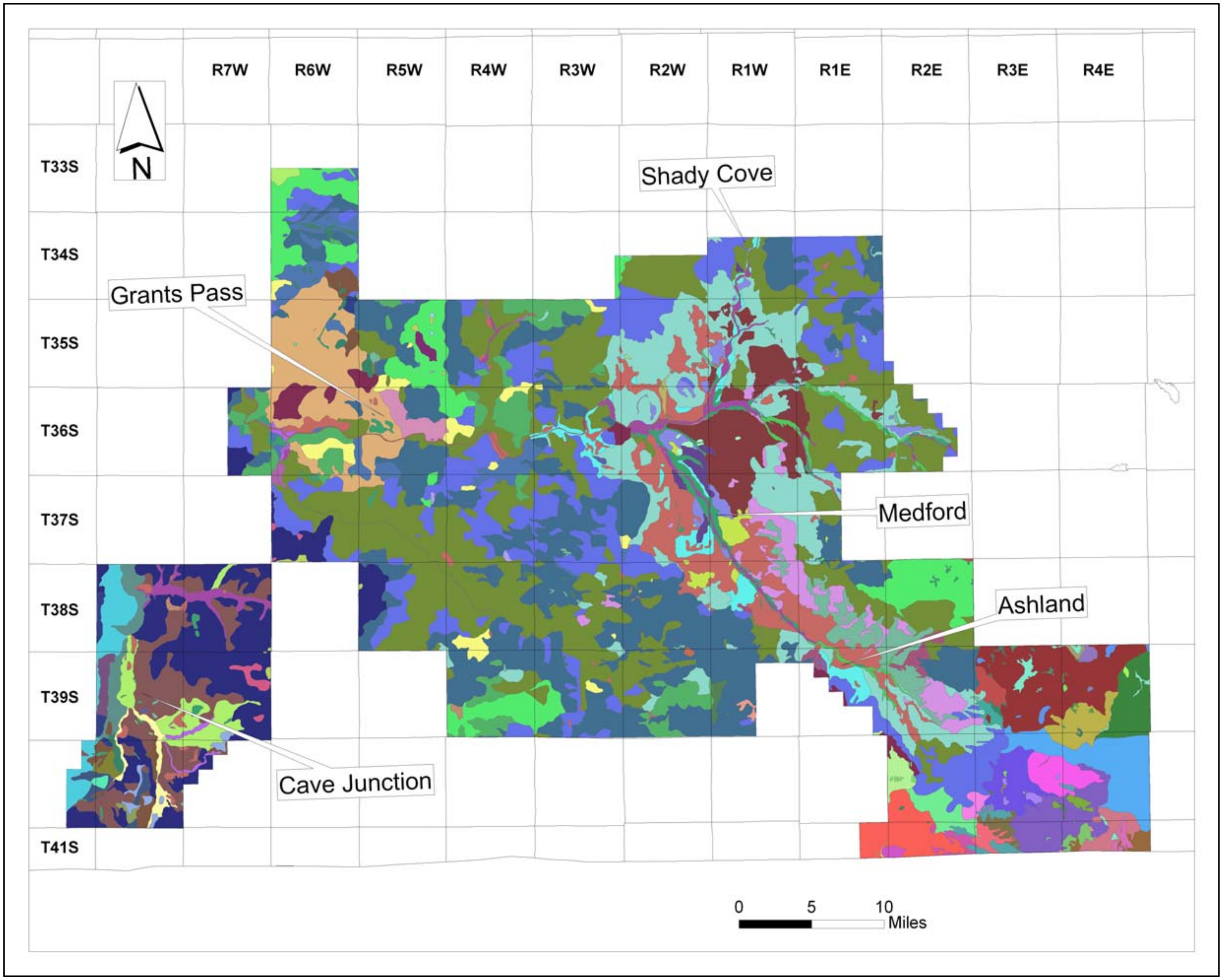

Figure 24. Historical vegetation types (subclasses) of combined project area, illustrating complexity of region. Attributes for the 89 units are available in GIS.

Regional Ecological Zonation as Interpreted from GLO Vegetation Attributes

Because of the study area's diversity of geology, soils, topography and climate (Environmental Setting, pp. 17-25), it was assumed that the ecological complexity of this landscape would be evident in the GLO dataset, despite the coarse nature of the vegetation records available for the study. Mapping of historical vegetation did reveal distinct geographical differences across the project area as follows: (1) plant community distribution, especially for upland vegetation, was geographically related, and types were found to be grouped or clustered by climatic zones, and (2) distinct differences were found in species assemblages (plant composition), for different parts of the study area. Since these attributes identify distinct regional variation within the project area, a review of GLO vegetation descriptions and polygon distributions enabled us to identify ecological zones based on clusters of similar map units.

After sorting polygons based on GLO vegetation attributes, several major ecological divisions in the project area were identified and delineated as an Ecological Zone Map (Figure 25). Climate is apparently the primary factor controlling the regional distribution of plant species and GLO plant communities in these environmental zones. Table 7 (p. 75) shows the map unit composition of each zone.

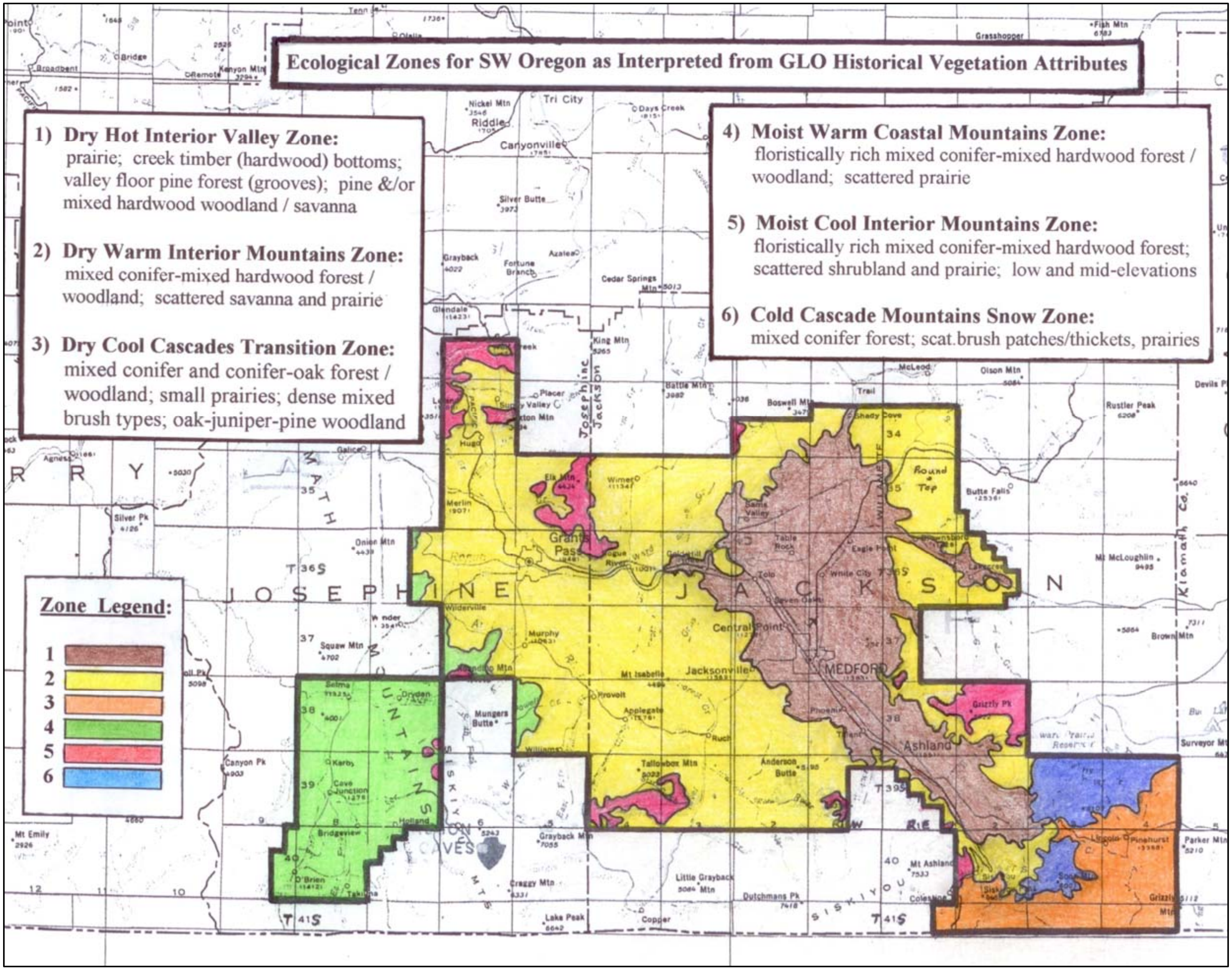

Figure 25. Ecological zones for combined project area, as interpreted from GLO survey records.

<u>Zone 1 (brown)</u> identifies the driest valley west of the Cascade Mountains in the Pacific Northwest. Topography is primarily a large valley floor with some low foothills and steep southerly ridge slopes. There is a strong Mediterranean climate with average annual precipitation estimated at about 18 to 25 inches (except for the slightly higher north end of the valley), occurring primarily between mid October and early June.

Prairie vegetation at the time of European-American settlement was estimated to cover 60-70% of the zone, primarily on droughty or well drained upland soils, but with some valley floor riparian forests and creek meadows. Mixed white and black oak woodland was common, both with and without yellow pine. Some white oak stands co-dominated by birchleaf mountain mahogany were common on northerly slopes with loamy soils. A small amount of white oak-bunchgrass savanna was found near the dry center of the valley. There were small islands or patches of chaparral (common buckbrush) on the plains and low hills, and some creek brush associated with an extensive network of riparian zones.

An outstanding historic feature was the existence of highly productive pine-hardwood groves on the west side of the valley. Impressive yellow pine stands are thought to have had floristically rich understories and large diameter mixed hardwood trees. They represented a unique bottomland forest type not found elsewhere in the study area or anywhere else in western Oregon.

Mesic conifer slopes with fir (Douglasfir) are generally rare or absent in GLO data and excluded from the Dry Hot Valley Zone. Exceptions include moist fringes of the valley, especially in the higher precipitation portion of the northern valley. Also, included is the large, moist alluvial fan found just southwest of Phoenix where Douglasfir was a component of valley floor forest.

<u>Zone 2 (yellow)</u> represents the generally warm/hot low elevation interior mountains and valleys between the Coast Range and the Cascade Mountain Ranges. Average annual precipitation is approximately 25 to at least 35 inches. The zone is transitional between the more mild northwest Oregon climate and northern California's Mediterranean climate.

GLO data was strongly dominated by drought tolerant mixed conifer-mixed hardwood vegetation. The principal conifers were yellow pine, fir (Douglasfir), and sometimes redwood (incense cedar) and sugar pine. Hardwoods were mostly black oak and madrone with the conifers, but white oak was increasingly important on dry pine sites and on droughty, clayey, or seasonally wet soils. Tree density classes were estimated at 50-60 % in the upland Forest Class with at least a third of the zone mapped as Woodland.

Shrubland (chaparral and other brushfields) are believed to have been present, but they were seldom documented and are uncommon in the GLO records. Prairie units were also poorly documented and characteristically small, but found today at many scattered locations. Even if these prairie sites had been fully represented in the historic data, the type would have been minor compared with prairie in the Dry Hot Interior Valley Zone (Zone 1). Oak savanna was important in this zone at several locations, primarily low elevation positions within the broad Rogue River corridor, Lower Applegate, and other valleys such as the Merlin-Sunny Valley area.

<u>Zone 3 (orange)</u> is within the Klamath River watershed portion of the southern Cascade Mountains. It is the center (western end) of a large climatic transition between the mild interior of western Oregon, and the central Oregon high plateau with its continental climate. Overlapping this transition is a north-south climatic and physiographic gradient between the very high, cold Cascades and the low, warm/dry Klamath River corridor south of the state line. Topographically, there is an extensive, complex southerly slope across the entire west half of this zone which turns and descends eastward, merging with a large plateau ranging from about 3000-4000 feet elevation. Both features extend south across the state line. Climate here is cool to cold, depending on location, and annual precipitation varies from about 18 inches to 35 inches.

This region is known today as a biological mixing ground due to the overlapping range of numerous species, and serves as a plant and animal corridor connecting very contrasting climatic regions. At some locations in this zone, historical and modern plant inventories lack common west side species such as madrone, whiteleaf manzanita and poisonoak, but include east side species such as western juniper, bush chinquapin and bitterbrush (*Purshia tridentata*).

The GLO map unit legend for this zone is both extensive and unique because of site and environmental variation, and it is much different than the other zones displayed in Table 7. Historical vegetation types were diverse, ranging from prairie, chaparral, juniper, mixed hardwoods, dry site mixed conifer, and moist cool mixed conifer stands.

Tree stand density during the GLO survey was primarily woodland, with a much smaller proportion in forest. On the south and west end of the zone, these stands were strongly mixed conifer (yellow pine and fir) with oak (white or black). On the northeast edge of the study area, these stands were mixed conifer zones without oak. And from modern vegetation inventories we know that the GLO reference to "fir" at many locations in this zone must have included both Douglasfir and white fir. It is also evident that the GLO use of yellow pine included both ponderosa pine and sugar pine at some locations, or that sugar pine was ignored in many mixed conifer stands in this region. Only a single occurrence of savanna was identified, but there were dense "mixed species" brush fields, and sizable areas of prairie types. An extensive early history for the Greensprings region of this project also provides numerous observations and land surveyor comments about the historical vegetation, including timber, forage and landscapes, encountered in this area (Foley 1994, pp. 2-13).

Zone 4 (green) represents the portion of the project with the strongest coastal climate influence, and identified by recent ecologists as the Western Siskiyou Mountains (see Study Area: Ecological Divisions). This zone includes mostly lower coastal mountains and valleys, and is noted for having considerable serpentine geology with unique vegetative composition. It includes the floor of the Illinois River valley where precipitation is high and the climate is mild with much less moisture stress than in the eastern Siskiyous.

GLO vegetation data indicates that this was the most floristically rich zone in the project area. Cover was primarily mixed conifer-mixed hardwood stands, where both forest and woodland density classes were equally abundant. Prominent trees reported here, interpreted from GLO notes, were fir (primarily Douglasfir but with minor amounts of grand fir), yellow pine (ponderosa and Jeffrey pine), sugar pine, redwood/cedar (incense and Port Orford cedar), live oak, laurel (madrone), bigleaf maple, and black oak White oak was more restricted to droughty soils and unique valley terrace habitats. Serpentine soils usually supported unique vegetation types, normally mixed conifer with woodland density, but some droughty gravelly or shallow sites were very open stands classified as savanna.

Other plants sometimes listed in this zone by GLO surveyors included common Coast Range species such as vine maple, myrtle, golden chinquapin, yew, tanoak, chitamwood (cascara), liveoak, balm (varnishleaf ceanothus) and whortleberry (both red and evergreen huckleberry). Large areas of lush hardwood riparian forests wound through the network of valleys feeding the Illinois River system. They occupied the active low floodplains separating extensive high terrace bottomlands that covered these broad valleys.

Zone 5 (red) is restricted to low and middle elevation polygons in the Rogue watershed portion of the project. These map units are generally small, isolated areas. Collectively they have much diversity in flora and physiography. All individual polygons contained either moist indicator species, or plants consistent with cooler climates. Average annual precipitation for the zone is estimated at 35-60 inches. Zone 5 is botanically similar to Zone 4 in the lower elevation polygons near Sunny Valley, and may actually merge with Zone 4 near Glendale just north of the project boundary. However, this area may be associated with a cooler climate since some mild climate Coast Range species are absent. It is assumed that the upper elevation sites in the zone, generally above 3000-4000 feet elevation, occupy an intermittent winter snow zone and have a much shorter growing season than Zones 1, 2 and 4.

Some of the diversity in species composition may be due to both the wide elevation range and broad geographical spread from the western slope of the Cascades to the interior of western Oregon. The lower elevation sites in northern Josephine County (north of Grants Pass) seem to have greater floristic diversity compared to the southern and eastern locations at high elevations, unless GLO surveyors of the latter areas documented fewer species.

Tree stands were primarily “mixed conifer” throughout the zone, namely fir, yellow pine and “redwood” (cedar), with fir probably including both Douglasfir and white fir in map units above about 3500-4000 feet elevation. Hardwoods such as laurel (madrone) and deciduous oaks are common at low elevations but much less common in the high elevations above 4000 feet. Some dense brushfields of mesic mixed shrub species and tree regeneration were present, assumed to be recovering from old burns. GLO data indicated that live oak was sometimes present, but only at the west side locations.

Stand density was predominately forest, although some woodland was mapped in northern Josephine County. Most of the small scattered polygons of shrubland within “timber” were probably old burns that later became brush stands. There were a number of small moist meadow basins (“glades”) in the Western Cascades near Grizzly Peak.

Zone 6 (blue) is a very cold winter snow zone found on high peaks, ridges and mountain slopes. This area is an extension of the southern Cascade Mountains in the vicinity of both Soda Mountain and Chinquapin Mountain. Elevations here range from 4300 feet to over 6000 feet. As in Zones 4 and 5, average annual precipitation here is high, probably over 40 inches, but at these elevations, much of the precipitation occurs as snow.

GLO vegetation records included numerous cold tolerant or high moisture indicator plants such as white fir, yew, whortleberry, chinquapin (shrub), gooseberry, shoe-make, cherry (bittercherry), elder (blue elderberry), willow, and maple (probably Douglas maple). Mixed conifer forest dominated much of the zone at the time of the survey. Timber type was mostly cited as “fir,” which in many stands we assumed to be either a mixture of Douglasfir and white fir, or primarily white fir. In addition, yellow pine, sugar pine, cedar (incense) and minor black oak were listed, depending on location. Some small areas were classified with lower tree density, namely woodland and savanna, which may have been stands recovering from historic burns.

A number of small dense brushfields dominated by ceanothus, cherry, or a variety of other cold tolerant species were mapped as shrubland at scattered locations. These were likely the result of the area's fire history. A variety of small moist prairies and one large one, Hyatt Prairie (now under Hyatt Reservoir), were present.

Table 7. Primary Vegetation Map Units Associated with GLO Ecological Zones
(See Appendix V for Definitions of Map Unit Codes)

ZONE 1	**ZONE 2**	**ZONE 3**	**ZONE 4**	**ZONE 5**	**ZONE 6**
Dry Hot	Dry Interior	Klamath	Moist Warm	Moist Cool	Cold
Interior Valley	Mountains	Watershed	Coastal	Interior	Cascades
Zone	and Valleys	Transition Zone	Mountains	Mountains	Snow Zone
Upland Forest	**Upland Forest**	**Upland Forest**	**Upland Forest**	**Upland Forest**	**Upland Forest**
FFON	FFDF	FFPO	FMFP	FFOC	FWF
FPVF	FFDFBu	FFPOC	FMFPBu	FFOCBu	FWFC
Riparian Forest	FFON	FMFW	FMPF	FFSPH	FWFCBu
FAS	FFPC	FMFWBu	FSJF	**Shrubland**	FWFO
FAT	FFSP	FMFMP	FSJFO	HCHO	**Shrubland**
Shrubland	FGC	**Riparian Forest**	**Riparian Forest**	HHCH	HE
HCH	FM	FATK	FAT	HU	HSC
HN	**Riparian Forest**	**Shrubland**	FTC	**Woodland**	HSO
HNM	FAT	HCHO	FTCC	OPFO	HU
HUR	FTC	HED	**Shrubland**	OPPO	HWA
Woodland	**Shrubland**	HMO	HU	**Prairie**	**Woodland**
OOP	HA	HSC	HUR	PF	OMFP
OPOM	HAP	HSO	HCH	PU	OPB
OSW	HCH	**Woodland**	**Woodland**		OWFC
OWB	HMO	OMOPK	OBF		**Prairie**
OWM	HU	OMPFC	OPPO		P
Prairie	HUR	OPFOJ	OSMPF		PF
PA	**Woodland**	OPFOK	OSOP		PFD
PABS	OFDF	OPOFH	OSPOF		PU
PASH	OFON	OPOJ	OSYP		**Savanna**
PBS	OPMO	OSPFJ	**Prairie**		SPF
PF	OSOP	OWCP	P		
PFAT	OSYP	**Prairie**	PA		
PU	OWB	PAD	PF		
Savanna	OWM	PB	PFAT		
SWO	**Prairie**	PBSK	PU		
	P	PF	PUS		
	PA	PFD	**Savanna**		
	PB	PU	SSRR		
	PF	PUD			
	PFAT	**Savanna**			
	PU	SPOC			
	PUS				
	Savanna				
	SPMO				

Fire Disturbance and Historic Burn Mapping

Fire history had a major impact on the composition and structure of pre-settlement landscapes as determined by modern ecological surveys and research (Atzet and Wheeler 1982; LaLande and Pullen 1999; Lewis and Ferguson 1999, p.166; Whittaker 1960, p. 306). Early accounts of explorers and travelers sometimes noted fires or the results of burning by the Indians (Lalande and Pullen 1999). The September, 1841 diary from the Wilkes Expedition, moving south from the Umpqua towards California, gave this account “continued our course over burned woods and small patches of prairie.” And later “we are now at the base of the Shaste (Siskiyou) mountains …… though densely covered with brushy wood the ascent was very easy” (Bornholdt 2005).

It is commonly believed that explorers, early settlers and travelers encountered much open forest, making access easier. However, it evident that this was very much related to the locality and was dependent on topography, the kinds of stands and their environmental history. Our study found about 80% of the study was either forest or woodland stand density, often with considerable brush undergrowth. Overland travel was less difficult by the use of trails, and but finding or constructing suitable routes for wagon roads could be challenging. A historian, author, and long time resident north of Grants Pass was interviewed for this study (Larry McLane, Sunny Valley area, personal communication, 2010). He explained how his family, some of the earliest settlers in the region, were able to quickly travel across much of the region by using the old Indian trails, which was the means used by most early travelers for traversing the country.

In spite of the very widespread burning by Native Americans, determining where recent burning had occurred in the project area was often difficult because GLO surveys did not provide a consistent record of fire evidence. Surveyors recorded only a few dozen occurrences of fire along the section lines. Examples of GLO references to fire include: “burned,” “enter deadening,” “scattering burnt timber,” “snags,” “undergrowth partly dead from burning,” etc. Only 15 fires were documented with entry and exit points (about 2775 acres), in a manner suitable for mapping (see Fig. 27 below).

Other GLO notes provide evidence of burning, but no points of entry or exit from the burn (which facilitate mapping fires). We have documented these locations as “other burning sites,” but their delineation as polygons was less reliable. In addition, many locations (some classified and mapped as “Shrubland”) had cover that was probably the result of stand replacement fires, although without direct evidence in the dataset. At some locations, fire could be “inferred” from stand descriptions such as: “open timber and thickets of small firs,” “undergrowth of fir thickets and bull pine,” “dense thicket of manzanita and small pines,” “part of timber dead,” “undergrowth mostly dead manzanita and greasewood.” These latter locations were noted on the map of historic burns (Fig. 27), but only as line segments showing exactly where the fire related descriptions were recorded.

We believe that GLO surveyors did not record very old burns. Also, we did not encounter any references to recent ground fires with low site impact, such as those on prairies. And, since only section lines were measured and documented, any fires in the interiors of sections would not have been recorded in the notes. Vegetation types with little woody cover such as prairie and savanna, may have had the most recent and consistent fire histories, but are not likely to have impressive evidence of low intensity burning. At best, **GLO surveys provided insight as to the location and rarely intensity of only a few historic fires**. Never were the obvious evidences of fire scars on live trees or fresh ash recorded, leaving “line references” to burning debris, fire snags or recent fire as the primary evidences. Certainly, GLO records would not be adequate for reconstructing fire return intervals, even if more historic data such as tree fire scars had been noted in line descriptions. “Fire scars are not testimony of frequent burning; rather, they establish either intense or long duration fire." Even "this evidence would underestimate the true fire-return intervals" (Agee 1993, p 355).

Prairie found on sites without soil limitations could not have been maintained as treeless grasslands by soil features alone. Many of these areas such as the Agate desert, clayey foothills of the central Bear Creek Valley, and portions of the so called "wet triangle" between Jacksonville, Central Point, and Medford, may be examples of prairie maintained by periodic burning by Indians, especially where soil features would not restrict the development at least some woody species. Historically, burning was a common local practice (Pullen 1995, II-1 & V-3; Boyd 1999, p.261-70) that probably reduced the occurrence of trees and shrubs in these settings. "…..it also seems possible that Indian burning was the primary factor influencing the vegetation of at least certain portions of this area while natural fires were of secondary importance" (Todt 1989).

Many but not all of the shrub types discussed in the Shrublands Class section (p. 53-56) represent seral plant communities originating after fire. All shrub stands classified and mapped from the GLO dataset, regardless of origin, are shown in Figure 17 (p. 56). An improved picture of the extent of historic fires for the project area is available when both the Historical Shrublands map (above) along with the GLO Historic Burns map below (Fig. 27) are considered.

State and transition models for southwest Oregon shrublands, historically and today, would vary greatly depending on environment, stand composition and disturbance history. Most stands, especially those in more mesic environments, would recover over time and convert toward a characteristic tree cover type or early successional stage of forest or woodland (Fried et al. 2004). For example, some GLO stands called "Creek Brush" on flood plains, may have preceded young "Creek Timber" but were in an early stage of development. Copper (cited in Detling, 1961) refers to some transitional moist shrublands as "Conifer forest chaparral." However, other transitional shrublands, especially in hot droughty environments, may have become locked in a transitional state. These may have remained as chaparral for an extended period, failing to progress toward their site potential. Also, there were apparently certain long-lived chaparral types that were more stable landscape features. Recent research in the Siskiyous, where older stands of *Ceanothus cuneatus* and *Arctostaphylos viscida* were aged, found both species to be long lived and regenerating without burning (Duren 2009; Duren and Muir 2010). Some chaparral types in SW Oregon, although not fully understood, may not be fire dependent, but self–perpetuating in the absence of disturbance (Keeley 1992, Keeley and Davis 2007).

Fire history changed significantly during the early settlement era. Traditional burning by Indians ceased, but fires set by prospectors, farmers and stockmen began to greatly impact portions of southern Oregon and California (Fried et al. 2004, p. 9; Robbins 1997, p. 131; Atzet and Wheeler 1982, p. 4). Most early photographs adjacent to towns and mining sites, show very brushy, sparsely stocked stands as in Fig. 26 of Ashland. Some may be the result of earlier wildfires and/or the cessation of traditional burning practices. But most are probably stands recovering from settlers or miners doing burning for prospecting and/or heavy logging,. Besides high grading virgin stands, leaving thin or scattered overstories, the abundance of slash was likely to have been burned. This would have initiated brush fields or shrub cover under residual partial cuts. An observation by Leiberg in the forest township surveys for southern Oregon, noted that periodic burning by Indians could not compare with the widespread impact of more recent fires occurring since the beginning of white settlement (Leiberg 1900; Morris 1934). No large brush fields or burns were identified from the GLO records, comparable to those observed by Leiberg about the turn of the century, or to the large extensive brush cover identified later by Gratkowski in SW Oregon (1961). These shrub stands evidently developed after severe burning episodes that occurred later in the settlement period.

Figure 26. Ashland in mid-1860s, a few years after initial settlement and establishment of a nearby sawmill. The north-facing slope above the town is a brushy, poorly-stocked remnant stand, probably of fir and pine, that may have been logged and burned. (Source: Terry Skibby collection, Ashland)

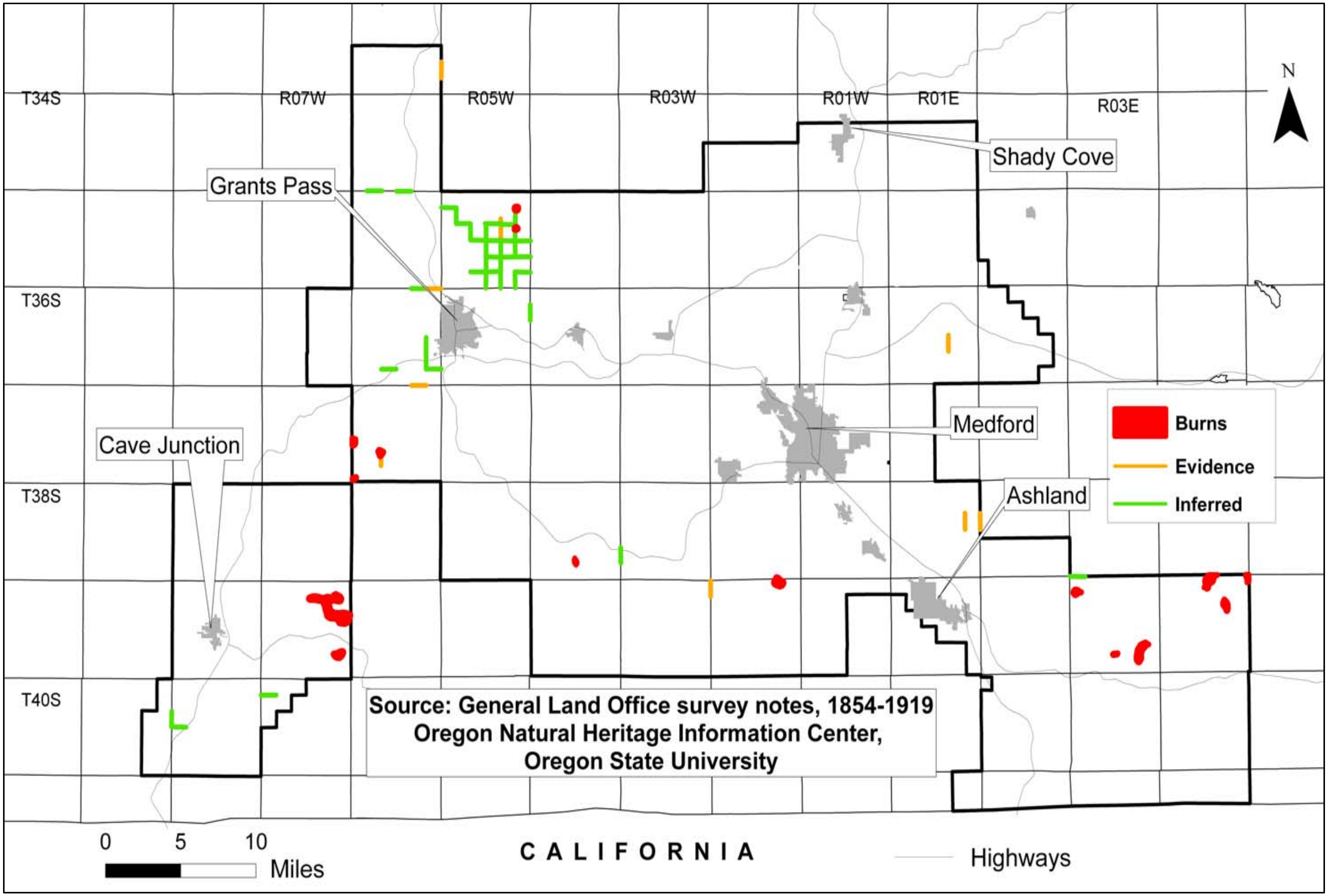

Figure 27. Locations of historic burns in combined project area, as recorded by GLO surveyors, or interpreted from the GLO dataset.

PROJECT EVALUATION AND CONCLUSIONS

Limitations of GLO Data

GLO survey notes contain a limited amount of information about historical landscapes, and the style and detail of records varied somewhat by surveyor. Almost all plant lists are restricted to a few common trees and shrubs, usually without herbaceous species, which provides a short list with which to work. At times a few surveyors even ignored recording shrubs in their line descriptions.

Line descriptions only provided a composite or average of vegetation dominance for each mile, unless a break was made in the line and a distinction made between different segments of the line. Changes in vegetation types along the lines are important for the historical record but were not always identified surveyors. Certainly subtle ecosystem changes would not have been noticed by the untrained surveyor. Possibly other vegetation boundaries were simply not identified to save time, because it would have required a pause in the survey to record the new entry and exit points.

Survey data were essentially from line transects around each section, so that much area was missed and undocumented by the surveyors. Topographic errors in township plat maps were common but expected within the interiors of sections, particularly when mapping drainage systems and ridgelines. Also, the documentation of burning evidence, although important, was weak and incomplete.

The amount of field notation was not always consistent between surveyors, so that less information was provided for some locations than others. And being trained in surveying or engineering, not botany, the quality of vegetation records was sometimes lower than expected. Some errors in species identification were obvious, and needed correction (greasewood, redwood, bugwood, etc.).

Interpretive maps and research based on GLO data are somewhat subjective because of limitations in the data, and much professional judgment is needed to create and delineate map units. Consequently, our local field experience in the project area was valuable for interpretation of the data and judging how to relate the data to local landscapes.

Data derived from locations surveyed in the latter decades may be less reliable as historic baseline data, than that from the earliest decade of surveys. Our historical vegetation map was intended to represent conditions in the early settlement period, as close to “presettlement” as possible. Although over ¾ of the project area was surveyed in the first decade of settlement, completion of the entire study area was spread over about 65 years. Fortunately, the remote and rough nature of the omitted parcels, decreased the possibility that human disturbance or altered burning patterns had impacted portions of the newer surveys.

Regrettably, our data set was not old enough to precede major site impacts on small local areas close to the earliest settlements and mining districts, and these may have impacted small portions of our dataset. These were being altered by heavy prospecting, severe burning, tree harvesting and farming before the GLO surveyors completed their first decade of surveys.

Landscape Changes since Settlement

This GLO study did not investigate the degree and extent of vegetation changes since settlement began. However, knowing that changes have widely occurred, it is appropriate to conclude this study by noting some significant impacts that have been imposed on presettlement landscapes in the last 160 years.

Initially, historical landscapes were altered or influenced primarily in the major valleys and low mountains near mining districts, settlements and homesteads. The influx of miners, farmers, ranchers, and business people quickly enlarged the area of land use and development. Within only 5-6 years, the Indian culture had vanished and their annual impact on southwest Oregon was gone. The absence of periodic low intensity burning was by itself a major change on large areas of native landscapes, in combination with agricultural development in the valleys as the population increased. There was heavy livestock grazing on valley prairies and throughout portions of the mountains, along with a wave of widespread, severe, indiscriminate burning of the uplands.

An outstanding detailed overview of both natural and human impacts on ecosystems of the Little Applegate River Watershed was reported by LaLande (1995). Landscape changes and disturbances discussed by LaLande (both pre and post settlement) were common to much of our project area. Five very significant types of post-settlement ecosystem impacts in Southwest Oregon are highlighted below.

1. **Development:** Conversion of natural ecosystems to mining districts, settlements, industrial areas, road and canal systems, farmland, orchards and pastures.

2. **Tree Harvesting:** Logging for construction materials, poles; cordwood for home, business or railroad locomotive fuel; and wood rails for fence construction.

3. **Range Livestock Use**: Valley prairies and wooded grasslands were heavily used for seasonal grazing and wintering of livestock. Late spring and summer grazing by large herds in the mountains was followed by years of fall burning, as livestock left the woods.

4. **Weed Species Introductions:** Introductions were from many sources, which accelerated as settlement expanded, and weeds began to fully occupy large areas. The most vulnerable sites were heavy disturbance areas and degraded natural ecosystems. Fortunately, intact and fully functional native ecosystems within the project, especially mesic sites, have maintained their integrity and resisted most weed introductions during settlement and to the present.

5. **Changes in Burning Patterns:** The presettlement fire history, a product of lightning and native American cultural practices, was dramatically changed with intense burning by prospectors and ranchers, followed by a century of aggressive fire control efforts. High density forests resulting from overstocking have become a concern in recent decades, the result of forest management decisions and altered burning cycles. We assume there has been a shift from woodland to forest density at some locations, with fire control and/or a decline in logging or thinning treatments. Some decline in savanna and prairie acreage is also expected with the elimination of periodic burning, but only where site features (soil, etc.) are not restricting greater tree density.

Questions and Future Work Recommended

Questions arise from the review of GLO records that this project was not designed to explore or answer. This is especially true of questions addressed through the larger fire grant project and its related studies, of which this study was only a single component, contributing data for the goals of the larger project objectives.

What role did fire have in shaping these historic landscapes and explaining what was found in the GLO vegetation study? For example, did fire influence plant community composition, determine stand density distribution, and initiate the abundance of heavy brush undergrowth in many forest and woodland map units? And why were there so few examples (polygons) of both GLO shrubland types and recent burns, in a region with such an abundance of lightning caused wildfires, and so much burning by native Americans?

The amount of vegetative information we were able to recover from the GLO records was quite limited. Therefore, we wonder what important native species were left out of GLO notes for each vegetation type, such as prairie grasses and other woody species. Also, what are the modern names for a few species that we are not sure of their identity, known now by only archaic names used in GLO work?

Change is inevitable, over time, in landscape cover, and especially where there are new impacts on the land. So what general changes in composition and ecological status have occurred in native cover during the century and a half since European settlement, and how are ecological processes to be maintained or restored without fire? And, what is the change in extent of the historic cover types since early settlement, i. e. acreage or percentage, remaining or lost, for the historical cover types reported?

And, how can GLO information be used as baseline data for natural resource management and as natural science educational material? How can we best relate coarse GLO records and historical vegetation maps to modern inventory systems that use aerial photography and a variety of methods for ecosystem classification? For example, can we accurately compare GLO plant abundance and density data, with modern foliar cover, basal cover, stand exam records, dominance ratings or other field plot information? And, can we enhance or make historic GLO data more useful by combining it to a greater degree with modern ecological inventories, other historic data, and recent soil surveys, to develop a better baseline assessment and begin to address some of the questions given above?

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APPENDIX

TOWNSHIP TABLE - ALL RECORDS

Twp	N bdy/E b	Surveyor	Start	End	Bdy descr	Gen descr
38S-02W	E	HYDE, GEORGE AND BUTLER IVES	JUN 1854	JUN 1854	[NO DATA]	
38S-02W	SUB	TRUAX, SEWELL	JUN 1857	JUL 1857		There are four sections, ____ 25, 26, 35, 36, which are high rocky mountains unfit for settlement and unsurveyed. That part of the township surveyed as described in the foregoing field notes is hilly, mostly open pine and oak timber and covered with grass. Soil 2nd and 3rd rate of a light red color mixed with quartz indicating a gold region. There are five or six settlers in this part of the township. Good gold mines in secs 32, 33, & 28.
38S-02W	SUB	HYDE, GEORGE AND BUTLER IVES	SEP 1854	SEP 1854		
38S-02W	SUB	GIBB, WILLIAM	SEP 1909	OCT 1909		In this fractional township there is but very little tillable land. The soil is mostly very rocky and land nearly all mountains. The meadow in the southeast quarter of section 26 is the only part where crops could be raised. There is a large quantity of good timber in each quarter section. This is mostly yellow pine and fir, but there is also a considerable amount of oak and matherone. There are two settlers in this fractional township: Thomas W. Barr, Sr., and Thomas W. Barr, Jr., in section 26. The improvements of Thomas W. Barr, Sr., consist of a house, barn fences and meadow and have an approximate value of $1200. The improvements of Thomas W. Barr, Jr., consist of a house, barn fences and clearing, and the approximate value is $1000.
38S-03W	E	HYDE, GEORGE AND BUTLER IVES	JUN 1854	JUN 1854	[NO DATA]	

Twp	N Ŀ	⁝ b	Surveyor	Start	End	Bdy d	Gen descr
38S-03W	N		THOMPSON, DAVID	MAR 1857	MAR 1857	[NO DATA]	This township contains a considerable amount of good farming land & should be subdivided. It is well timbered with pine, oak & fir.
38S-03W	SUB		RANDS, ERNEST	AUG 1910	AUG 1910		This township contains level rolling and mountainous land. The soil is sandy and stony ranging from 2nd to 4th rate. The township is well timbered with fir, pine, oak, and laurel. It is also covered with a dense undergrowth of manzanita, buck-horn and mahogany. There is one settler, Mrs Armpriest, in secs 8 and 9; Mr. Jeffries in sec 16; Wm. Morrison in sec 16 and one settler in sec 12 whose name could not be learned. All corners established on a fomer rejected survey made by Deputy Stout have been destroyed by me.
38S-03W	SUB		THOMPSON, DAVID	NOV 1857	NOV 1857		The quality of land in this township is 2nd rate land in the NE & SW part of the township; in the middle quarter ___NW 1/4 high steep & stony ridges not suitable. Applegate Creek is a clear stream of water running through the southern part of the township. Timber chiefly pine, oak, fir, & cedar equally distributed over the entire township.
38S-04W	E		THOMPSON, DAVID	MAY 1857	MAY 1857	[NO DATA]	
38S-04W	N		THOMPSON, DAVID	APR 1857	APR 1857	[NO DATA]	This township contains a considerable portion of good farming land & should therefore be subdivided.
38S-04W	SUB		THOMPSON, DAVID	JUL 1857	JUL 1857		The south and NE part of this township is very mountainous, steep and rocky. Consequently not subdivided. The middle and west part is good 2nd rate land, rolling and is well timbered with pine and oak and on Applegate Creek [RIVER] with balm gilead. Gold is found on Applegate Creek and several hundred men are now engaged in mining, generally with good success.
38S-04W	SUB		OWEN, JASON	OCT 1872	OCT 1872		[NO DATA]

Section II: Line Table (Examples)

(single page excerpts from three different Line Tables)

Codes below are used for transcribed GLO data when presented in Access "Line Tables." Expanded code definitions are available in Christy et al. (2002).

C	=	Section corner
D	=	Plant names added from the line description
E	=	Meander post
F	=	Flooded, including ponds or lakes with entry and exit points
H	=	Man-made features, point data on the survey line
I	=	Intercepted objects (usually tree), directly in the path of the line
Q	=	Quarter section corner
R	=	River, having separate entry and exit points on the line
S	=	Stream, point data without separate entry or exit points on line
T	=	Topographic features intercepted
V	=	Vegetation intercepted, or having separate entry and exit points
W	=	Water, non-flowing, small size without entry or exit points

TOWNSHIP 38S-03W

Line	Dir	Dist	Code	Intercept	Species	Tree Diam	Tree Bear	Tree Dist	Year	Line Description
01-06	S	02.50	M	TO A TRAIL COURSE NE					1854	
01-06	S	03.50	S	TO JACKSON CREEK 4 LINKS WIDE, COURSE NE FROM S70W [NOW CALLED MILLER GULCH, NOT J. CR.]					1854	
01-06	S	03.50	M	THE GOLD DIGGINS EXTEND UP THIS CREEK FROM ONE & A HALF TO TWO MILES [MILLER GULCH]					1854	
01-06	S	09.50	T	TOP OF A RIDGE COURSE SW					1854	
01-06	S	13.20	S	TO A DRY CHANNEL COURSE NE, GOLD DIGGINS ALLONG IT [SOUTH FORK JACKSON CREEK]					1854	
01-06	S	25.14	I	LAUREL 12 IN. DIA.	LAUREL	12	.	.	1854	
01-06	S	30.00	T	SUMMIT OF LINE ON DIVIDE BETWEEN GOLD [ROGUE] RIVER VALLEY & APPLEGATE CREEK					1854	
01-06	S	40.00	Q	SET QUARTER SECTION POST	W. OAK	10	NE	34	1854	
01-06	S	40.00	Q		B. OAK	10	NW	44	1854	
01-06	S	61.50	V	ENTER PRAIRIE COURSE E & W					1854	
01-06	S	80.00	C	SET POST CORNER OF SECTIONS 6, 7, 1 & 12	Y. PINE	38	NW	298	1854	
01-06	S	80.00	C		Y. PINE	34	SW	348	1854	
01-06	S	80.00	C		Y. PINE	12	NE	225	1854	
01-06	S	80.00	C		Y. PINE	36	SE	550	1854	Land rolling hills. Soil 2nd rate clay loam & gravelly. Timber oak, y. pine, fir & etc. Undergrowth mansanita, greasewood, hazle & etc.
01-06	S	80.00	D		FIR	.	.	.	1854	
01-06	S	80.00	D		MANSANITA	.	.	.	1854	
01-06	S	80.00	D		GREASEWOOD	.	.	.	1854	
01-06	S	80.00	D		HAZLE	.	.	.	1854	
07-12	S	06.50	M	TO A ROAD FROM JACKSONVILLE TO CRESCENT CITY COURSE S30W					1854	
07-12	S	16.50	V	LEAVE PRAIRIE COURSE NE & WEST					1854	
07-12	S	20.52	I	W. OAK 16 IN. DIA.	W. OAK	16	.	.	1854	
07-12	S	27.50	T	WEST POINT OF RIDGE					1854	
07-12	S	32.00	S	TO A STREAM 5 LINKS WIDE COURSE S70W					1854	
07-12	S	40.00	Q	SET QUARTER SECTION POST	FIR	50	NW	26	1854	
07-12	S	40.00	Q		FIR	24	SE	24	1854	
07-12	S	40.28	I	A FIR 24 IN. DIA.	FIR	24	.	.	1854	
07-12	S	41.00	T	COMMENCE ASCENT ON NE SLOPE OF A VERY ROCKEY MOUNTAIN					1854	

TOWNSHIP 40S-07W

Line	Dir	Dist	Code	Intercept	Species	Tree Diam	Tree Bear	Tree Dist	Year	Line Description
01-36	E	11.46	I	A FIR 16 IN. DIA	FIR	16	.	.	1855	
01-36	E	20.75	S	A BRANCH 3LKS WIDE, C. SE [JOHNSON GULCH]					1855	
01-36	E	25.50	T	TOP OF RIDGE, C. SOUTH					1855	
01-36	E	33.25	T	A RAVINE, C. SOUTH					1855	
01-36	E	40.00	Q	SET QUARTER SECTION POST	LAUREL	12	NW	10	1855	
01-36	E	40.00	Q		BLACK OAK	8	SE	71	1855	
01-36	E	65.60	S	LEFT BANK OF SUCKER CREEK 80 LKS WIDE, C. NNE, RAPID & ROCKY BED					1855	
01-36	E	66.50	T	ENTER CREEK BOTTOM					1855	
01-36	E	73.50	I	A SUGAR PINE 24 IN. DIA	SUGAR PINE	24	.	.	1855	
01-36	E	80.00	C	SET POST COR TO TPS 39 & 40 SOUTH, RANGES 6 & 7W [SECS 1, 6, 31, 36]	SUGAR PINE	20	NW	33	1855	
01-36	E	80.00	C		SUGAR PINE	22	NE	5	1855	
01-36	E	80.00	C		CHINQUAPIN	6	SE	34	1855	
01-36	E	80.00	C		SUGAR PINE	16	SW	60	1855	This mile lies on a SE slope of mt. with rocky surface & soil 3rd rate. Timber fir, pine, live oak, chincapin, laurel & yew, very thick. Undergrowth of same; unfit for settlement.
01-36	E	80.00	D		FIR	.	.	.	1855	
01-36	E	80.00	D		PINE	.	.	.	1855	
01-36	E	80.00	D		LIVE OAK	.	.	.	1855	
01-36	E	80.00	D		YEW	.	.	.	1855	
02-35	E	03.50	T	TOP OF RIDGE, C. NORTH					1855	
02-35	E	14.00	S	SPRING BRANCH 2 LKS WIDE, C. NE					1855	
02-35	E	15.00	S	SPRING BRANCH 2 LKS WIDE, C. N					1855	
02-35	E	40.00	Q	SET QUARTER SECTION POST	CEDAR	12	NE	5	1855	
02-35	E	40.00	Q		FIR	5	SE	8	1855	
02-35	E	45.00	T	TOP OF RIDGE, C. N & S					1855	
02-35	E	62.50	T	SUMMIT ON S SLOPE. BEGIN ON SE DESCENT					1855	
02-35	E	80.00	C	SET POST COR TO SECS 1, 2, 35, 36	LAUREL	8	NW	57	1855	
02-35	E	80.00	C		LIVE OAK	4	SE	38	1855	
02-35	E	80.00	C		LAUREL	4	SE	38	1855	
02-35	E	80.00	C		CHINQUAPIN	2	SW	40	1855	Line lies on S & SE slope of mt. unfit for settlement. Dense growth of fir, pine, laurel, live oak & chincapin timber; and thick undergrowth of same.
02-35	E	80.00	D		PINE	.	.	.	1855	

TOWNSHIP 41S-03E

Line	Dir	Dist	Code	Intercept	Species	Tree Diam	Tree Bear	Tree Dist	Year	Line Description
01-02	S	02.91	S	CROSS A SMALL BRANCH, COURSE EAST					1871	
01-02	S	40.91	Q	SET A SAND STONE 24X18X3 FOR 1/4 SEC COR. NO TREES NEAR TO MARK.					1871	
01-02	S	58.40	V	TO TOP OF A BRUSHY HILL					1871	
01-02	S	58.40	T	TO TOP OF A BRUSHY HILL					1871	
01-02	S	80.91	C	TO POST, CORNER TO SECTIONS 1-2-11 & 12	.	.	.	.	1871	Land rolling, soil good. First half mile covered with chapparal, last half mile bearing good bunch grass and some scattering oak.
01-02	S	80.91	D		CHAPARRAL	.	.	.	1871	
01-02	S	80.91	D		BUNCH GRASS	.	.	.	1871	
01-02	S	80.91	D		OAK	.	.	.	1871	
01-06	N	35.00	T	TO THE TOP OF A HILL LYING EAST AND WEST					1871	
01-06	N	40.00	Q	SET A POST FOR QUARTER SECTION CORNER	BLACK OAK	20	SW	48	1871	
01-06	N	40.00	Q		BLACK OAK	22	NE	73	1871	
01-06	N	49.80	S	CROSS A SMALL BRANCH, COURSE EAST					1871	
01-06	N	76.60	S	CROSS A BRANCH [SKOOKUM CREEK] 20 LINKS WIDE, COURSE SE					1871	
01-06	N	80.00	C	SET A POST FOR CORNER TO SECTIONS 1-6-31 & 36 AND T40 & 41S OF R 3 & 4 EAST OF THE WM.	YELLOW PINE	14	NW	70	1871	
01-06	N	80.00	C		YELLOW PINE	10	NE	73	1871	
01-06	N	80.00	C		YELLOW PINE	20	SE	58	1871	
01-06	N	80.00	C		WHITE OAK	20	SW	73	1871	Land nearly level, soil good. Timber first rate yellow pine, cedar, white & black oak. Undergrowth scattering patches of chapparal, grass good and plenty.
01-06	N	80.00	D		CEDAR	.	.	.	1871	
01-06	N	80.00	D		CHAPARRAL	.	.	.	1871	
01-06	N	80.00	D		GRASS	.	.	.	1871	
01-12	W	39.86	Q	SET A POST FOR QUARTER SECTION CORNER	YELLOW PINE	24	SW	16	1871	
01-12	W	39.86	Q		BLACK OAK	12	NW	69	1871	
01-12	W	77.61	T	TO SUMMIT OF A RIDGE BEARING N & S					1871	
01-12	W	79.72	C	TO POST, CORNER TO SECTIONS 1 & 2, 11 & 12	.	.	.	.	1871	Land rising to the west, soil fair. Timber scattering oak and pine. Last half mile covered with chapparal, on first half mile grass good and plenty.
01-12	W	79.72	D		CHAPARRAL	.	.	.	1871	
01-12	W	79.72	D		GRASS	.	.	.	1871	

Section III: GLO Plats (Examples of Surveyor Maps)

(two individual plats, at a reduced scale, as described below)

- T37S, R2W (plat date: January 16, 1855) - Jackson County:

This GLO plat is located south of the Table Rocks and on the west side of early Medford. Medford or Chaparral City as some called it, was established nearly 30 years after this plat was drawn, in the east end and center of section 25, just prior to the coming of the railroad. Early Jacksonville, first called Table Rock City (Webber and Webber 1982), is shown in section 32 (NW ¼). This was the site of the first gold discovery in southern Oregon which resulted in the formation of a town site, platted in 1852. Jacksonville was the first County Seat of Jackson County.

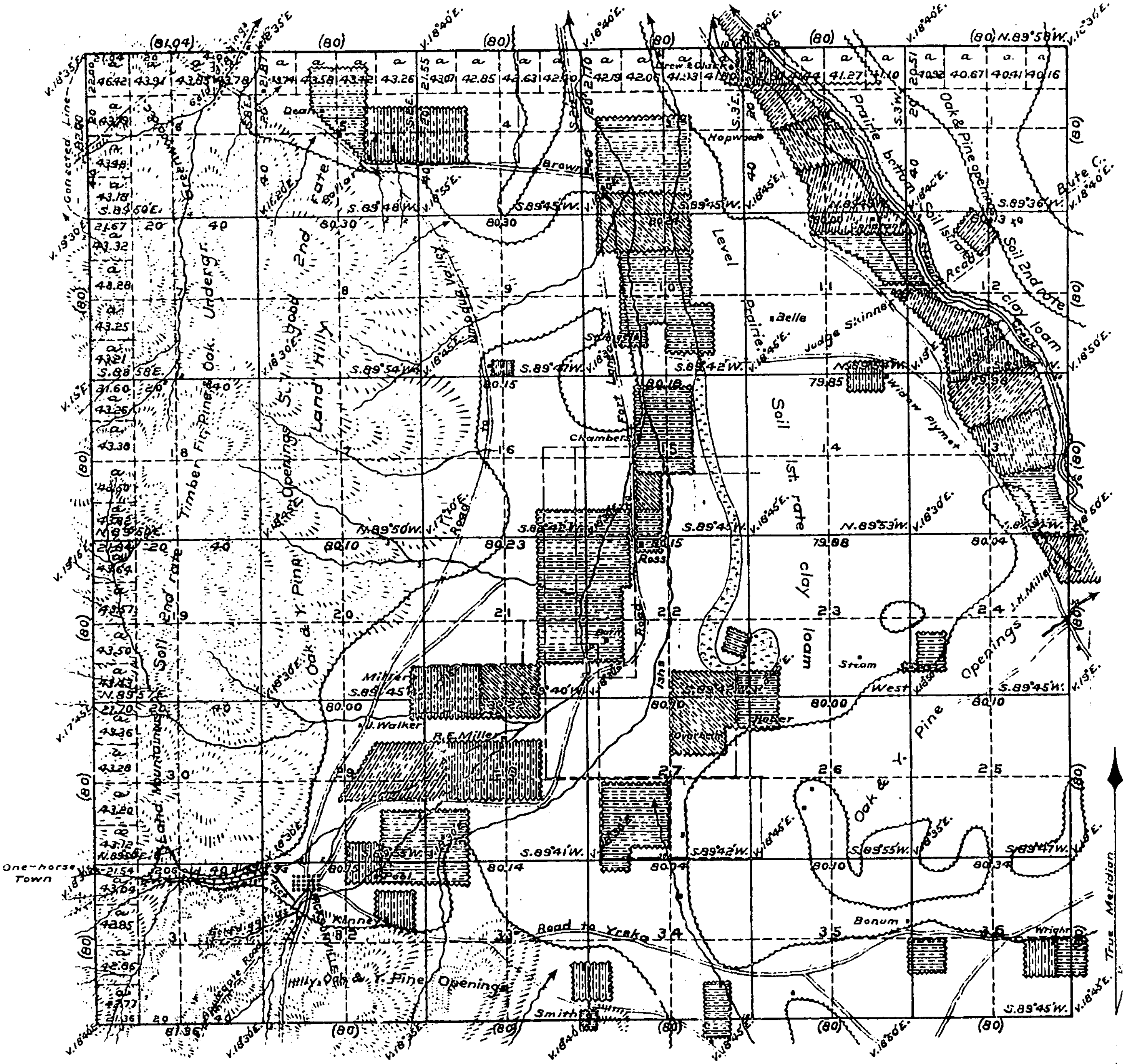
Early Jacksonville was founded at the edge of the valley floor, mostly on prairie, but at the boundary between prairie and forest or woodland. Early Medford was founded near the Bear Creek (Stewart Creek) riparian corridor in a mixture of pine-hardwood groves, mixed oak woodland, prairie swales, and brushy woodland or chaparral, the latter probably the result of very early severe logging of pine-hardwood forest.

- T36S, R5W (plat date: July 30, 1855) - Josephine County:

This GLO plat is located just west of the Josephine County line (east boundary), straddling the Rogue River (Gold River). In 1855, no communities existed here, and the early population was primarily near mining sites at Waldo and Kerbyville in the south end of the county (Marschner 2008). The future site of Grants Pass was established here nearly 30 years later, just preceding the coming of the railroad. Early Grants Pass was located in the south center of section 17, not far north of a ferry site crossing the Rogue River.

Early Grants Pass, like Medford, was founded on plains at a strategic site for establishing a train depot for the future railroad. Early vegetation was both mixed conifer-hardwood forest with some prairie swales. Douglasfir, yellow pine, sugar pine and possibly incense cedar, were probably the main conifers cleared for this town site, along with hardwoods such as black oak, white oak and laurel (madrone).

TOWNSHIP N° 37 SOUTH RANGE N° 2 WEST WILLAMETTE M

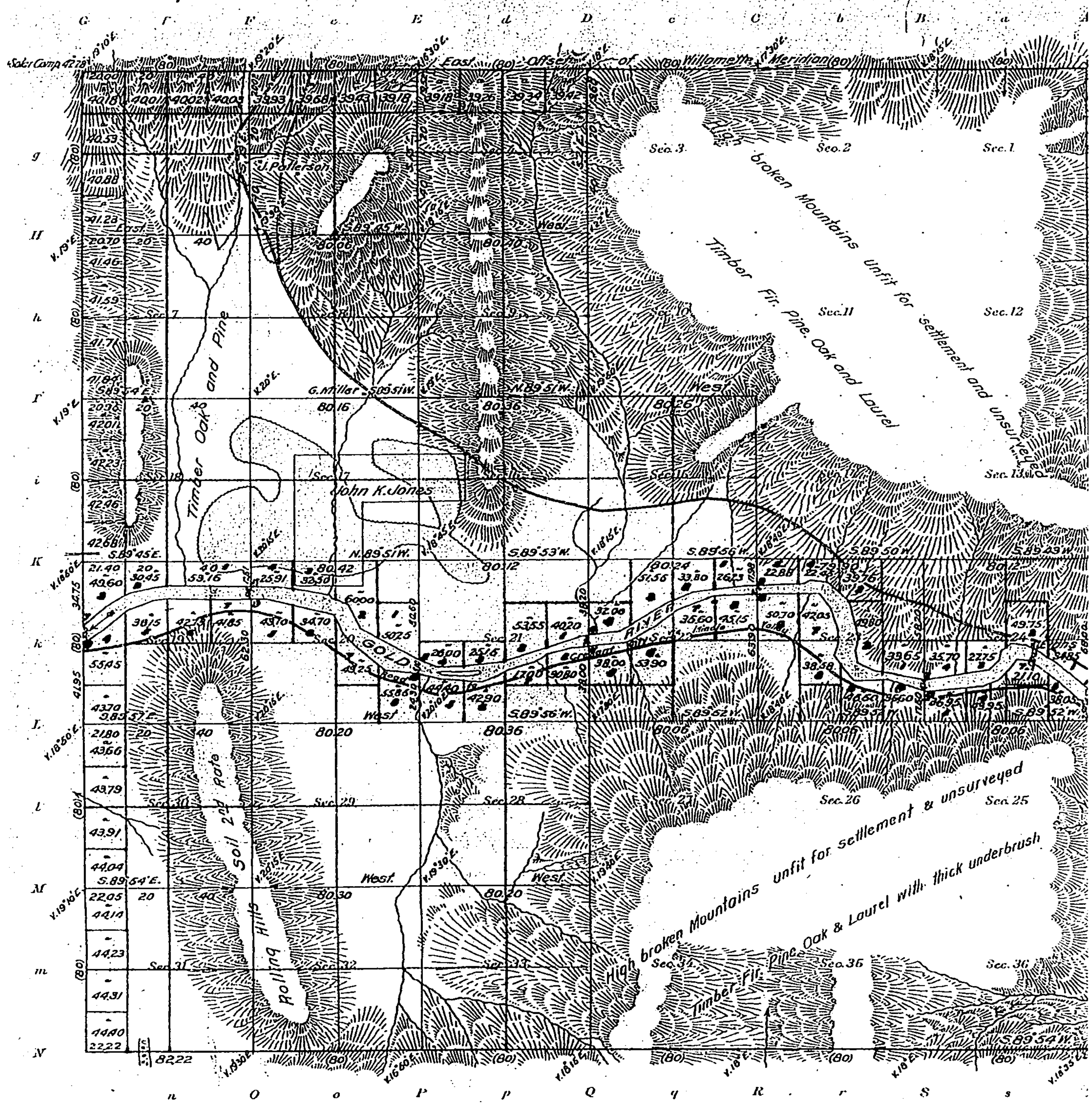


...nated	By whom surveyed	Contract		Amount of surveys			When surveyed	When charged in the Sur. Gen'ls. Accounts
		No.	Date	Miles	chains	links		
...es	Ives and Hyde	39	Jany. 4th. 1854	12	01	36	Decr. 25th 1854	4th. Qr. 1854
	Ives and Hyde	39	Jany. 4th. 1854	60	17	14	Jany. 16th 1855	1st. Qr. 1855
...r	of Acres		23,174.45					

The above Map of Township No. 37 South of Range No. 2 West of the Willamette Meridian Territory of Oregon is strictly conformable to the field notes of the survey thereof on file in this office which have been examined and approved.

Surveyor General's Office
Salem, January 16th., 1855
(Signed) C. K. Gardner
Surv. Gen. of Oregon

Township No. 36 South Range No. 5 West, Willamette Meridian,



Surveys Designated	By Whom Surveyed	Contract No.	Contract Date	Amount of Surveys Mls.	Amount of Surveys chs.	Amount of Surveys lks.	When Surveyed	When charged in the Sur. Genl's Accounts
Township Lines	Ives & Hyde	47	Augt. 18th 1854	12	02	22	July 30th 1855	3rd Qr. 1855
Subdivisions	Ives & Hyde	47	Augt. 18th 1854	43	09	40	July 30th 1855	3rd Qr. 1855
Meanders	. .	.	. . .	13	73	52	. . .	. . .
Total number of	Acres 13854.23							

The above Map of Fractional Township No. 36 South ... Meridian Territory of Oregon is strictly conforma... in this office, which have been examined and a... Surveyor General's Office. Salem July 30th 1855

Section IV: Historic Plant Names and Cross Reference to Scientific Names

A six page table follows, based on the GLO common plant name list for the Combined Studies (see Results, Vegetation Products: **Table 4, Native Plant List and Name Variations Used in SW Oregon GLO Surveys** (p. 45). Scientific names used in the Section IV Table are based on traditional botanical authorities and texts in common use (see reference list at end of table).

SECTION IV: HISTORIC PLANT NAMES AND CROSS REFERENCE TO SCIENTIFIC NAMES FOR SW OREGON
GLO HISTORICAL VEGETATION STUDIES, JACKSON & JOSEPHINE COUNTIES

GLO Plant Name & Variations	**Modern Common Name or Probable Name(s) / Notes**	**Scientific Name***
TREES		
alder	usually white alder - range is most or all of project area, but see below:	*Alnus rhombifolia*
"	red alder - only likely at moist west edge & moist NW corner of project	*Alnus rubra*
ash	Oregon ash	*Fraxinus latifolia*
balm, balm gilead, balm of gilead	black cottonwood	*Populus trichocarpa* (= *P. balsamifera* ssp. *trichocarpa*)
balsam	assumed to be balm or black cottonwood	*Populus trichocarpa* (= *P. balsamifera* ssp. *trichocarpa*)
black oak	California black oak	*Quercus kelloggii*
bull pine	ponderosa pine - young with dark brown bark, or large old open grown tree	*Pinus ponderosa*
bur oak	assume white or Brewers oak here since leaves are similar to the real bur oak	*Quercus garryana* or *Q. breweri* most likely at this single site (T39S, R2E, 12-13)
cedar, ceder	usually incense cedar - range is probably all of project	*Libocedrus decurrens* (= *Calocedrus decurrens*)
"	western redcedar - if present, only in moist NW corner of project	*Thuja plicata*
"	Port Orford cedar but only in west side tanoak zone (W of Williams)	*Chamaecyparis lawsoniana*
chinquapin, chincapin, chinkapin, chinkopin, chincopin	golden chinquapin, giant golden chinkapin	*Castanopsis chrysophylla*
chitamwood, chitam wood, shittim	cascara, chittam	*Rhamnus purshiana*
cottonwood	black cottonwood	*Populus trichocarpa* (= *P. balsamifera* ssp. *trichocarpa*)
crab apple	Oregon crab apple, questionable here (T38S,R1W, line 26-35) If inaccurate identity, possibly choke cherry or ?	*Malus fusca* (*Pyrus fusca*), but habitat suitability is a question (T38S, R1W, SE). Also possibly *Prunus demissa* (= *P. virginiana* var. *demissa*)
dogwood	Pacific dogwood	*Cornus nuttallii*
elder	assume blue elderberry (not a tree; see shrub list)	---
eucallypcus, eucalyptus	probably used here for Oregon myrtle	*Umbellularia californica*

GLO Plant Name & Variations	Modern Common Name or Probable Name(s) / Notes	Scientific Name*
fir	Douglas-fir is the target species throughout most of the project; but also grand or white fir (hybrid), in very moist low elev. or high cold locations	*Pseudotsuga menziesii*, *Abies grandis*, *Abies concolor*
hawthorn, thorn, haw	Douglas hawthorn, black hawthorn, western black hawthorn	*Crataegus douglasii*
hemlock	western hemlock is almost certainly misidentified in this project & probably is Pacific yew	*Taxus brevifolia*
jack oak	possibly very dense stands of short/scrubby young white oak/Brewers oak	*Quercus garryana* or *Q. breweri*
juniper	western juniper	*Juniperus occidentalis*
laurel, laurrel, laurell	Pacific madrone; much less likely myrtle in extreme west side coastal influence; (also see shrub list for laurel)	*Arbutus menziesii*; much less likely *Umbellularia californica* in extreme west side coastal influence
live oak, liveoak, live-oak	canyon liveoak	*Quercus chrysolepis*
madrone, madrona, matherone	Pacific madrone	*Arbutus menziesii*
maple	assume bigleaf maple (= Oregon maple)	*Acer macrophyllum*
mrytle, myrtle	Oregon myrtle, also known as California laurel	*Umbellularia californica*
oak	usually white &/or black oak; possibly live oak to the west in project	*Quercus garryana*; *Q. kelloggii*; *Q. chrysolepis*
pine	usually ponderosa pine; sugar pine in local areas, Jeffrey pine on serpentine	*Pinus ponderosa*; *P. lambertiana*; *P. jeffreyi*
poplar	assume black cottonwood, both low and high elevations; less likely is quaking aspen (only cold areas)	*Populus trichocarpa* (= *P. balsamifera* ssp. *trichocarpa*); less likely *Populus tremuloides* (only cold areas)
quaking aspen	quaking aspen	*Populus tremuloides*
red cedar	incense cedar, western redcedar, Port Orford cedar depending on location	*Libocedrus decurrens*; *Thuja plicata*; *Chamaecyparis lawsoniana*
red fir	Douglas-fir	*Pseudotsuga menziesii*
redwood	used mostly for incense cedar; also possibly western redcedar &/or PO cedar (west end of study)	*Libocedrus decurrens*; and/or *Thuja plicata* or *Chamaecyparis lawsoniana* at west end of study area
scrub, schrub, shrub or small oak	assume white or Brewers oak; but scrub oak may = live oak in west project	*Quercus garryana*; *Q. breweri*; possibly *Q. chrysolepis* for scrub oak - west side
scrub pine	probably young ponderosa pine stand, or any stressed pine on poor site; or small Jeffrey pine on serpentine	*Pinus ponderosa*; possibly *P. attenuata*, or *P. jeffreyi* on serpentine soils
shore pine	? - possibly young sugar pine; or knobcone pine; or ? (habitat is too far inland from coast to be shore pine)	*Pinus lambertiana*; *P. attenuata*; or ?; (too far inland to be *Pinus contorta*)

GLO Plant Name & Variations	Modern Common Name or Probable Name(s) / Notes	Scientific Name*
soft maple	assume bigleaf maple (= Oregon maple) (see maple)	*Acer macrophyllum*
spruce	possibly Douglasfir for this area, or ? (spruce is assumed absent here)	possibly *Pseudotsuga menziesii*, or ?
sugar pine	sugar pine	*Pinus lambertiana*
sweet oak	probably tanoak where cited here, but traditionally Sadler oak elsewhere	*Lithocarpus densiflora*, unlikely *Quercus sadleriana* here
tamarack	assume white fir since lodgepole (= tamarack elsewhere) is absent at site	*Abies concolor* (high cold) or its hybrid with *A. grandis* (grand fir, low moist)
tan oak	tanoak	*Lithocarpus densiflorus*
timber	any older tree stand, conifer or hardwood	---
white fir	white fir; data locations here are for east side high, cold snow zone	*Abies concolor* or its hybrid with *A. grandis*
white oak	Oregon white oak, also known as Garry oak	*Quercus garryana*
white pine	probably used for sugar pine in this area	*Pinus lambertiana*
willow	most likely tree willows here are: Pacific willow, Arroyo willow, Red willow, Scouler willow, or ?	likely *Salix lasiandra*, *S. lasiolepsis*, *S. laevigata*, *S. scouleriana*, &/or etc.
yellow pine	ponderosa pine &/or assume Jeffrey pine on serpentine	*Pinus ponderosa*; assume *P. jeffreyi* on serpentine soil or both species
yew, Pacific yew	Pacific yew	*Taxus brevifolia*
SHRUBS		
annis, anis	(see laurel-annis)	---
aroma balm (see balm)	sticky laurel, mountain balm, snowbrush, or varnishleaf ceanothus (west side)	*Ceanothus velutinus* or *C. velutinus* var. *laevigatus*
arrowwood, arrow-wood, Indian arrowwood, arrowood	creambush oceanspray	*Holodiscus discolor*
balm (shrub form)	sticky laurel, mountain balm, snowbrush, varnishleaf ceanothus	*Ceanothus velutinus* var. *velutinus* or *C. velutinus* var. *laevigata* (= var. *hookeri*)
bearberry, bear berry	pinemat manzanita (low shrub); but either whiteleaf manzanita or madrone (when cited as a witness tree)	*Arctostaphylos nevadensis*; either *Arctostaphylos viscida* or *Arbutus menziesii* (when cited as a witness tree)
bear brush	Fremont silktassel or bearbrush	*Garrya fremontii*
briars	assume prickly or spiny shrubs	Various
brush	any dense shrub stand, or mix of shrubs & young tree regeneration	---

GLO Plant Name & Variations	Modern Common Name or Probable Name(s) / Notes	Scientific Name*
buckbrush, buck brush, buck, buck bush	probably redstem ceanothus or less likely snowbrush (moist areas); wedgeleaf ceanothus (only likely if dry warm)	*Ceanothus sanguineus* or less likely *C. velutinus* (cool moist climates); *C. cuneatus* (only dry warm climates)
buck-horn, buck horn	unkn. in literature; assume wedgeleaf ceanothus based on associated sp.	*Ceanothus cuneatus* (name used in only two areas: T38S, R3W; T39S, R7W)
bugwood	birchleaf mountain mahogany	*Cercocarpus betuloides*
ceanothus	various species in project area	*Ceanothus* velutinus, *C. cuneatus, C. integerrimus, C. sanquineus, C. cordulatus*
chaparral, chapparral, chaparrel, chaparal, shaprell	usually com. buckbrush; but may be in a mix with whiteleaf manzanita & etc. but at high elevations, probably greenleaf manzanita & other sp.	*Ceanothus cuneatus* &/or *Arctostaphylos viscida*; *Arctostaphylos patula* - high elevations
cherry, wild cherry	bittercherry at high cold elevations; chokecherry in low elev. riparian; upland-consider serviceberry or Kl. plum	*Prunus emarginata* (high cold) ; riparian: *P. demissa* (= *P. virginiana* var. *demissa*) , in low uplands consider *Amelanchier* or *Prunus subcordata*
chimesal, chemesel	chamise but questionable identity; may be chaparral: i.e. com. buckbrush, manzanita, oceanspray, lilac or ?	*Ceanothus cuneatus* &/or *Arctostaphylos viscida*; less likely *Holodiscus discolor* or *Ceanothus integerrimus*.
chincapin, chinquapin, chinkapin, chicapin, chincopin, chinkopin	golden chinquapin or giant chinquapin (also spelled chinkapin)	*Castanopsis chrysophylla* (= *Chrysolepis chrysophylla*)
chokecherry	western chokecherry	*Prunus demissa* (= *P. virginiana* var. *demissa*)
currant	possibly red flower currant, sticky currant, wax currant, or ?	*Ribes sanguineum*, *R. viscosissimum*, *R. cereum* , or others
elder	blue elderberry	*Sambucus glauca* (= *S. caerulea*)
elkbrush, elk-brush	may be generic locally for dense impenetrable brush: lilac, buckberry, balm., etc	possibly *Ceanothus integerrimus, C. cuneatus, C. velutinus, C. sauguineus*, etc.
gooseberry, goose berry, goosebury	possibly lobbs gosseberry, Siskiyou gosseberry, or shinyleaf gosseberry, or others	*Ribes lobbii*, *R. binominatum*, *R. cruentum*, etc.
grape, wild grape, grape vine	western wildgrape	*Vitis californica*
greasewood, greecewood	wedgeleaf ceanothus or common buckbrush (our area); greasewood (Gilkey & Dennis 2001)	*Ceanothus cuneatus*
hazle, hazel, hazl	California hazel or western hazel	*Corylus cornuta* var. *californica*
heath	low dense shrubby growth; locally growse huckleberry or boxwood (only on eastside)	either *Vaccinium scoparium* or *Pachystima myrsinites* (cold east side of study area)
honey suckley, honeysuckle	probably either chaparral honeysuckle &/or hairy honeysuckle or ?	*Lonicera interrupta* or *L. hispidula*

GLO Plant Name & Variations	Modern Common Name or Probable Name(s) / Notes	Scientific Name*
huckleberry (see whortle)	huckleberry: various species depending on location , i..e. big , grouse, red or evergreen huckleberry.	*Vaccinium membranaceum* or *V. scoparium*, high cold east side; also *V. parvifolium* or *V. ovatum*, warm moist west side)
laurel, laurrel, laurle, lauarel (also, see trees)	snowbrush or varnishleaf ceanothus (also balm – shrub form, or mountain balm)	*Ceanothus velutinus* or *C. velutinus* var. *laevigatus*
laurel-annis, laurral-annis, laural annis	unknown.shrub; assumed to be aroma balm / laurel = snowbrush (based on associated sp.)	mostly *Ceanothus velutinus*, but rarely *C. velutinus* var. *laevigatus* (west end of study area)
lilac, wild lilac, lilack, lilach	deerbrush, wild lilac (lower elevations); but probably snowbrush in high east side snow zone	*Ceanothus integerrimus*, but probably *C. velutinus* in high cold eastside snow zone
manzanita, mancenita, mancinita, manzinita, mansanita	usually whitleaf manzanita, but also hoary manzanita in western part; only greenleaf manzanita in colder climates and high elevations	*Arctostaphylos viscida*; *A. canescens* (west side); *A. patula* (cold)
mountain balm	Snowbrush	*Ceanothus velutinus* (= *C. velutinus* var. *velutinus*)
mountain mahogany, mahogany	birchleaf mountain mahogany (also see bugwood)	*Cercocarpus betuloides*
mountain maple	probably Douglas maple (Rocky Mountain maple)	*Acer glabrum* var. *douglasii*
mountain oak	assume Saddler oak (deer oak); less likely huckleberry oak or low form of tanoak	*Quercus sadleriana*; less likely *Q. vaccinifolia* or *Lithocarpus densiflora* (low growth form)
mulberry or mulbry	unknown; single occurrence (T37S, R3W, line 5-32); consider serviceberry, oceanspray, osoberry, or ?	unk; *Amelanchier alnifolia* or *Holodiscus discolor*, *Oemleria cerasiformis*, or ?
ninebark	ninebark (Pacific ninebark)	*Physocarpus capitatus*
Oregongrape	mainly tall Oregongrape & Cascade Oregongrape; also Piper's Oregongrape	*Berberis aquifolium*, *B. nervosa*, *B. piperiana*
Oregon redroot	ceanothus; probably varnishleaf ceanothus (west edge of study); less likely redstem ceanothus.	probably *Ceanothus velutinus* var. *laevigatus* (west side); less likely *C. sanguineus*
plum, plumb, wild plum	Klamath plum, except as a witness tree which may be cherry, choke cherry, mountain mahogany	*Prunus subcordata*, except as witness tree which may be larger *Prunus* or *Cercocarpus betuloides*
poisonoak, poison oak	poison oak or Pacific poison oak	*Rhus diversiloba* (= *Toxicodendron diversilobum*)
red whortleberry, red whortl. bush	probably red huckleberry	*Vaccinium parvifolium*
rhododendron	Western or Pacific rhododendron (= mountain laurel). But sometimes misapplied here to an unknown shrub	*Rhododendron macrophyllum* (except where misidentified by GLO)
rose	mostly baldhip rose; possibly Nootka rose, dwarf rose, California rose, clustered wildrose	*Rosa gymnocarpa*, *R. nutkana*, *R. spithamea*, *R. californica*, *R. pisocarpa*
sagebrush, sage	name believed to be misidentified; likely gray rabbitbrush	*Chrysothamnus nauseosus* ssp. *albicaulis* or *C. nauseosus* ssp. *speciosus*
salal, sallal	salal	*Gaultheria shallon*

GLO Plant Name & Variations	Modern Common Name or Probable Name(s) / Notes	Scientific Name*
salmon berry	salmonberry is unlikely or would be rare here (Illinois Valley; also consider blackcap, raspberry, ninebark or ?	*Rubus spectabilis*; or *R. leucodermis*, *R. melanolasius*, *Physocarpus capitatus*, or ?
serviceberry, service, sarvice	primarily Pacific / Western serviceberry; less common is pale serviceberry	*Amelanchier alnifolia* var. *florida* (= *A. florida*); *A. pallida* (minor)
shoe-make, shoemake	refers to sumac which resembles Sitka mountaintn ash where cited in project	probably used for *Sorbus sitchensis* (high cold eastside snow zone)
skunkwood	probably skunkbrush (= squawbush) see: Randall 1965, also Yocom and Brown 1971)	*Rhus trilobata*
snowbrush, snow brush	snowbrush (also see balm)	*Ceanothus velutinus*
spice	probably Oregon myrtle = Calif. laurel where cited in NW corner of project	Probably *Umbellularia californica*
tasslewood, tasselwood	creambush oceanspray	*Holodiscus discolor*
thimbleberry	Thimbleberry	*Rubus parviflorus*
vine maple, vine-maple	vine maple when cited in low west side; assume Douglas maple in east side	*Acer circinatum* (west side of study area); *Acer glabrum* var *douglasii* (high cold east side of study area)
vines	vines represented by various shrubs	---
whortle, whorttle, whortleberry	huckleberry: mainly big huckleberry & less likely is grouse huckleberry (both in cold eastside); evergreen huckleberry or red huckleberry (warm moist westside)	*Vaccinium membranaceum*, *V. scoparium*; *V. ovatum*, *V. parvifolium*
willow (shrub form)	various in riparian i.e. Coyote willow, sandbar willow, etc; others in uplands	various in riparian i.e. *Salix exigua*, *S. sessilifolia*, etc; other willow species in uplands
OTHER		
bunchgrass, bunch grass	bunchgrass, various upland native sp.	---
elk brake	probably bracken fern	*Pteridium aquilinum*
fern	fern, various sp.	---
grass	grass, various sp.	---
nettles	probably stinging nettle (= northwest nettle) &/or hoary nettle	*Urtica dioica* ssp. *gracilis*, &/or *U. holosericea*
pea vine	assume pea, various species; but possibly vetch instead	assume *Lathyrus* sp. but possibly *Vicia*
weeds	weeds, assume unknown forb sp.	---
wild clover, clover	clover, various sp.	*Trifolium* sp.

* Scientific name references (primary sources): Abrams and Ferris (1923-1960); Gilkey and Dennis 2001; Hickman (ed. Jepson Manual) 1993; Hitchcock & Cronquist 1973; Peck 1962; Preston 1966; Sudworth 1908; see report by Pullen (1995), for local Indian cultural plant names. (also see botanist contributors list in "Acknowledgements Section" for those who assisted correlating difficult historical plant names with modern names).

Section V: Vegetation Type (Subclass) Legend and Map Unit Descriptions

F (a) Upland Forest

FFDF - Low to mid elevation xeric Douglasfir - mixed hardwood forest in a dry climatic zone (< 35 in. ppt.) where Douglasfir is dominant; yellow pine (ponderosa) and hardwoods are codominant or secondary. Tree stand data is usually referred to as fir "timber, heavy timber, or dense forest" by GLO surveyors. A reference to "opening" within the stand sometimes indicates a change from "heavy timber" canopy to dense undergrowth, "small fir" or "fir thickets," etc. In the Siskiyou Mountains or western portion of the project, some areas also include buck-horn, elk-brake, live oak, poisonoak and bugwood (birchleaf mtn. mahogany). These are believed to be mid or late successional stands where hardwood trees and pine are diminishing in abundance as the fir (Douglasfir) gains canopy dominance. Otherwise, this Type is believed to be similar to FFON below which should be used for more information.

FFDFBu - Same as map unit FFDF, but an old burn, sometimes referred as "partly burnt," or "nearly all burnt and dead." Some GLO data locations also identify the undergrowth as "dense brush" of manzanita, oak and fir.

FFOC - Moist Douglasfir Forest at low, mid or upper elevations, usually with madrone ("laurel") except in the colder high elevations; also may include some yellow pine (ponderosa) and black oak, rarely with bigleaf maple or Pacific yew. Some local areas in the western project near Evans Creek, Sexton Mtn. and Thompson Creek commonly include "redwood" (assume incense cedar); also sugar pine and live oak. Undergrowth is quite variable in GLO records but may have chinkapin, dogwood, hazel, serviceberry, lilac, willow, vine maple, thimbleberry, buckbrush (*C. sanguineus*), fern, and rarely bugwood, or cherry (bittercherry in cold locations). On the west side or Siskiyous, additional species noted (sometimes "thick") include salal, rhododendron, spice, arrowwood, elk-brake, chimesel, manzanita, chaparral, scrub oak, and snowbrush or balm. Inclusions of small areas with dryer south slope vegetation are included in the map unit. From modern inventories we know that white/grand fir is expected in some areas at low very moist drainage positions, and in some high cool elevations, although not identified in GLO survey notes.

FFOCBu - Same as map unit FFOC, but altered by burning

FFON - Low to mid-elevation xeric mixed hardwood-mixed conifer forest in the dry interior mountains climatic zone (under 35 in. ppt.). Either yellow pine (ponderosa) or hardwoods are dominant. Douglasfir is less abundant than in FFDF (above) and can be minor along with incense cedar. Both black oak and madrone (laurel) are usually present, with white oak included at dryer, lower or more open locations. This community is typically mapped on warm droughty sites such as southern aspects, or as developing stands that are early to midseral stages of FFDF. Understory species are not specified on some surveys, but in others are described as "thick/some" manzanita, greasewood, lilac ("lilach"), occasionally "plumb", or willow, and at high elevations cherry (bittercherry). Other plants less often mentioned include arrowwood, chimesal, hazel and bigleaf maple. Unmappable areas of OFON and dryer pine, oak woodland or savanna are included in places (10-40%). Some areas with granitic soils may also have sugar pine although not listed in survey notes.

FFPC - A mixture of xeric mixed conifer-mixed hardwood types, namely FFDF and FFON (unmappable, 40 - 60% each), found on complex low mountain topography east of Grants Pass.

FFPO - "Heavy timber" of fir (assume Douglasfir) with pine (yellow pine and sometimes sugar pine) in a cool moist climatic zone (over 35 in. ppt.) in SE Jackson County. Incense cedar is present in some places. Understory is brush or oak and chaparral, sometimes dense. This mixed conifer community is a more droughty warmer forest type than the adjacent FMFMP type, and white fir which is not mentioned, is probably less important and minor in the stand. In this map unit there are inclusions of "scattering" oak (black/white oak) and yellow pine. Undergrowth is described only as scrub oak, mtn. mahogany, & / or chaparral.

FFPOC - Complex mixture of "heavy fir timber," often on north slopes (fir is assumed to include both white fir and Douglasfir), with scattered yellow pine and black/white oak, in SE Jackson County, Klamath watershed. Undergrowth is manzanita (assume greenleaf), snowbrush, serviceberry, oak, chaparral, serviceberry, lilac, buckbrush, cherry, mtn. mahogany, and is "thin or dense," depending on location.

FFSP - Sugar pine mixtures with yellow pine (ponderosa pine) and fir (assume Douglasfir); xeric forest at low to mid elevations, usually including a hardwood mixture of laurel (madrone) and black oak. This vegetation type is normally found in the lower precipitation zones (under 35 inches), and the soils are sometimes noted as granitic. It is most common on south aspects or valley fans where pine is dominant, but may occur on north aspects with either pine or Douglasfir as dominant. Sugar pine ranges from common to sparse in the various canopy types. Open canopies, especially when mapped on southerly slopes, provide for some grass or bunchgrass understory at times.

FFSPH - Middle elevation (cool) moist forest on granite soils, sometimes described as "heavy timber" with fir (assume both white fir and Douglasfir), yellow pine and often sugar pine. A little black oak is sometimes present on warmer sites, along with "redwood" (incense cedar) and "hemlock" (assume Pacific yew). Undergrowth is often "dense," listed as chinkapin, arrowwood (oceanspray), aroma balm (snowbrush), hazel, willow, and/or manzanita (assume greenleaf).

FGC - A group of xeric mixed conifer-mixed hardwood types, namely FFDF, FFON, FFSP, OFON and prairie types. This unmappable, very complex pattern of soils and topography found on low hills and plains in the valley by Grants Pass and Merlin, is in a dry warm climatic zone (under 35 inches ppt.). Soils are often granitic in origin but a variety of other soils are found here as well.

FM - Laurel (madrone) forest or "thicket." When this Umpqua area type is used in the Rogue or Applegate area of this project area, some fir (assume Douglasfir) is included here from the local GLO records, but it is secondary to laurel.

FMFMP - Timber dominated by fir and pine, often "heavy or thick" in a cool moist climatic zone of SE Jackson County (Soda Mtn. area). Fir is believed to be both white fir and Douglasfir (red fir), pine is yellow or sugar pine. Incense cedar and black/white oak may be present in places. Undergrowth is hazel, serviceberry, balm/laurel (snowbrush), vine maple (assume Douglas maple here) and less often chaparral, buckbrush, lilac, oak (often "thick, dense or heavy"). It is similar to more open woodland type OMPFC, and similar to forest type FMFW which does not normally have oak.

FMFP - Very moist Douglasfir-mixed pine (sugar and ponderosa)-black oak forest in low, mesic, interior valleys and mountains of southwest Oregon. Chinquapin, laurel (madrone), bigleaf maple and cedar (incense cedar and sometimes Port Orford cedar) are often present in this high precipitation zone at the eastern edge of the Coastal Mountains (Tan Oak Zone). Understories are "brushy in places" and may include vine maple, yew, hazel, lilac, dogwood, live oak, tanoak (assumed to be abundant but seldom identified by GLO) and "whortleberry" (huckleberry). Some less common species are myrtle, "greasewood" (wedgeleaf ceanothus), tamarack (probably grand fir), chitamwood (cascara) and balm (varnishleaf ceanothus). Other species sometimes noted include manzanita, buckbrush, thimbleberry, willow, Oregon redroot, arrowwood, poisonoak, plum and fern. Tree density varies considerably in some places. More open areas with woodland spacing are included here and considered unmappable. Maple and alder (assume white alder) are mentioned primarily when crossing the associated creeks.

FMFPBu - As map unit FMFP, but is burned; an "old deadening," with dense thicket of species such as chaparral, manzanita, buckbrush, vine maple, huckleberry, maple, live oak, tamarack (assume grand or white fir) and chinquapin, also with "small or scattered timber."

FMFW - Fir timber (assume white fir and Douglasfir) with incense cedar, yellow pine and sometimes sugar pine. Undergrowth includes "laurel" (snowbrush), manzanita (assumed to be greenleaf), and sometimes "lilac" (*Ceanothus* but not necessarily *C. intergerimus*, probably snowbrush), tasselwood (oceanspray), willow, "heath". This type occurs in a cool moist climatic zone of SE Jackson County near the Klamath County line.

FMFWBu - same as map unit FMFW but burned; contains dead timber and brush.

FMPF - Warm moist mixed pine (ponderosa and sugar)-Douglasfir-black oak-madrone (laurel)-incense cedar forest in the Tan Oak Zone, primarily low interior valleys, foothills and coastal mountains of the Illinois River watershed. Sugar pine is occasionally absent from the descriptions, while white oak and bigleaf maple (both uncommon) are sometimes present. Tree density varies considerably in some places, and some more open areas classified as woodland are included, considered unmappable. Some inclusions in this type must be grassy since they are often labeled as "open" and "good grazing" or "good grazing land, fit only for grazing." This type is typically found on both valley plains (bottomland) and southerly mountain slopes. GLO understory species documentation is quite variable but may include oak, hazel, live oak, lilac, greasewood, manzanita, buckbrush, dogwood, fern, chinquapin and bearbrush. Maple, alder and ash are found along the associated creeks. Some moist forest areas (FMFP) are included which are not mappable.

FPVF - Valley floor plains and old alluvial fans with yellow pine (ponderosa)-mixed hardwood forest associated with deep, very productive alluvial bottomland soils. Early settlers often referred to these areas as "pine or oak groves." Black oak, white oak and laurel (madrone) were common or co-dominant with the pine. Cedar (incense), "thorn" (hawthorn), lilac and "greasewood" (wedgeleaf ceanothus) were sometimes present. Examples of this type were only found in the dry interior valley near present day Medford. In higher rainfall margins of the valley (over 25 inches), or where soils were enhanced with subsurface water (such as the large moist alluvial fan SW of Phoenix), Douglasfir was probably common, even if absent from GLO notes. Also, this plant community is believed to be rich floristically although not indicated as such by the GLO record. The type is classified as forest, although it is likely that historic burning patterns explain why some areas fit the more open "woodland" density class. FPVF primarily occurred on very old valley plains, large alluvial fans and high old alluvial terraces. However, north and northeast of the mouth of Bear Creek there are examples on lower terrace soils and marginal riparian zones (rarely flooded) such as in Sams Valley and along the Rogue River. GLO notes do not give enough details to separate pine forests of typical valley floor plains from those on marginal riparian bottoms which rarely flood. Some "openings" and prairie may have occurred here as inclusions which had little pine, mostly white oak and/or grass cover. Also, unmappable areas of "creek timber" (FAT) and meadow prairie (PF) may be included where this unit borders high frequency flood zones (10 – 20% of map unit).

FSJF **-** Yellow pine dominant forest with Douglasfir and incense cedar on upland soils derived from serpentinite and peridotite. Jeffrey pine is probably dominant on this map unit due to serpentine soils, even though yellow pine is normally used to indicate ponderosa pine. Laurel (madrone) and oak are incidental (seldom mentioned). Understory species other than "greasewood" (wedgeleaf ceanothus) and manzanita, are not specified.

FSJFO - Forest co-dominated by yellow pine and Douglasfir timber, or Douglasfir is dominant with yellow pine in the stand. Soils are derived from serpentinite-peridotite geology, as is map unit FSJF, but with black oak and laurel (madrone) included in the stand records. Jeffrey pine is probably present on this map unit due to serpentine soils, even though yellow pine is normally used by GLO surveyors to indicate ponderosa pine. Understory is primarily hazel, lilac, manzanita, "greasewood" (wedgeleaf ceanothus), honeysuckle and oak, or is sometimes given only as "very little." Incense cedar is present in some locations. Tree density ranges to "woodland" spacing in some locations, usually where pine is dominant, and is sometimes referred to as "open" or "scattering," (all unmapped inclusions).

FWF - High elevation white fir timber, primarily on north slopes, in a cold southern Cascades snow zone. Douglasfir, yellow pine and incense cedar are rarely listed as present, and are most likely on the warmest topographic positions. Undergrowth is usually listed as "balm" (snowbrush) and/or lilac (*Ceanothus* but probably not *C. intergerimus* at this location since this species is not found here in modern inventories; assume snowbrush: *C. velutinus*).

FWFC - High elevation, cold, snow zone of the southern Cascades with fir, pine and cedar timber, often "dense, heavy or thick." Fir is assumed to include both white fir and Douglasfir, but white fir is assumed to be dominant and the primary species in most locations. Pine is usually present as a less common secondary species (assumed to include both ponderosa pine and sugar pine) but may have been more prominent in warmer positions or in younger developing stands. Cedar (assume incense) is usually sporadic or incidental and sugar pine is reported in a few locations. Undergrowth is often dense such as laurel or balm (snowbrush), serviceberry, manzanita (assume greenleaf), dogwood, "hemlock" (assume Pacific yew here) and bush chinkapin; also gooseberry, cherry, willow, elder (assume blue elderberry), shoemake, bearberry, laurel-annis, vine maple (probably Douglas maple here), and "whorttle" (huckleberry).

FWFCBu - same as map unit FWFC but burned; dead timber and brush, dense undergrowth.

FWFO - Similar to FWF (same topography, setting, overstory) but description includes minor oak (assume black oak), and undergrowth is listed as only willow, hazel.

F (b) Riparian and Wetland Forest

FAS - Ash swale, sometimes "brushy" or "thick." Oregon ash, willow and briars are the only plants mentioned in GLO notes. It is found in low valley floor depressions/swales associated with creeks or dry channels.

FAT - Riparian hardwood forest ("creek timber") generally in **dry** interior valleys of SW Oregon, dominated by mixtures of Oregon ash, black cottonwood ("Balm of Gilead"), white oak, black oak, willow and white alder. Occasionally, yellow pine, cedar and bigleaf maple are listed, with fir and cherry (chokecherry) rarely noted. Balm is assumed to be dominant only in local areas and along creek edges or swales. Recent investigations on these bottomland sites show that when cottonwood dominates these riparian forests, soils are usually more sandy / gravelly and the stands have little or no oak. Understories are not always given in GLO notes but some include a dense mixture of grape vines, nettles, "briars", hazel and/or "thorn" (hawthorn). It is assumed plum, elderberry and chokecherry could have occurred. A variation of this type was mapped in **mois**t western valleys that may include yew and fir (assume Douglasfir and probably grand fir in places). In the mesic Illinois Valley, additional undergrowth may include hazel, vine maple, dogwood, manzanita, thimbleberry, ninebark and possibly salmonberry (questionable identity). Included are unmappable areas of "thick creek brush" or "brushey bottoms" (HUR), prairie (PA, PF); and (in Ill. Valley) fir thickets or pine-oak openings.

FATK - Brushy floodplain with black cottonwood and willows along creeks on mid elevation bottoms (Klamath River watershed in Southern Cascade Mountains).

FTC - Black cottonwood ("Balm"), ash, white alder, and willow riparian forest on gravelly, sandy alluvial bottomland in the Rogue Valley, where balm is primary and other hardwoods are secondary. Occasionally, bigleaf maple, hawthorn, incense cedar and/or yellow pine are noted. Undergrowth records are sketchy but may include hazel, vine maple, willow, briars and/or nettles. Unmappable inclusions of pine-mixed oak, and fir woodland are included on more loamy, clayey alluvium along with thick "creek brush" (**HUR**).

FTCC - A riparian zone complex (unmappable as individual components), primarily of balm with other hardwoods (**FTC**), and "creek brush" (**HUR**). Undergrowth is mostly unspecified except for willow, "greasewood," briars and nettles. Sometimes there are small inclusions of open "yellow pine"-oak woodland and/or scattering oak-pine savanna.

H. Shrubland and "thickets"

HA - Manzanita shrubland.

HAP - Manzanita "thicket" with small size yellow pine and oak; found on broad valley floor, terrace or plains positions.

HCH - "Chaparral thicket" or "thick growth" at low or middle elevations, species unspecified; probably a mixture of manzanita, "greasewood" (wedgeleaf ceanothus), poison oak, young white and/or black oak, and "plumb."

HCHO - "Heavy, dense, or brushy" chaparral brushfields on various aspects at moderate elevations in the southern Cascades (Soda Mtn area), and on upper elevation southerly mountain slopes of the Siskiyous. In the southern Cascades, species are unspecified, but probably mixtures such as wedgeleaf ceanothus, serviceberry, plum, white oak, and/or mtn. mahogany, with bitterbrush in some more open stands. In middle/upper elevations of the Siskiyou Mtns. (Applegate area), this map unit also includes thick undergrowth of oak, arrowwood, elk-brush, serviceberry, willow (and assume bittercherry in this setting). Young pine, oak, fir may occur in the undergrowth. These sites are probably recovering from old burns. Minor inclusions of pine, oak, fir timber, and upland prairie on upper ridge slopes (PU) may be included.

HE - Ceanothus shrubland, mapped in the southern Cascade Mountains (Soda Mtn. and Chinkapin Mtn. areas) at high elevations in the mixed fir and true fir zones (white fir and Douglasfir). GLO data indicates "dense balm and/or lilac brush," and we assume they may also contain greenleaf manzanita and possibly shrub chinkapin. Lilac at these high elevations is assumed to be *Ceanothus velutinus* or snowbrush, not *C. integerrimus* as at lower elevations. These are probably old burns.

HED - Brush fields, without overstories or with minor yellow pine, fir, incense cedar, and oak in the southern Cascades (Klamath watershed). Undergrowth sometimes described as "thick" or as "almost impenetrable undergrowth of brush on NE face" and includes mixtures of snowbrush, manzanita (assume greenleaf), mtn. mahogany, serviceberry, scrub oak and sometimes cherry, buckbrush (also we assume plum and lilac were included).

HHCH - Moderate to high elevation chaparral thickets, usually manzanita-mixed shrub brushfields, primarily on southerly slopes in the eastern Siskiyou Mountains (Applegate area). Brush stands or "dense undergrowth" are manzanita (assume greenleaf above 4000 feet elevation, whiteleaf at lower elevations). A short list of other shrubs, includes only buckhorn and sweet oak brush in some places, but a greater list in other areas includes laurel, chinquapin, hazel, and live oak. Scattered trees, if present, include yellow pine, white pine, red fir, maple, "laurel" (madrone) and fir (assume both Douglas fir and white fir). These sites are probably recovering from old burns.

HMO - Dense "mahogany brush" or "plum-mahogany thickets" (Klamath plum and birchleaf mountain mahogany) which sometimes include white oak. These brushfields are probably recovering from old burns. In the southern Cascades (Soda Mtn. area), this type of "dense chaparral" is typically found on middle elevation loamy soils and is often very dense on north facing slopes. Additional undergrowth species were not specified. In the Siskiyou Mtns. (Applegate area), this vegetation type was found on low to mid elevation mountain slopes of all aspects, but especially on southern aspects at the mid to upper elevation range. Undergrowth may be thick brush, "thickets" or "thick chaparral" (assumed to include manzanita, and possibly wedgeleaf ceanothus, serviceberry, and/or poisonoak) sometimes with a few scattering pines or madrone. Inclusions of upland prairie (PU) on shallow loamy upper ridge slopes, and minor inclusions of conifer patches were also present.

HN - "Greasewood" brush or "thickets" (wedgeleaf ceanothus) on plains or uplands; treeless based on GLO notes but assumed to have incidental white oak or yellow pine in places.

HNM - **"**Greasewood" brush or "thickets" without additional species noted, on patterned ground or mounded plains/tableland. This type is similar HN on non-mounded landscapes.

HSC - Dense (deciduous shrub) serviceberry-cherry thickets, or cherry brush, sometimes with oak (probably white, Brewers, or scrub oak). Some areas on warmer slopes are mostly scrub oak or dense oak brush and assumed to include plum and/or serviceberry. Located in the southern Cascades on upper elevation ridges of the Klamath watershed.

HSO - Mostly "thick" deciduous brush stands of oak brush or scrub oak, sometimes called "thickets," occasionally with serviceberry and juniper. It occurs on warm middle elevation slopes of the SW Cascades (Klamath drainage) near Soda Mtn. and is usually at lower elevations than HSC. Undergrowth is not listed but assumed to include plum, lilac, birchleaf mtn. mahogany and/or wedgeleaf ceanothus.

HU - Brush; composition unknown.

HUR - Riparian zones called "creek brush," "brushy bottoms," and "very brushy bottoms," also referred to as "brush, thick brush, thickets." Composition may be unknown, or sometimes includes willows, grapevines, and briars, and probably occasional hardwood trees. Although not listed by the GLO, this historic 1854 account for Bear Creek Valley cited the following "A few wild plums were to be had along the streams, and elderberries quite plentiful" (Stearns 1987). Some examples of "creek brush" may represent young stands of "creek timber" (FAT) in an early stage of development, while others are probably just shrubby thickets with little tree potential.

HW - Willow swamp or "willow swale" with no local descriptive information.

HWA - Willow swamp, sometimes with quaking aspen, but otherwise undescribed; middle elevations with cool climates of the SW Cascades (Rogue watershed side of Soda Mtn.).

HW - Willow swamp or "willow swale" at low elevations in western portion of project with no local descriptive information.

HWS - Willow swales or narrow drainages near the Table Rocks in Jackson County that also include tree or shrub forms of willow and occasional Oregon ash, white alder and/or cottonwood ("Balm of Gilead").

N. **Composition Unknown**

NG - Used here for a "rocky glade" or opening in forest with no vegetation data provided.

O. **Woodland** (Stands are variable & sometimes include areas of "Forest" density)

OBF - "Open" black oak-Douglas fir woodland described in the Umpqua Valley with oak and hazel understory. Minor amounts of pine (sugar pine and yellow pine) are added at this location by Lake Selmac (Illinois Valley) in SW Oregon. The understory is undescribed locally by GLO.

OFDF - Same as FFDF (xeric Douglasfir-Pine &/or Mixed Oak Forest), but stands have lower density, sometimes described as "scattering, open timber, openings." A reference to "opening" sometimes indicates a break or departure from a full canopy of heavy timber" to "dense undergrowth" of "small fir" or "fir thickets." Some locations are described with chaparral, manzanita, scrub oak and laurel in the understory, but frequently no undergrowth data is given. Comments about productivity are sometimes included such as "good grazing" or "covered with grass" or "good pasture land."

OFON - Same as FFON (xeric mixed hardwood –mixed conifer forest) but with lower density where either yellow pine or hardwoods dominate. These stands are sometimes referred to as "open," or with "scattering" timber, and may include "good grazing" or "good grass" in places. In the Siskiyou Mountains (Applegate area), undergrowth is usually patches of chaparral and manzanita, or "thick" manzanita, oak and elk-brake: also lilac or wild lilac in places. It may include plum, scrub oak, poisonoak, serviceberry, hazel, and young conifers/madrone. Inclusions of oak or oak-yellow pine savanna and creek vegetation may occur. Upland prairie or "bald ridges" are common on shallow loamy ridge slopes of the Applegate watershed which are usually unidentified inclusions in the map unit. There are also inclusions of moist forest (FFOC) on complex topography, adjacent to the high precipitation zone at Tallowbox Mountain.

OMFP - Mixtures of fir (assume both Douglasfir and white fir) and yellow pine, often with incense cedar, at cool middle elevations in the southwestern Cascades. White fir is probably more common in older stands with the longest period since burning, and in the cooler topographic positions. Undergrowth is not described. Some areas of "forest" density are included in this "woodland" map unit.

OMOPK - "Scattering timber" of mixed oak and yellow pine, sometimes with incidental fir and incense cedar, found at mid elevations on topography dominated by steep to rolling warm southerly slopes. The map unit is located primarily south of the Siskiyou summit (near freeway) in SE Jackson County. Pine is common and hardwoods are both white/black oak. Undergrowth is not described – we assume various mixtures of chaparral, plum, lilac, serviceberry, mtn. mahogany, bitterbrush, common buckbrush and sometimes juniper. Inclusions of white fir-Douglasfir forest may occur on moist cool northerly aspects associated with loamy soils (estimated 5-10%); also found are un-identified brush thickets and upland prairie (est. 10-30% of map unit).

OMPFC - "Open woods" dominated by mixed pine (yellow, sugar pine), fir (assume both Douglasfir and white fir) and incense cedar of the southern Cascades plateau area. White fir is assumed to be less common at the driest locations and in areas most recently burned; but strongest in the cooler, moist positions and places with the longest history without fire. Likewise, black oak is more common in the warmer, drier locations. White oak and juniper appear in mostly poor soil, droughty inclusions. Undergrowth is mostly undocumented but a few references are made to buckbrush (identity is questionable here but may be either wedgeleaf ceanothus or snowbrush), chaparral, mahogany and manzanita (assume greenleaf manzanita).

OOP - Mixed white and black oak (either dominant), with or without scattered yellow pine (ponderosa). This sometimes ranges to pockets of pine dominating hardwoods (inclusions). "Laurel" (madrone) is present in some areas, usually where pine is more common. Understory associates, sometimes "thick," include "greasewood" (wedgeleaf ceanothus), manzanita, and sometimes "bugwood" (birchleaf mtn. mahogany), "plumb" and rarely lilac. This is a widely distributed vegetation map unit of mid-elevation uplands, low foothills, interior valley terraces and plains. "Good grazing land" is noted at times. Often this unit includes un-mappable areas of "openings" (probably prairie or oak savanna), white oak-"bugwood" woodland (OWM), or upland pine-fir forest types (10-40%). To the west in the Siskiyous, black oak becomes much less important (or absent) in this map unit than in the western Cascades, and madrone is usually minor or absent. Here undergrowth may also include chaparral, scrub oak, hazel and rarely cherry. In the Siskiyou Mountains (Applegate area), inclusions of "bald ridges" or upland prairie (PU) are assumed to be common on the shallow loamy soils of upper ridge slopes (5-15% of map unit). Most of these prairies were ignored by GLO surveyors in their survey notes.

OPB - Open yellow pine (ponderosa), fir (assume both Douglasfir and white fir) and cedar (incense cedar) timber near Howard Prairie, in the Klamath watershed of SE Jackson County. It occurs in cool mid elevations as flat to gentle slopes near the margins of meadow bottoms. Undergrowth is undescribed. These low plateau areas are assumed to be transitions from fir timber to only pine when approaching the edges of meadows.

OPFO - "Scattering" Douglasfir - pine woodland, usually with madrone ("laurel") and often with oak or chinkapin. A **variant** of this south coastal region vegetation type is recognized here for use east of the Coast Range, in moist interior mountains just NE of Grants Pass. The eastside version differs as follows: incense cedar is regularly present in the canopy and oak is black oak but not always present. Rarely, live oak is also present. Eastside undergrowth may include hazel, live oak, possibly chinquapin, and thickets of small, young fir (assume Douglasfir). Absent here in GLO data are rhododendron, huckleberry and salal, normally present in the coastal area, although both salal and rhododendron have been found nearby in modern surveys.

OPFOJ - Fir, pine, cedar mixtures at mid elevations on generally warm southern slopes, in complex with scabland or very rocky soils supporting juniper, oak, pine (un-mappable inclusions). Either fir (assume Douglasfir and possibly white fir) or yellow pine dominate the stands, with incense cedar common. Black oak and sugar pine are present in some places. Timber is "open" or "scattering" but can range to forest class density. Undergrowth is not well described but refers to oak, "balm" (snowbrush), lilac, manzanita (assume greenleaf), plum, "tasslewood" (oceanspray), and serviceberry. Numerous juniper scab rock inclusions are included on gentle or southerly slopes with other droughty soils with black/white oak, yellow pine and incidental cedar (estimated 10 – 20% of area).

OPFOK - Yellow pine (ponderosa) and fir timber (probably Douglasfir but may include some white fir in places). It occurs in middle elevations and dry, cool locations of the Klamath watershed in SE Jackson County. "Tamarack" is mentioned which may have been a name used for white fir. Also included are black oak and less often white oak. Similar areas with savanna tree density ("open woods") are included. In places understory notes include "fine grass, good grazing." There are inclusions of upland prairie with patches of brush/trees (PUD), 10 – 40% of map unit. Sugar pine was not mentioned by GLO, but is likely to have occurred with fir in places. Woody undergrowth is not identified.

OPMO - Yellow pine (ponderosa) is dominant or prominent, and co-dominant black and/or white oak, typically found on low mountains, foothill slopes and valley floor positions. Large areas mapped on plains and wide interior valleys, were sometimes referred to by GLO as "level pine plains, pine plains, rolling pine timber, or open pine timber. Inclusions of riparian brush, creek or bottom timber and prairie are believed to have been common but undocumented. "Laurel" (madrone) is usually present except at high elevations or on clayey soil, and minor occurrences of fir (Douglasfir) or incense cedar are sometimes present. Also, included are similar stands with "forest" density that occur throughout the range of the type (unmappable inclusions). Understory is often unspecified but may include "greasewood" (wedgeleaf ceanothus), manzanita and occasionally "bugwood" (mtn. mahogany), "plumb," or grass. In the Siskiyou Mountains, GLO data includes "thick, dense or scattering undergrowth" with oak, scrub oak, "buckbrush" (assume wedgeleaf ceanothus), poisonoak, Oregongrape, serviceberry and "buck-horn." Inclusions of prairie on shallow, loamy, upper ridge slopes are believed to have been common but unreported. Other un-mappable areas included are oak savanna "openings" (SWO), oak woodland (OOP), and Douglasfir forest (FFDF & FFON) (10-40%).

OPOFH - "High Rolling Land" in a cool to cold climatic zone; "scattering" fir or pine alters with oak for dominance; incense cedar is common. Assume both white fir and Douglasfir, yellow pine, white and black oak are included. Oak is probably more common in stands on drier locations or clayey soils. Undergrowth is not documented at most locations, but with a few references to willow, hazel, and chaparral.

OPOM - Patterned ground supporting woodland on mounds interspersed with scabland, on valley plains and tablelands. Mounded pine-oak woodland plains ("open pine timber") where yellow pine (ponderosa) is codominant, with white oak and lesser amounts of black oak. Madrone is absent or only minor. Understory is quite variable, sometimes with "greasewood" (wedgeleaf ceanothus) and/or whiteleaf manzanita, "thick" in places as in patches. "Openings" are interspersed throughout the type as very shallow, treeless swales/drains (often forming vernal pools), with a gravelly surface on the valley floor but very stony on upland tablelands.

OPOJ - "Light or scattering timber" of yellow pine and white/black oak, sometimes with juniper, in the southern Cascades. Undergrowth is mostly "grassy, good grass, abundant/rich bunchgrass, luxuriant bunchgrass." Woody undergrowth is generally none or little, but may include patches referred to as "much chaparral." There are small unidentified inclusions of open scabland (assume savanna or prairie) that probably supported minor juniper and oak.

OPPO - Yellow pine-mixed black/white oak woodland in moist climatic areas (Illinois Valley and Sunny Valley-Wolf Creek area), although white oak was seldom indicated in the Illinois valley. This type occurs on bottomland and warm southerly slopes, often on very productive soils, and is sometimes described as "open" or "scattering." The map unit may have both inclusions of "openings" or savanna, and denser forest. Fir (assume Douglasfir) is sometimes indicated as a secondary species. Undergrowth may be thick or only listed, and is sometimes omitted. Species sporadically included are "greasewood" (wedgeleaf ceanothus), manzanita, young oak, hazel, poisonoak, live oak, "balm" and "spice." This map unit is mixed with prairie (PF, PA), creek brush or "thick brushy bottoms" **(**HUR), and undescribed creek corridors.

OSMPF - Moist mixed pine (ponderosa, sugar) - Douglasfir - incense cedar woodland in the interior valleys of SW Oregon, Illinois Valley. Stand density is given as "scattering," but may include "forest" density in places (unmappable inclusions). Douglasfir may achieve dominance over pine (ponderosa and sugar) in older stands. This map unit is found on soils derived from serpentine and peridotite geology, usually stony and brick red in color. Consequently, Jeffrey pine is assumed to be present, or possibly even more common than ponderosa pine, when yellow pine is noted. Understory is poorly documented but includes manzanita, chinquapin, honeysuckle, myrtle, and sometimes oak (assume black), live oak and sticky laurel.

OSOP - Oak (black and white) and yellow pine woodland, where either yellow pine or mixed oak are dominant, mainly on serpentine soils in Josephine County. Sometimes incense cedar is present. Stands are called "scattering" or "open" but may range to "savanna" density on low interior valley hills and plains. Yellow pine is assumed to be used by GLO for Jeffrey pine on this type, replacing ponderosa pine on serpentine soils. Understories are "greasewood" (wedgeleaf ceanothus), oak, lilac, hazel, manzanita, or are not specified.

OSPFJ - Mixed pine – mixed oak timber similar to type OMPFC, but usually without fir. Both yellow (ponderosa) and sugar pine, black and white oak and incense cedar are usually present, and occasionally juniper. Woody undergrowth is none to "light" or "patchy chaparral." Grass is "thin, plenty or good." Occurrence is limited to the southern Cascades plateau area, south and east of Soda Mountain in the Klamath watershed.

OSPOF - Open yellow pine and oak woodland with Douglasfir in places, occurring on gravelly outwash fans/terraces with serpentine influence. Jeffrey pine is assumed to be present due to the presence of serpentine soils, along with ponderosa pine. Plant composition is poorly documented by GLO, with undergrowth only listed as manzanita, oak, lilac, "greasewood" (wedgeleaf ceanothus), or is unspecified.

OSW - White Oak Swale without additional information; probably a seasonally moist/dry shallow drain or bottom with brush and/or grass understory.

OSYP - Scattered or open yellow pine woodland slopes on droughty serpentine soils. Jeffrey pine is assumed to be yellow pine in this type, or may be mixed with ponderosa pine. Some Douglasfir may also occur. Stand composition is poorly documented and may include savanna tree density in places. Soils are "poor" reddish, very stony, serpentinitic, and severely impacting vegetative cover. Understories are not documented except to indicate "very little."

OWB - White oak woodland on droughty hill and ridge slopes that may include only minor or incidental occurrences of other hardwoods and conifers. When black oak, yellow pine (ponderosa), birchleaf mtn. mahogany ("bugwood"), or "laurel" (madrone) are noted, they are minor, or may be inclusions not diagnostic of the unit. Shrubs are often unspecified but may be "thick" or in "patches." This usually includes wedgeleaf ceanothus ("greasewood") and/or whiteleaf manzanita, and both are more common on loamy than clayey soils. Understory may be "grass" or be "good grazing land." A "scattering" of "oak openings" or savanna and prairie are often interspersed within the unit and unmappable (10 - 40%).

OWCP - A large, very complex pattern of various upland habitats without adequate or consistent GLO documentation for delineation and mapping, found in the southern Cascades eastward from Soda Mountain in the Klamath watershed of SE Jackson County. Estimated composition is woodland (OMOPK, OPOJ, OPFOK) 40-60%; shrubland (HMO, HCHO, HSC, HSO), 20-40%; upland prairie (PUD) 10 – 20%; and savanna (< 10%).

OWFC - Timber is fir, pine and cedar in the cold southern Cascades, as described in "forest" type FWFC, but only "scattering" timber. Undergrowth is dense or heavy balm (snowbrush).

OWM - White oak woodland on uplands where birchleaf mountain mahagony ("bugwood, plumb") is the primary associated species. From modern surveys we know that this map unit is usually found on northerly, loamy hill and ridge slopes that are too droughty for coniferous forest. Any mention of pine or black oak would be uncommon and not diagnostic of the unit.

P. **Prairie**

P - Prairie, wet and dry undifferentiated, sometimes with a few pine in the southern Cascades.

PA - Dry prairie on large valley floor plains or high terraces, and in small interior valleys, primarily non-flooding and non-riparian bottomlands; may also occur on gentle upland swales. Prairie is found on both clayey and loamy soils. It may be treeless or have "scattering" or "a few scattering" oaks, usually white oak, but sometimes black oak or yellow pine is noted. Low prairies bordering riparian bottoms may also include inclusions of moist prairie (PF). Passing through valley prairies are seasonally wet clayey swales and small creeks associated with willows, oak or thick riparian "creek timber." These un-mappable inclusions such as creek prairie (PF), creek brush (HUR), or creek timber (FAT) may represent 10-20% of the map unit.

PABS - A mixture of two prairie types, namely dry valley prairie (PA) and mounded prairie (PBS), where they are un-mappable as separate units.

PAD - Prairie of valley basins and plains in extreme SE Jackson County, similar to PA but may include "scattering" or incidental juniper, pine, oak. It is described as "fine prairie, rich grass, beautiful prairie" at some locations.

PASH - Dry and/or wet valley bottomland prairie (PA and/or PF) which cannot be classified from GLO notes, mixed with a "few scattering bunches" of ash or "ash timber" and may include scattered white oak, yellow pine and "thorn" (hawthorn). It occurs on bottomland north of Medford, with meandering creek channels and "swaley" areas. It cannot be determined from GLO notes if tree density of ash clumps actually fits "riparian forest or woodland" spacing.

PB - Brushy prairie; composition unknown, but probably a riparian type with "creek brush."

PBS - Mounded prairie or biscuit-scabland mapped on plains or tablelands, a complex pattern of small mini-mounds and very shallow intermound scabland drains which become vernal pools in many areas. Prairie mounds often have "patches" of thick "greasewood" (wedgeleaf ceanothus) brush in places. Survey notes sometimes indicate "a few scattering oak," with "greasewood" undergrowth. These are assumed to be either small inclusions of white oak savanna (SWO) or just incidental occurrences of oak. Grass types are not given in GLO data.

PBSK - Mounded prairie in extreme SE Jackson County (Klamath watershed); same as PBS but may also include scattered juniper, with black/white oak and yellow pine, or patches of the same. No mention of hydrology or whether there are vernal pools in wet seasons.

PF - Wet meadow or "creek prairie" in the Rogue watershed, found on low terraces, clayey swales, wetlands and riparian zones, subjected to incidental or seasonal flooding and/or seasonal watertables. GLO descriptions refer to "prairie bottom, fine grassy glade, marshy swale, springy swale, grass and clover moist glade," and "swaley."

PFAT - Mixture of "creek prairie" or wet meadow (PF) with significant amounts of "creek timber" (FAT) and "creek brush" (HUR). Trees or brush occurring in this prairie map unit near creek banks and on more frequently flooded positions, may comprise 20 – 40% of the map unit.

PFD - Moist or wet meadow in the Klamath watershed of the southern Cascades, found on creek terraces or valley bottom topography, sometimes with "good grass" noted. Willows, briars or other woody species are present along the creeks, and it may include "scattering timber" of yellow pine. Also included here are some adjacent areas of seasonally dry prairie, inclusions undifferentiated from this wet bottom map unit.

PU - Xeric upland prairie mapped on gentle to moderate hill slopes and steep uplands, also on steep mountain ridges, mostly south facing. Clayey soils are common in the lower elevation s of Bear Creek Valley, but with shallow loamy (or stony) soils in upper elevations or in the Siskiyou Mountains. Although treeless, it may have inclusions of scattered or incidental trees/shrubs, especially on the margins, sometimes with patches, "scattering" or "a few scattering" white oak (savanna), and sometimes with islands of oak woodland on included slopes. References are made to "good grazing land, hills covered with grass, good grass, grassy, bald hills." Some lower slopes grade into valley floor areas of prairie (PA). Inclusions of non-prairie types are estimated to range from 5% to 20%.

PUD - Upland prairie on moderate to steep slopes at mid elevations, in complex with sparse mixed oak, yellow pine and/or juniper, or patches/grooves of the same. Occurrence is in the dry climatic region of the Southern Cascades near Soda Mountain (Klamath River Watershed). Woody undergrowth is mostly described as none or with some chaparral (wedgeleaf ceanothus), but also includes a few areas with "dense thickets" of undergrowth. Descriptions given include "open slopes, bald hills, open land, little grass, good grass, good grazing, good cattle range."

PUS - Xeric upland prairie with scattered yellow pine (assumed to be Jeffrey pine) and sometimes white oak. This vegetation type is found on both gentle valley terraces and moderate to steep slopes of foothills and mountains of Josephine County. The stony, sometimes shallow soils are derived primarily from serpentine or peridotite. Yellow pine, when found on serpentine soils, is believed to be Jeffrey pine or a mixture with ponderosa pine. GLO vegetation data sometimes mentions only "patches of greasewood" (wedgeleaf ceanothus) with yellow pine. Some inclusions of Jeffrey pine savanna or pine-oak/fir woodland may also occur here.

S. **Savanna**

SPF - Same as woodland map unit, OMFP, with fir (assume both Douglasfir and white fir) along with yellow pine and often cedar (incense), but with fewer trees. This type in the Klamath watershed of the southern Cascades, and is described as "open timber, good grazing, open brushy country." It is not known if the open landscape is due to a site limitation, or is more likely the result of a severe burn. GLO undergrowth is usually omitted, but has included serviceberry, "tasselwood" (oceanspray), rose, and mtn. mahogany.

SPMO - Same as woodland map unit OPMO but has lower tree canopy density, referred to as "openings." This xeric type is mostly found on valley floors, low hills and on southerly slopes in central eastern Josephine County. Either pine or oak dominate the stands. On some locations, including some serpentine soils, fir is present but is minor or secondary to the other canopy species. Understory generally includes manzanita (sometimes "in bunches"), greasewood and rarely lilac. The typical understory density is undocumented most of the time, but on southerly slopes GLO notes have sometimes described understory as "little, very little, some, very sparse or mostly dead." In some areas, there is "good grass" or "good grazing."

SPOC - Mid elevation timber described as "openings" or "some open" of yellow pine, fir (probably Douglasfir), white/black oak and "redwood" (incense cedar). Occurrence is in the southern Cascades, Klamath watershed. Undergrowth is poorly described but may include "greasewood" (wedgeleaf ceanothus), mtn. mahogany, serviceberry, lilac, oak and/or sage.

SSRR - Scattered stunted yellow pine (assume Jeffrey pine) on gravelly, cobblestone outwash plains, serpentinitic and very droughty. Composition for this vegetation type is poorly documented, and the understory is not specified except for "greasewood" (wedgeleaf ceanothus). Density is typically very open, ranging to "woodland" class spacing in places, but these are treated as unmappable inclusions. The map unit is best displayed near the mouth of Rough and Ready Creek, south of Cave Junction in Josephine County.

SWO - White oak-grassland savanna (similar to OWB but lower tree density) mapped in the dryer valley floor and foothill area (Jackson County), and sometimes noted with "few scattered" oak. Occasionally this map unit includes only incidental yellow pine (ponderosa) and/or black oak. Understories are usually not mentioned but were probably bunchgrasses with few shrubs. There may be inclusions of oak woodland (OWB) and other vegetation map units in places. This vegetation type is probably grossly under mapped. For example, some woodland map units are encountered with possible references to savanna inclusions that are considerable un-mappable, i.e. "grassy, openings, or open" areas. Also, "scattered oak" mentioned in prairie descriptions probably refer to islands of savanna (SWO).

U. Unvegetated

UG - Gravel bars and riverwash; may have scattered willows or brush patches.

W. Water and Wetlands

W - Water bodies and rivers (> 1 chain across).

WU - Wetland, composition unknown.

Section VI: Contract Completion Letter and Summary to BLM

July 23, 2009

To: Steve Slavik, Medford BLM, COR for Contract # L07PX02701 (GLO project)

From: Gene Hickman, BLM contractor, Bend, Oregon

Subject: request for contract summary: deliverables and closing comments

In response to your request for a closing summary and comments regarding my GLO contract deliverables, I have prepared this synopsis of the project history and products developed. This contract was finalized and signed in May, 2007, for completion in May, 2008. Later, a time extension was granted with a new delivery date of January 15, 2009. The data files and map products were all delivered to ONHIC, as per contract (see item C.5.2.1), and all were certified as satisfactorily completed by ONHIC on or prior to January 13, 2009.

LIST OF DELIVERABLES:

1) The primary product specified for this contract was called a "vegetation condition map," to be created from GLO survey notes for the project area of 29 townships. The product is actually developed as a set of maps by townships, and are basically "historic vegetation" maps prepared in draft form by me, that were to be ready for digitizing under another contract. 2) In order to produce the maps, two other products were developed consistent with ONHIC instructions, both being essential for the preparation of the maps and for the interpretation/use of the maps. These are the transcribed GLO diary notes (contract item C. 5.1) developed on an Access data base (spreadsheet), and a map unit legend with Vegetation Type descriptions developed from the GLO plant data set.

Although my final subunit of mapping was completed and certified by ONHIC in January, 2009, the temporary loss of project funds delayed map digitizing of the last set for many weeks. In the meantime, I requested that BLM fund two additional townships to improve the geographical coverage. This was authorized by BLM memo to me on Feb 1, 2009, for delivery by May 30, 2009, with funding provided directly through the local BLM office. These maps were completed as before and approved by ONHIC for payment May 26, 2009, bringing the total number of townships completed for the project to 31.

QUALITY CONTROL AND SUBMISSION OF DELIVERABLES TO BLM:

This small project (only one of several related studies funded in a Grant through the Joint Fire Council) also involved a second BLM contract with the Oregon Natural Heritage Information Center of OSU (located in Portland), which worked in coordination with me for completing the products (contract item C.1.1.2). I was able to have peer review of the work as needed during the entire project from ONHIC. The Center also provided quality control for the maps as they were submitted for digitizing, and verified my completion of the work according to ONHIC standards.

Because of this unique working arrangement, all of my final products (see above) were given to ONHIC and funneled through this OSU office in Portland. Both the data files and GIS maps became part of the ONHIC master GLO data base, for formatting in special manner and for map compilation after digitizing. As a result, John Christy, my contact at ONHIC has packaged all the data sets in a zipped file which should be available this week to BLM and Paul Hosten, Principal Investigator for the Grant. The file was posted earlier, but some edits were made in the Access data, and the file was updated this week by ONHIC with these changes. The web site from which the products can be downloaded is located at: http://oregonstate.edu/ornhic/transfer/rogue_illinois_appleg.zip This will allow BLM to print hard copies of the vegetation maps and other work submitted (contract item C.1.1.1). As an added benefit, this file also includes my earlier GLO study (not part of this contract) covering 19 townships adjacent to the BLM study area, funded by OWEB through OSU. Also, I will arrange to obtain a copy of the above file directly from ONHIC, on CD (or thumb drive) in the near future for both myself and the BLM as an additional file backup.

Work copies of the USGS Quads were provided to me by the Medford BLM office for drafting and detailing rough vegetation notes as part of the map creation process to develop mylars for digitizing. These work maps were utilized for preliminary drafting during the map the making process, and instructions later from the PI were that these are not to be returned to BLM. (item E.2.3)

This project encountered a number of unique and unexpected (major) problems with the data base program and the computer equipment, delaying work considerably at times. A set of work diaries explained progress and documented work problems, and was included with each invoice to Medford BLM (contract item C. 5.4). Four invoices were submitted over the study period for the original contract of 29 townships because it was completed in segments, representing four geographical areas, convenient for organizing the work. The four areas or subunits matching the invoices, and the full project area are drawn on a small map which I have included here. The adjacent GLO project area I had completed earlier under separate funding through OSU is also shown.

CLOSING COMMENTS

The working arrangement with OSU was ideal for developing the products and completing the project, but may seem awkward to others regarding the delivery of my work back to BLM. Coordination with ONHIC was chosen to facilitate the completion of a product using a standardized system developed by the Center, with data formatting consistent with their system already in use, which led to this office being the final step in completing the data set.

In retrospect, an awkward part of the contract for me was reaching the end of this study knowing it was actually incomplete, in spite of fulfilling the contract, being without a contract item allowing me to package the data set for presentation to the PI and BLM. For this reason, I have identified this need in recent months, first by a memo to Charley Martin on January 21, 2009, and recently to both Doug Kendig and Paul Hosten. Without a document or report in which the products could be formally presented, study area described, procedures explained, results discussed and evaluated, important information about this project and the results may be lost or never identified. So it was very good to hear a few days ago that some funds have now been set aside for me to accomplish this purpose and also for future publication involvement with Paul. I am now developing my outline for the contents of this report, and will soon begin working to assemble an appropriate presentation of the GLO study to BLM and the project managers.

Gene Hickman

Cc: Dr. Paul Hosten, BLM Principal Investigator, NPS, Hawaii