South Ridgeline Habitat Study Final Report

August 2007

List of Tables and Figures

TABLES

FIGURES

****

Title:	South Ridgeline Habitat Study
Location:	City of Eugene, Oregon
Purpose:	Inventory and assess habitat values of upland areas
Area:	Approximately 2600 acres, southern edge of City
Time Frame:	May – October 2006; final report August 2007
City Project Mgr.:	Neil Björklund, Senior Planner, Planning and Development Department
Consultant Project Mgr.:	Bruce Newhouse, Salix Associates
Consultant Team:	Bruce Newhouse, Dick Brainerd (Salix Associates)
	Tim Brooks, Greg Winterowd (Winterbrook Planning)
	Christie Galen (SWCA Consultants)
	Nancy Holzhauser (Environmental Solutions LLC)
	Jim Reed and Erika Beyer (GIS)
	Barbara Wilson (Data Management and Entry)
	Katie Mitchell (Database Design and Reporting)
	Dan Gleason (Advisor: Pileated Woodpecker)
	Marc Hayes (Advisor: Northern Red-legged Frog)

****

1.0 Executive Summary

This report contains documentation of a five-month inventory and assessment of over 2600 acres of upland habitats on public and private land in the South Ridgeline area of Eugene, Oregon. The South Ridgeline Habitat Study (SRHS) was undertaken to document the location, quantity, and quality of upland habitat, and suitability of habitat for uncommon and rare species in the area, and to do so in a way that meets the inventory standards contained in the administrative rules for Statewide Planning Goal 5.

This study began in May 2006 with the City of Eugene leading preparatory meetings between staff and consultants, hosting a public information meeting, and sending out 1581 individual property owner requests for access for the field inventory along with information about the overall project. The inventory methodology was refined during this period with particular attention to the vegetation and wildlife communities found in Eugene. The consultants then conducted on- and off-site field inventories, completed spatial and text data entry and analysis, assessed (rated) site values, and prepared a draft report (dated November 2006). After public submittal of comments and review by the City and consultants, this final report was revised and submitted to the City.

The inventory and analysis was conducted in 21 Habitat Assessment Units (HAU) (Figure 3), which consisted of larger blocks or patches of habitat with generally well-defined boundaries. Each HAU was divided into sub-areas termed Vegetation Mapping Units (VMUs), each containing habitat with fairly homogeneous vegetation characteristics. Three hundred twenty (324) vegetation units were mapped within the study area, comprised of 22 different habitat (or cover) types (Table 9). Each VMU and each "parent" HAU were then assessed (rated) for uncommon and rare species and habitat elements, as well as for other habitat qualities such as size and diversity. Where access was not permitted, off-site inventories were conducted from adjacent lands, and assessments were completed using aerial photos, previous site analyses and data from similar reference sites. Individual VMU inventory forms and rating tables are in Appendix E, and HAU/VMU maps are in Appendix J.

This study provides a snapshot of habitat values present at the time of the inventory. Because some of the inventory areas are being actively developed for residential use or management is changing, they may no longer exist in the states in which they were evaluated. Many valuable natural resource sites that were inventoried are publicly owned and, therefore, not subject to the development pressure of nearby privately-owned properties – although there may be other stress factors that affect them.

Of the habitat types inventoried, the remnant savanna and grassland (prairie) sites rate the highest both because they are among the rarest in the Willamette Valley, and because they provide habitat to numerous rare species. This study includes an assessment of the uncommon and rare species as evaluated by several agencies, and an evaluation of their likelihood of occurrence in the habitat types inventoried in the SRHS area.

This report contains: 1) background information about the study area, including ecological history; 2) methodology for inventory and assessment ratings; and 3) a summary of results. The major appendices to this report include: 1) a table of uncommon and rare species with status and preferred habitat of each; 2) a set of matrices illustrating affinities of each uncommon and rare species for each

habitat type in the SRHS area; 3) individual vegetation mapping unit inventory and rating forms; 4) HAU maps showing vegetation mapping units within each; and 5) site photographs.

2.0 Purpose of the Study

The purpose of the SRHS is to "identify, map and evaluate the relative quality of predominantly native forest and shrub communities, oak savanna, and natural prairies and balds… and to address rare plants … their habitats, and the habitats of state-designated sensitive-critical or sensitive-vulnerable animal and bird species known to live within the study area" (City of Eugene 2006a). The City identified two objectives in addition to the purpose:

1) Create an up-to-date and accurate inventory and assessment of habitat features in the South Hills that will enable the City of Eugene to expand its Goal 5 inventory consistent with administrative rules for Statewide Planning Goal 5 related to wildlife habitat (as set forth in OAR 660-023-0110), and

2) Enable the community, city staff, the Eugene Planning Commission and the Eugene City Council to conduct an informed review of the existing habitat, and make clear and reasoned decisions regarding conservation of significant wildlife habitats and plant communities that are important to the community.

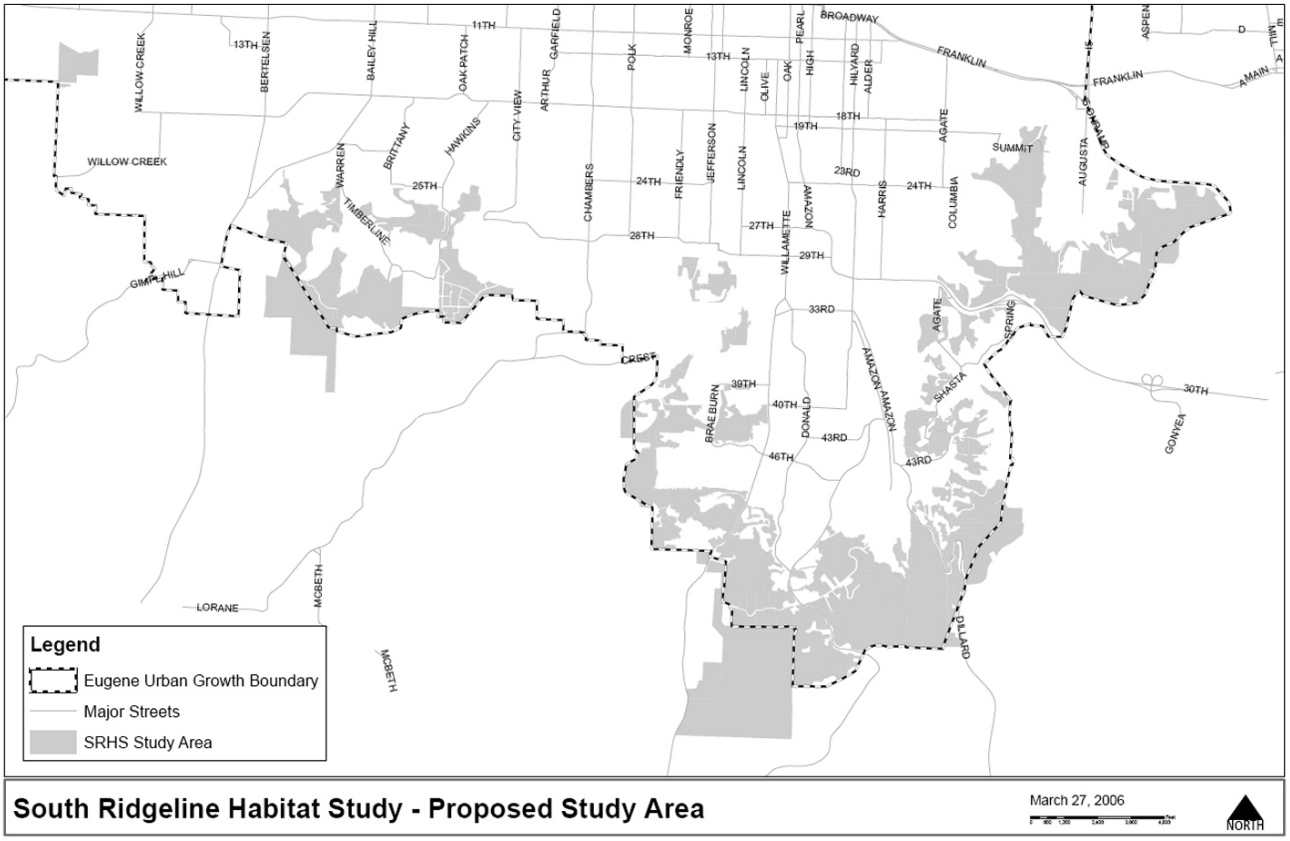
The City of Eugene identified the need for a more ecologically-based habitat inventory than previous Goal 5 inventories in order to recognize a broader range of ecosystem features and species are useful indicators of native biodiversity and ecological health, and are consistent with the intent of Goal 5.

Additional background on previous Goal 5 planning in the Eugene area is available on the City's web site (http://www.eugenenr.org/Eug_G5/default.htm) (City of Eugene 2006b).

3.0 Background

3.1 Landscape Context. The SRHS is located on the ridgeline generally defining the southern limits of the City of Eugene (Figure 1). The majority of the SRHS area drains into the Upper Amazon subbasin of the Long Tom Watershed, while a few areas outside the UGB drain south into Spencer Creek, Camas Swale Creek, and Russell Creek – the latter two feed directly into the Willamette River. Thus, the SRHS lands are headwater basins for Amazon Creek and its tributaries, and to a small extent, other Willamette basin streams.

Figure 1. Original SRHS study area.



Source: City of Eugene web site.

Within the hierarchy of the Environmental Protection Agency's ecoregion mapping system, the SRHS area lies within the ***Willamette Valley Level III Ecoregion***, and within the ***Valley Foothills Level IV subregion*** of that ecoregion (Thorson et al. 2003). Habitats within the study area are most closely allied with those of other foothill areas bordering the southern portion of Willamette Valley.

The Soil Survey of Lane County Area, Oregon (NRCS 1981) defines all or nearly all of the study area within the Bellpine – Hazelaire – Philomath Mapping Unit, which is characteristic of Willamette Valley foothills. This unit is described as follows:

> *Moderately deep and shallow, well drained and moderately well drained, gently sloping to steep silty clay loam, cobbly silty clay loam, and cobbly silty clay that formed in material weathered from sandstone or in mixed material weathered from igneous and sedimentary rock.*

Most slopes in the study area face in a northerly (from northwest to northeast) direction, but a few are oriented to other directions City park ownerships outside the UGB have mostly southerly or westerly aspects. Slopes range from nearly flat (e.g., portions of HAU 6, Morse Ranch) to extremely steep (e.g., rocky cliffs in HAU 11, Spencer Butte Park). Most slopes are gentle to moderate.

3.2 Ecological History. Prehistoric and historic changes in vegetation and associated wildlife in the Willamette Valley are well studied and analyzed. (See: Franklin & Dyrness 1989, Johannessen et al. 1971, Kagan & Wiley 2002, ODFW 2006, ORNHIC 2003, PNWERC 2002, Thelenius 1968, Thieman 2000, TNC 2004, Vesely & Tucker 2004, Wilson 1998, Wilson 2002, et al.). Little is known about initial settlement of western North America by the earliest human inhabitants after the crossing of the Bering land bridge at least 10 to 12 thousand years ago, but for the several millennia preceding EuroAmerican settlement in the mid-1800s, the Willamette Valley was inhabited by the Kalapuya people. Their land management activities greatly influenced the ecology of the area, and the effects of their practices remain visible in a few places today. For example, prairie and savanna habitats around Fern Ridge Reservoir and in the west Eugene wetlands area often are considered legacies of Kalapuya land management.

The Kalapuya relied on foods available in their local environment, and migrated around the Valley seasonally to utilize these foods as they became available. In the process, they likely moved seeds of some plants to new locations. Some important food sources included camas, tarweed, oak acorns and grasshoppers – all associates of open prairie and savanna habitats. To maintain abundance of these open habitats and their associated food species, the Kalapuya regularly burned the Valley floor and foothills to reduce encroachment by trees and shrubs. Burning also provided hunting opportunities when wildlife fled during fires, concentrated deer, elk and other wildlife species in the remaining forest patches, and likely made travel easier and reduced poison-oak.

Fire-adapted plant communities such as prairie and savanna came to dominate the landscape of the lower elevations of the Willamette Valley and wildlife and other species associated with these plant communities were common. Frequent burning eliminated accumulation of living and dead vegetation and duff, leaving little fuel. Regular, historic burns likely were relatively quick, generally cool, and varied in intensity over the landscape.

Herbaceous (ground layer) vegetation in savanna and woodland habitats likely was comprised of perennial species that survived the frequent, cool burns, and annual species that could produce seed before the fires were set. Most seedlings and many sprouts of shrubs and trees likely succumbed to burning, so woody plant encroachment was kept in check. Larger trees (especially those with fire-resistant bark), and occasional small seedlings, escaped the relatively cool, patchy burns resulting in the scattered trees in prairies and savannas which were commonly noted in the mid-1800s. Oregon white oak is known to have occurred most commonly in many of these habitats, and Ponderosa pine, Douglas-fir, California black oak, and other species were present in smaller amounts. Although the cooler, moister north slopes likely burned less often, they may have burned hotter and more completely when they did burn because of the buildup of fuels (Stringer, pers. comm.).

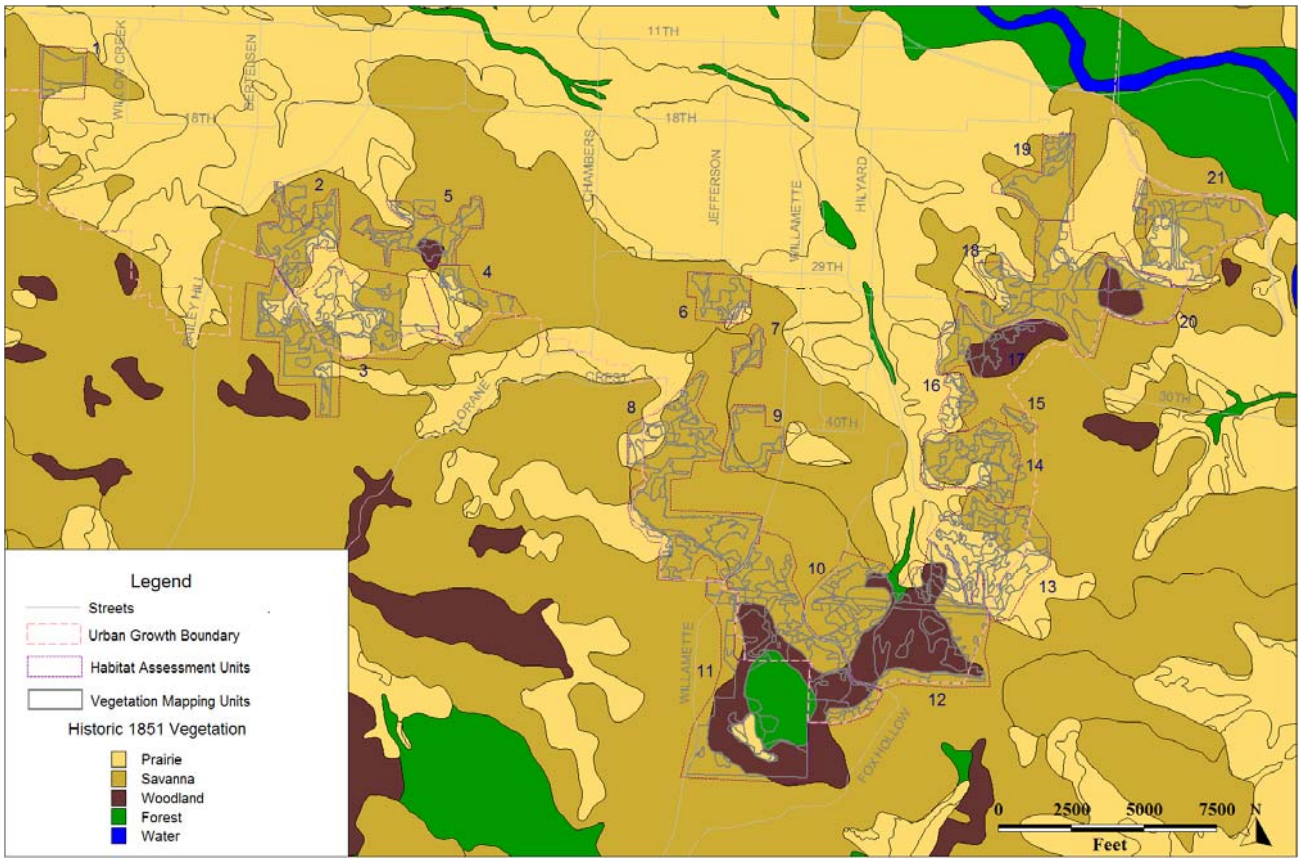
The following excerpts summarize the practice of aboriginal burning and subsequent change after EuroAmerican settlement.

> *"As climate turned cooler and moister 4,000 [years ago], oak savanna and prairie ecosystems were maintained only by frequent fires set by native people to stimulate food plants and help in hunting. The period that ended with Euro-American settlement is a natural historical benchmark." (Wilson 2002)*

> *"The extent and pace of human disturbance increased with Euro-American settlement in the mid-1800s. Intensive trapping essentially eradicated beaver populations by the early 1830s, dramatically changing the basin's hydrology, vegetation, fish, and wildlife. As settlers displaced a native population decimated by disease, grassland burning stopped and farming began. (Pacific Northwest Ecosystem Research Consortium 2002, in NPCC 2004.)"*

The US Government Land Office surveyors mapping the Willamette Valley in about 1851 kept detailed notes and sketches of the vegetation they encountered, which recently have been translated into generalized maps. In the SRHS area, a matrix of savanna/prairie habitats is depicted for the majority of the study area (Figure 2). The primary exception is woodland and forest that was mapped for much of the Spencer Butte area. (Definitions of these general habitat types can be found in the Glossary at the end of this report.)

Figure 2. Historic (ca. 1851) vegetation of the SRHS area.



Source: ORNHIC 2005 data.

The following table summarizes the changes in habitat structure that have occurred within the SRHS study area since the mid-1800s. The acreages in this table do not include areas with minimal habitat value that were determined to be "developed," and were not included as inventoried habitat.

Table 1. Acreage of 1851 vs. 1936-44 vs. 2006 inventoried habitats within the SRHS area.

Habitat type	1851 acres	1936-44 acres	2006 acres
Prairie	438	314	194
Savanna	1522	244	33
Woodland	493	754	218
Forest	135	1215	2020
Agriculture & Other	0	60	122
TOTAL	2587	2587	2587

In the table above, "Agriculture & Other" includes all agricultural uses as well as about 8 acres of residentially developed sites that have some inventoried habitat values.

Since settlement of the Willamette Valley by EuroAmericans began in the mid-19th century, cessation of burning and conversion of native habitats to agriculture and development have had enormous impacts on the landscape. Only small remnants of the open prairie and savanna habitats remain, and most have been degraded by invasive exotic plants and encroaching native woody species. Because of this, the Oregon Conservation Strategy (ODFW 2006) lists development and land conversion, lack of fire and invasive species among the top threats to native habitats in the Willamette Valley foothills. Similar assessments of landscape change and conservation priorities are documented in studies by Alverson (2005), NPCC (2004), Kagan & Wiley (2002), TNC (2004), et al. These studies consistently recognize native upland prairie, savanna and woodland habitats, wetlands and riparian areas as the rarest, and as having the highest conservation concern for the Willamette Valley.

3.3 Existing Habitat Conditions. The study area is broadly defined as the south ridgeline of Eugene, stretching from just east of Hendricks Park, westward to the Wild Iris Ridge area, and including some outlying areas such as the Pitchford Road area (HAU 1) and Morse Ranch Park (HAU 6). The original proposed study area encompassed a total of 2,628 acres, generally ranging in elevation from 398 to 2054 feet. The study area includes lands both inside and outside the Urban Growth Boundary (UGB). All lands outside the UGB that are within the study area are public lands owned by the City of Eugene. Lands within the UGB include both City-owned park lands and private lands (Figure 2).

Most privately-owned lands within the study area are zoned for residential use. Some of these areas recently have been developed or are in the process of development. Most lands to the north of the study area are developed with residential and related uses. Lands to the south of the study area generally are outside the UGB and within the planning jurisdiction of Lane County. They are typically in rural residential, farm or forest use.

3.31 Vegetation. Undeveloped lands within the study area primarily are conifer or mixed deciduous-coniferous forests, and smaller amounts are hardwood forest, woodland, savanna, prairie/grasslands, or other types. Armenian blackberry, Scot's broom, tall fescue, and other invasive and non-invasive exotic species are common in forests, woodlands, savannas and prairies.

After many decades of grazing, farming, development, and lack of fire, nearly all the savanna and prairie habitats which were common prior to EuroAmerican settlement now either are converted to other uses or forested. The few open habitats that remain are small in size with ground layer vegetation commonly dominated by exotic species. These invasive, exotic plant species have been introduced intentionally in some cases (for food, forage or landscaping, for example), while others have been introduced inadvertently. Examples of common native and invasive species that occur in the study area are shown in the following table.

Table 2. Common native vascular and invasive, exotic vascular plant species of the SRHS area by layer (tree, shrub, forbs/grasses).

Category	Common native species	Common invasive, exotic species
Trees	Douglas fir, bigleaf maple, Oregon white oak	Sweet cherry
Shrubs	Snowberry, poisonoak, oceanspray, tall Oregongrape	Armenian blackberry, Scot's broom
Forbs	Sword fern, trailing blackberry, Oregon iris, bracken fern	English/Irish ivy, narrow-leaf plantain, false dandelion, wild carrot
Grasses	Blue wildrye, Columbia brome	Tall fescue, sweet vernalgrass, creeping bentgrass

The overall change in vegetation in undeveloped portions of this urbanizing area since the middle of the 19th century has been from open prairie and savanna habitats dominated by native plant species, to forested habitats dominated by native trees, or to small, remnant open habitats dominated by exotic species.

As encroaching, native, woody plants and invasive, exotic plant species begin to dominate in open habitats, native plant diversity in those habitats drops. Because of the decline in native plant diversity, native insects and other wildlife dependent on those species decline as well. The native species and open habitats unique to the Willamette Valley are declining. In the SRHS area this local native biodiversity associated with open habitats is being replaced by a more common and less diverse set of native forest habitat plants and wildlife, and by exotic plants and wildlife.

3.32 Wildlife. As native prairie and savanna vegetation communities have declined in the SRHS area, associated wildlife populations also have declined. Many of the species on the list of target uncommon and rare species assembled for this project (Appendix B) are associated with those rare open habitats. Conversely, as forest habitats have expanded in the SRHS area, common species associated with those habitats have increased. The following table lists examples of common, familiar wildlife species found within the study area.

Table 3. Examples of common native and exotic wildlife of the SRHS area by category.

Wildlife category	Common native species	Common exotic species
Year-round	Winter Wren, Spotted Towhee,	Wild Turkey, European

resident birds	Song Sparrow, Common Flicker	Starling, House Sparrow
Seasonal or migrant birds	Western Wood Pewee, Orange-crowned Warbler	None
Large and medium sized mammals	Black-tailed Deer, Raccoon	Virginia Opossum
Small mammals	Western Gray Squirrel, Deer Mouse	Eastern Fox Squirrel, House Mouse
Amphibians and reptiles	Pacific Tree Frog, Ensatina Salamander, Western Terrestrial Garter Snake	Eastern Bullfrog
Invertebrates (e.g., insects, spiders, worms, snails)	Western Tiger Swallowtail Butterfly, Dragonflies, Bumblebees, Many Others; Some Very Mobile	Cabbage White Butterfly, European Honey Bee, Brown Garden Snail

Records of species presence are not as complete for fauna that are smaller, less well-known or more difficult to observe. It is likely that some of these species, including many invertebrates and some amphibians, reptiles and birds, have disappeared locally and in some cases, regionally.

Water features are important habitat components for both fish and wildlife. Historically, some headwater streams feeding Amazon Creek probably supported native fish populations, including native cutthroat trout. Over the past 50 years, urban development has disconnected these headwater streams from their receiving streams, so that today, very few to no fish species are present there. Two or three small ponds are present in or near the study area, likely originally constructed for livestock use. These ponds are small and shallow, and are unlikely to contain any fish populations, but they may be used as breeding habitat by Northern Red-legged Frogs as well as other amphibians, and invertebrates, and provide habitat for aquatic or emergent plants.

Within habitats in the SRHS area that change from undeveloped to developed, only those native wildlife species tolerant of humans and residential uses persist (see Common Native Species, Table 3). Some of the native wildlife species that persist are viewed by human residents as pests or welcomed guests, depending on individual perspectives. Noteworthy in this category are Black-tailed Deer and Raccoons. Exotic wildlife species are introduced either intentionally or accidentally, or they move in from nearby areas. Many exotic species in the table above also are viewed as pests and/or guests by human residents of the area.

3.33 Ecological Functions. Despite past impacts, SRHS area habitats host a suite of native species, and functional (or partly functional) ecosystems. Ecological functions associated with undeveloped areas which have some native vegetation in the SRHS area include the following:

- Provide habitat for native plants, animals, fungi and microbial life
- Provide habitat for rare species
- Provide connectivity for native species movement and gene flow
- Contribute to maintaining surface water quality and quantity by providing infiltration and slow release into surface streams
- Contribute to slope stabilization and erosion control

- Contribute to air quality by taking in carbon dioxide and releasing oxygen
- Provide special habitat features needed by certain plant, wildlife and fungi species, including: rocky areas, snags and logs, wetlands, large trees, etc.

4.0 Methodology

The following paragraphs discuss the preliminary meetings and data transfer, the development of all stages of the project and methodology, and how the methodology was applied.

4.1 Meetings. The City held a public information meeting on May 2, 2006 to introduce the project, answer questions and take feedback from the public. The City created a project web site and developed a process and guidelines for additional, individual citizen input on potential habitat resources that might be relevant to the SRHS. Regular meetings were held between the City Project Manager and the consulting team in order to refine and revise portions of the methodology and the assessment and rating system, with the intent to assure that the City's project goals were met. The City and consultant team met with numerous interested citizens and landowners throughout the inventory phase, including meetings on private properties where access had been granted.

Additional meetings between the City Project Manager and the consultant team took place through the duration of the project to keep the City Project Manager apprised of the consulting team's progress, and to seek feedback and approval of final methodology development.

After preparation of the draft report and inventory, two methodology meetings were held at the public library. Subsequently, the City held several neighborhood and other meetings to explain the methodology and draft results to the community, and to solicit feedback.

4.2 Map and Data Transfer and Acquisition. The City provided general information (rare species location data, etc.) and mapped Geographic Information System (GIS) data (study area boundary, tax lot lines, roads, etc.) soon after the project commenced. Several base layers of GIS data and base color aerial orthophoto imagery from 2004 were transferred to the consultant GIS specialist, who used them to create field maps for the inventory. Updated aerial photos from 2005 were later incorporated into the study. Additional documents received during the study included information and natural resource studies submitted as part of site-specific planned unit development (PUD) applications (see Site-Specific Reports bibliographic section at the end of this report).

4.3 Methodology Development and Application. Inventory and assessment methods were developed in collaboration with the City. The methods were designed to be consistent with state-acknowledged Goal 5 methodology applied by Eugene and other Oregon communities, and were broadened to provide a more ecologically-based approach that addressed habitats and species of special interest within the study area. The procedures followed by the consulting team for preparing and conducting the SRHS inventory are listed here, and addressed in detail in subsequent sections.

1. Identification of Goals
2. Identification of Study Area
3. Private Property Access Protocol
4. Analysis of Existing Information

5. Design of Inventory and Mapping System
6. Field Inventory
7. Data Entry (GIS)
8. Data Entry (Database)
9. Incorporation of Supplemental Data
10. Map Review and Historic Vegetation Analysis
11. Design of Vegetation Mapping Unit Report Form
12. Design of Ratings System and Report Form
13. Habitat Suitability Mapping
14. Draft Report Preparation
15. Public Comments
16. Final Report Revision and Submittal

Each numbered item above is explained in the following paragraphs.

1. Identification of Goals
The goals of the inventory were contained in the original project Scope of Work. These included the purpose of the inventory and assessment, a recommended study area (Figure 1), and a list of habitats and species of interest. The purpose was addressed previously in this report (see Section 2.0), and the following two sections address the *inventory area* and *target habitats and species*.

2. Identification of Study Area
The original proposed SRHS area included 2,628 acres in three ownership categories, as shown in Table 4, below.

Table 4. Original number of parcels, and acreage of original SRHS study area.

Ownership Category	# Parcels	Acreage
Parcels within the UGB > 0.5 ac in size (includes public land)	720	1940
Parcels within the UGB ≤ 0.5 ac in size	1200	156
Adjacent publicly-owned lands outside the UGB	17	532
ORIGINAL STUDY AREA TOTAL:		**2628**

After the project began, the City requested that the consulting team add to the proposed inventory any small areas that were contiguous to the study area and contained similar habitat, but were outside the original study area boundaries. These added areas are shown in Table 8.

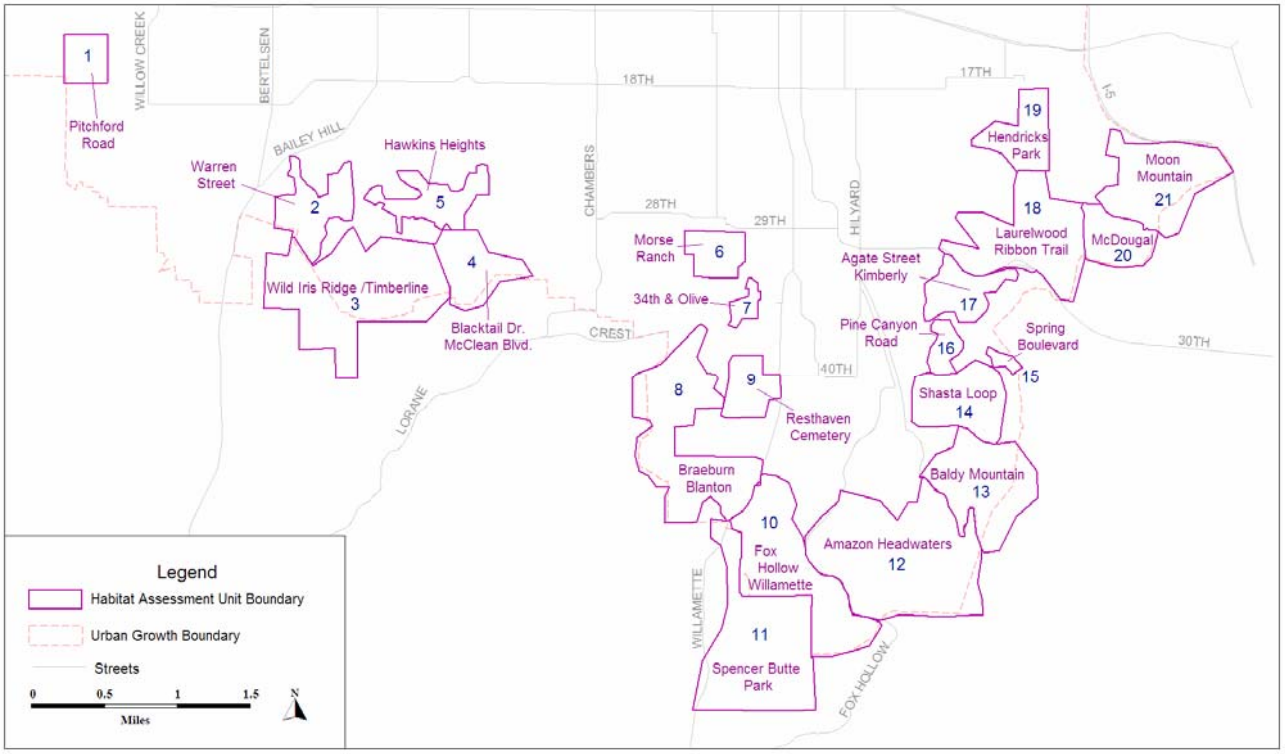
The City also requested identification of adjacent or nearby areas that might be included in a future inventory project, but were not within the scope of this project due to size, limited access, location, lack of connectivity with vegetation mapping units with the proposed study area or other factors. These "potential future additions" are shown on individual Habitat Assessment Unit maps in Appendix J.

The study area was subdivided on paper by the City Project Manager into 21 units to facilitate inventory and assessment. These were termed "Habitat Assessment Units" and are abbreviated

throughout this report and attachments as "HAUs." The considerations used for delineating these HAUs on the map were (in approximate order of importance):

- isolation (separate habitat patches became individual HAUs)
- significant barriers (paved roads or developed areas between habitat areas)
- narrow areas of connectivity between larger patches

Figure 3. Habitat Assessment Unit (generalized) outline map.



3. Private Property Access Protocol

The City directed that on-site field inventory be conducted only on the private lands with access permission granted by the landowner and on City-owned property within the UGB. The City mailed project information and forms to private landowners requesting the return of signed property access permission forms to grant access to the consultants for the purpose of conducting the inventory. The mailing went to owners of all privately-owned lots larger than 0.5 acre within the study area (approximately 515 landowners; approximately 1326 acres), and the City received back access permission from 102 landowners for about 9% of that area.

Consultants were granted permission outright to access City-owned lands within the UGB, but directed to not access City property outside the UGB (but within the inventory area).

Off-site inventory methods were used for private lands without access permission in the UGB, and City-owned property outside the UGB.

4. Analysis of Existing Information

A previously-used cover type classification system was adapted for the field inventory, and lists of rare habitats, uncommon and rare species and invasive species were developed, as described in the following sections.

Cover Type Classification.

For use in a similar project in Corvallis, the consulting team successfully adapted and utilized a cover type (also called "habitat type") classification system defined in Adamus, et al. (2000). This system contains brief summaries of the general type of vegetation that is in the tallest layer, which is the most visible layer to see both in the field and on aerial photographs. The system classifies vegetation by the density (or "percent cover") of the tree layer into four categories, listed here in descending order of tree density: forest, woodland, savanna and prairie (or grassland).

The system was adapted to address local conditions in Eugene. As it was initially designed, the system was intended for use in categorizing cover types using regional-scale aerial or satellite photography, whereas for the Corvallis and Eugene projects, it was adapted for on-the-ground use supplemented with local scale aerial photography. An explanation and definitions of the cover type codes used in the inventory are in Appendix A.

Target Rare, Sensitive and Uncommon Habitats and Species.

The City sought to obtain information about the existence of rare habitat types, and the existence or potential for uncommon and rare plant or animal species in the study area. The habitat types of primary interest identified by the City included: native-dominated forest, shrub and forb communities, including old growth Douglas fir/western hemlock, Oregon white oak/California black oak woodland, Oregon white oak savanna, ponderosa pine, old growth grand fir, and upland native prairie communities and natural balds. The City-identified plant species of interest included: Kincaid's lupine, shaggy horkelia, tall bugbane, thin-leaved peavine, Thompson's mistmaiden, wayside aster, white-top aster and Willamette Valley daisy. The City-identified wildlife species of concern for this study included northern red-legged frog and pileated woodpecker. Appendix B contains background information on these species, and Appendix F contains a crosswalk between the common plant and animal names used in this report and their respective scientific (Latin) names.

The City's emphasis on a more ecological approach led to development of a more complete list of rare habitats and species. To create a list of rare habitats potentially occurring in the area, the consulting team relied primarily on published sources – most particularly the Oregon Conservation Strategy (Strategy) (ODFW 2006). The team also consulted other studies that identify rare habitats of the Willamette Valley: Campbell (2004), Kagan and Wiley (2002), NPCC (2004), PNWERC (2002), and TNC (2004). There is strong agreement among all the sources consulted as to which habitats are rarest in the Willamette Valley ecoregion.

The field team recorded and assessed mature to old growth grand fir and Douglas fir/hemlock forest, which are not on the Strategy list for the Willamette Valley and generally not listed as rare here by the sources listed above. Retention of these habitats on the target list recognizes that there are portions of the study area which are transitional to adjacent montane ecoregions, and that these habitats may contain uncommon to rare biodiversity elements.

An expanded uncommon and rare species list was developed to more completely recognize plants and animals that may occur in or near the study area. These species have been identified as either

sensitive, uncommon or rare by the US Fish and Wildlife Service, Oregon Department of Fish and Wildlife, Oregon Department of Agriculture, the Oregon Natural Heritage Information Center and/or the Native Plant Society of Oregon. An annotated list (Appendix B) shows the origin, legal status, and High-Medium-Low rating assigned for this study for each uncommon and rare species. This list is shown below in simple form as Table 5.

*Table 5. Potentially-occurring and **documented** (shown in **bold type**) uncommon and rare species of the SRHS area.*

AMPHIBIANS & REPTILES	MAMMALS	Plants, Cont.
Clouded Salamander	Brazilian Free-tailed Bat	Howellia
Northern Red-legged Frog	California Myotis	**Howell's montia**
Oregon Slender Salamander	Camas Pocket Gopher	Kincaid's lupine
Western Rattlesnake	Long-eared Myotis	Large-fruited lomatium
Western Toad	Long-legged Myotis	Meadow checkermallow
	Red Tree Vole	Mountain lady's-slipper
BIRDS	Silver-haired Bat	Narrow-leaved milkweed
Acorn Woodpecker	Townsend's Big-eared Bat	Oceanspray broomrape
American Peregrine Falcon	**Western Gray Squirrel**	Pacific pea
Bald Eagle	White-footed Vole	Pale bulrush
Band-tailed Pigeon		**Puget groundsel**
Chipping Sparrow	**PLANTS**	Racemose pyrrocoma
Common Nighthawk	Beautiful shooting star	Rosin weed; tackweed
Grasshopper Sparrow	Blue verbena	Shaggy horkelia
Lewis's Woodpecker	Bradshaw's lomatium	Sinister gilia
Little Willow Flycatcher	Clasping-leaved dogbane	**Tall bugbane**
Mountain Quail	Coffee fern	**Thin-leaved peavine**
Northern Goshawk	Columbia water-meal	Thompson mistmaiden
Northern Spotted Owl	Cusick's checkermallow	Timwort
Olive-sided Flycatcher	Dotted smartweed	Toothcup
Oregon Vesper Sparrow	Dotted water-meal	**Upland yellow violet**
Pileated Woodpecker	Drooping bulrush	**Wayside aster**
Purple Martin	Dwarf montia	White-flowered navarretia
Slender-billed Nuthatch	Fleshy lupine	**White-topped aster**
Streaked Horned Lark	Golden-fruited sedge	Willamette navarretia
Western Bluebird	**Grass widows**	Willamette Valley daisy
Western Meadowlark	Hall's violet	Willamette Valley larkspur
Yellow-breasted Chat	Hemp dogbane	
	Hitchcock's blue-eyed grass	
INVERTEBRATES	Holy grass	
Fender's Blue Butterfly	Hooker's pink	
Taylor's Checkerspot	Howell's brodiaea	
NOTE: **bold face type** indicates species previously confirmed in or adjacent to study area.		

Invasive Plant Species.

The consulting team assembled a list of plant species known to be invasive in the SRHS area. These species were recorded on the inventory sheet when encountered in the field. The list is provided in Appendix D.

5. Design of Inventory and Mapping System

To produce a more ecologically balanced inventory, a field inventory data sheet was designed to be inclusive of a broader, more balanced range of values than the previous habitat assessment methodologies used elsewhere – that is, less focused on habitat suitability for vertebrate wildlife, and more oriented towards observing and recording detailed current and historic features so as to allow a more accurate and complete description of habitats of both plant and wildlife species and the condition of those habitats. The following paragraphs describe these methods in more detail.

Timing. The seasonal timing of the surveys was intended to allow for observation of plant communities in the growing season, and provide opportunity for incidental observation of uncommon and rare plant species which might occur within the study area. Uncommon and rare plant species of open areas, such as prairies and savannas, tend to flower and be most visible in May and June, so consultants targeted those areas first. Uncommon and rare species of forested habitats tend to flower and remain visible later, so those areas were inventoried later. Scientifically-rigorous surveys to systematically determine presence or absence of uncommon and rare plant or wildlife species were not included as part of this project. Instead, the project was oriented towards identifying rare habitats and suitable habitats for uncommon and rare/sensitive species.

The order of site visits in the early portion of the inventory required coordination with the City of Eugene Public Works Department and private landowners striving to meet the City's requirements for mowing (to meet fire safety objectives on undeveloped properties). Consultants worked to "keep ahead of the mowers," responding to City Project Manager direction resulting from contacts either from the Public Works Department or private owner's wishing to have inventory completed on their sites before mowing. All requests were addressed as quickly as possible by the consulting team.

Team. Before the inventory, two regionally-known expert advisors were consulted for input on two species highlighted by the City for inclusion in the inventory (Northern Red-legged Frog and Pileated Woodpecker). Their recommendations were included in the inventory and assessment methodology. Five field biologists conducted the inventory. The field team members received field calibration training on the entire methodology to maximize consistency in observation and recording of data.

Inventory Tools and Products. The following table lists the tools that were developed and used, and the products which resulted. Many are referenced as attachments to this report.

Table 6. SRHS inventory tools and products.

INVENTORY TOOLS	PURPOSE / DESCRIPTION
FIELD TOOLS	
Field inventory data form and instructions	Appendix A A two-page field data form for recording Vegetation Mapping Unit data provided for recording of the following features: cover type, vegetation layer (tree, shrub, herb) nativeness and cover, uncommon and rare and invasive plant and animal species, special habitat features, and general information such as size and location. Information was entered into a database at completion of inventory,

INVENTORY TOOLS	PURPOSE / DESCRIPTION
	which was condensed into a one-page Vegetation Mapping Unit Inventory Form (see Inventory Products section, below).
Base map/aerial photo	The GIS specialist provided the field team with an HAU map showing the area to be inventoried and outlining lots with and without access permission. A base map of topography, headwater drainages, wetland soils, streets, and again, parcels with and without access permission also was provided.
OFFICE TOOLS	
Target uncommon and rare species table	Appendix B List of all federal, state and local uncommon and rare plant and animal species. Highest listing status receives "High" ranking, lowest status receives "Low" ranking.
Target uncommon and rare species / habitat suitability matrix	Appendix C "High, medium, low and no" suitability for each uncommon and rare species in each cover type.
Invasive species table	Appendix D A list of escaped, naturalized, exotic species that have high impact on wildland habitats. Listed on field data sheet by layer if encountered during inventory. "Standard prairie invasives," listed in the Appendix and on numerous field inventory sheets includes species such as: tall fescue, colonial bentgrass and Queen Anne's lace.
Site natural resource reports	(On file with City of Eugene; see Site-Specific Documents Consulted, also.) Various biological consultant reports previously submitted to the City were consulted for relevant data.
Oregon Natural Heritage Information Center (ORNHIC) uncommon and rare species sighting reports	(On file with City of Eugene) Most uncommon and rare species sighting records received were outside the study area boundaries, but a few are within.
Base map/aerial photo	Aerial photos also were used in the office to note adjacency of valuable, mapped Vegetation Mapping Units, adjacent disturbance, and historical vegetation types.
INVENTORY PRODUCTS	**PURPOSE/DESCRIPTION**
Vegetation Mapping Unit (VMU) maps	Appendix J These are GIS maps showing the vegetation mapping units drawn on 2005 aerial photo base maps. Field mapping was done on 2004 aerial photos, but updated by the team in the office to 2005 aerial photos when those became available.
VMU field inventory forms	(Stand alone appendix – data base) These forms contain data from the two-page field inventory sheets condensed onto approximately one page.
VMU and HAU rating	(Stand-alone appendix – data base)

INVENTORY TOOLS	PURPOSE / DESCRIPTION
tables	Each VMU field inventory data sheet is followed by a table showing the assessment/rating of habitat values for that VMU, and each HAU is rated for the VMUs within and other aspects.
Report	This report, discussing the ecological history of the study area, the methodology used to inventory upland habitats, and the results of the study.

6. Field Inventory.
The field inventory was conducted from May through August of 2006. All portions of all 21 HAUs which had access permission were inventoried on-site. When possible, lands for which access permission had not been obtained were viewed from adjacent parcels with access permission or from public streets.

Included with this report as Appendix A is a blank template copy of the field Vegetation Mapping Unit (VMU) Inventory Form, and the associated instructions and standards used by crew members for the inventory.

Access.
Many of the parcels where access permission was granted were relatively small, and not always in areas providing views of adjacent properties for which the team did not have access permission. Most of the returned forms granting permission directed the field team to call ahead to the owner to coordinate access for individual property visits, and some landowners escorted biologists during the inventory of their site.

In general, the lack of access required that most privately-owned properties had to be inventoried using a combination of off-site methods. These included viewing from adjacent private property where access was granted or from adjacent public lands or rights-of-way, or using aerial photos and/or previously submitted land use permit application reports on file with the City. (See On-site/Off-site section below.)

Mapping.
While visiting a field site, areas within each HAU with homogeneous vegetation were mapped as Vegetation Mapping Units (VMUs) and given a unique letter label within the HAU. Minimum Vegetation Mapping Unit size was generally 2 acres, but rare habitat types were mapped to a 1 acre minimum. Within each VMU, some newly-built homes or developing areas with little to no habitat values were marked in the field as "developed," ("DV" on the maps in Appendix J) and are not included in habitat area calculations.

Boundaries were drawn around each VMU area on a transparent overlay on a 2004 aerial photo base map. The letter code was then assigned to the VMU and written on an Inventory Form for the text data recording.

The City provided a study area boundary, but encouraged the inclusion of adjacent areas with suitable habitat. The considerations used for inclusion vs. exclusion for this inventory included the following.

Included. Land inside designated inventory areas with substantial habitat values were included, particularly if they contained potential habitat for any target species. Some areas where substantial habitat values remain are included, even though houses may have been constructed within the inventory area. Tree layers occasionally are left intact in areas where a single house is built in an otherwise undeveloped area, providing potential habitat for Western Gray Squirrels and/or other uncommon or rare wildlife species. Occasionally, the shrub and/or ground (herbaceous) vegetation layers were observed to be intact also, providing habitat for more target plant and wildlife species.

Excluded. Most areas with existing residential development were excluded from the inventory by outlining them on the aerial photo, and marking them "DV" to signify "developed." Some residential sites where development seemed imminent (such as newly graded places in a developing area with recently dumped gravel), also were excluded. Manicured, grassy areas between development areas were excluded in some instances, if no suitable habitat was present for native (especially target) plant or wildlife species.

An additional 188 developed acres with little habitat value were mapped within the original study area boundaries but are not included in habitat acreage totals on the following table. Included in the inventory acreage total are 159 additional, adjacent acres proposed to be added to the original study area. In the table below, A – B + C = D.

Table 7. Original (A), developed (B), added (C), and total surveyed (D) acres.

HAU	A: Original survey acres (w/ DV)	B: DV Acres	C: Added survey acres	D. Surveyed Acres (w/o DV)
1	35	0	0.73	35
2	85	7	28.00	106
3	251	23	4.95	233
4	65	37	3.01	31
5	74	7	6.88	74
6	32	4	3.68	32
7	17	1	0.00	16
8	221	2	1.05	221
9	44	23	1.03	22
10	243	14	13.37	242
11	320	1	0.05	319
12	399	7	19.49	412
13	160	19	9.45	150
14	87	6	16.47	97
15	6	3	0.00	3
16	18	0	3.73	22
17	46	2	4.68	48
18	187	19	10.64	178
19	81	4	1.09	78

20	88	0	4.77	93
21	158	8	26.43	176
TOTAL	2618	188	159	2589

Note that the total acres for "Original survey acres w/ DV" in Table 8 above (2,618) is less than the total acres shown in Table 4 for the original proposed study area (2,628). The difference of 10 acres is due to: (1) corrections to the boundaries of publicly owned park lands outside the Urban Growth Boundary based on updated, more accurate tax lot boundaries for those areas that became available during the project, and (2) many very small corrections throughout the study area based on the revised tax lot boundaries, where extremely narrow strips were created on lots that are not meaningful at the scale of the habitat mapping.

On-Site vs. Off-Site Data Recording.
VMUs were inventoried on-site, off-site with a view, and off-site without any view (primarily using aerial photo interpretation). Many VMUs were inventoried using some combination of these observation categories. Ideally, all field inventory would be conducted on site, but in reality, because the consulting team was granted permission to access only a small fraction of private lands, only those properties, and City-owned public lands, could be inventoried on site.

Off-site inventories were conducted using several methods and information sources. Initially, view into private lands with no access permission granted was sought from adjacent public streets, public property, or private lands where access permission had been granted. These parcels were identified on data sheets as "off-site/view." In some cases, where only a portion of a VMU could be viewed, only a part of the inventory data sheet could be filled out in the field, so these were labeled as a combination of off-site with view and without view. Aerial photos also were used to add data for off-site inventories.

Off-site inventory of public lands outside the UGB was conducted similarly, except views from outside the UGB generally were limited to adjacent public streets. Again, aerial photos were consulted to provide necessary data.

On-site mapping allowed completion of all portions of the Inventory Form, but off-site inventory of many sites required use of a different system. For those situations where key data was missing because of a lack of access and/or poor view from adjacent sites, the rating team used a "reference site" system. Initially, the rating team used their best professional judgment to identify the nearest Vegetation Mapping Unit with features similar to the VMU with missing or incomplete data. This "reference" area was called a Reference Vegetation Mapping Unit, or RV. Information from an RV identified for the rating of another Vegetation Mapping Unit then was used as a surrogate for recorded, on-site data, and displayed on the Inventory Forms in the database with an "RV" label. In the best professional judgment of the consulting team, the limited and careful use of reference information was the best surrogate available for the missing information. Consultants used reference information cautiously so as to not overly inflate or under-rate the potential value of a VMU.

In all on-and off-site inventories, tree layers were easiest to assess, mid layers (shrubs and understory trees) moderately easy to difficult, and ground layers (herbaceous vegetation) much more difficult to assess for the simple reason that the taller vegetation is easier to see at a distance and on aerial photographs.

Limitations.
The largest limitation to the inventory was the lack of access to most private land. Lands with no access were inventoried and assessed using several methods: viewing wherever possible from adjacent lands with access, interpreting aerial photos (which sometimes lack detail in tree shadows), and for sections of the report form where information was needed for assessment and scoring, using nearby reference sites with similar habitats to supply information that could not otherwise be obtained

The other primary limitation noted during the project was the lack of inventory information available for uncommon and rare species, as systematic surveys for uncommon and rare species have not been conducted in most of the SRHS area. To accommodate this limitation, presence or absence of target species was not used in numerical site scoring. Known occurrences, however, are listed on the Inventory Form for each site: both field observations and ORNHIC recorded sightings.

7. Data Entry (GIS)
The VMU boundaries delineated by field inventory team members on the transparent overlay were digitally entered into a Geographic Information System (GIS) data layer. Additional information that may have been mapped in the field (e.g., uncommon and rare species sites) was digitally entered into other layers. Draft HAU/VMU maps were checked for errors and boundaries were updated to the newer 2005 aerial photos where necessary. Corrections then were supplied to the GIS specialist, and the affected data layers were corrected.

8. Data Entry (Relational Database)
All field data was checked for consistency and completeness, and then entered by a biologist into a relational database entry form that was developed for the project. The data was checked again after entry. Several brief follow-up field visits were made to resolve questions.

9. Incorporation of Supplemental Data
Several background reports provided by the City were used to supplement field observations. These are listed at the end of this report as "Site Specific Documents Consulted." Rare species site information was ordered from the Oregon Natural Heritage Information Center by the City of Eugene, and was available for use in this project. Recorded sightings of uncommon and rare species are noted on the Vegetation Mapping Unit Rating Table where applicable. No additional information was available from state and federal wildlife agencies, as they now primarily rely on ORNHIC for record keeping.

After the draft SRHS inventory and assessment was introduced at numerous public meetings in late 2006 and early 2007, approximately 37 public comments were submitted. These were compiled and transferred to the consultant team in late spring of 2007, and the team considered each one individually. Nearly all comments were directed at property-specific concerns. Many submittals did not specify if a specific action was desired, so it was inferred in those cases that more information was being submitted for consideration. Several map and database changes resulted from the review of the submittals, and those are itemized in an accompanying data set listed at the end of this document.

Where supplemental information was available, it was entered into the appropriate section of the Inventory Form and/or Rating Table, and the source was cited on the form.

10. Map Review and Historic Vegetation Analysis
Draft maps of each HAU showing all delineated Vegetation Mapping Units were produced, and edited by the field team for accuracy, then revised maps were produced by the GIS specialist. Maps of each HAU showing the VMUs were overlaid on 1936 or 1944 aerial photo coverage and historic ca. 1850 vegetation mapping to show vegetation change over time.

11. Design of Vegetation Mapping Unit Inventory Form.
An "output" report form (Vegetation Mapping Unit Inventory Form) was created to show the field data in a concise and readable format.

12. Design of Ratings System and Report Form
The rating team developed a system for assessment and scoring at local (Vegetation Mapping Unit) and landscape (HAU and larger) scales. The details of the methodology used for this scoring are contained in Appendix E.

The assessment and scoring system was designed to score large VMUs comprised of rare habitat types in good condition highest, and small VMUs with common habitat types in poor condition lowest. Similarly, at the coarser landscape scale, the system scores HAUs with many large, high-scoring VMUs within them highest, and those with few, small, low-scoring VMUs within them, lowest.

Weighting of the scores for individual elements in the VMU and HAU rating system directly affects total scores. The consulting team attempted to weight scores to best represent the City's desires for recognizing rare habitats and species, while also utilizing the latest scientific and regional conservation planning information available.

Vegetation Mapping Unit Rating Table.
Each VMU Inventory Form contains the field inventory data, and each associated Rating Table uses the field information, combined with some GIS information such as size (acreage), to produce a rating table using weighted scoring formulas.

VMU scores were based on habitat suitability for uncommon and rare species (Rare Species Suitability Index, see following paragraph), and overall habitat rarity, condition and size. Additional, specific habitat suitability values for Northern Red-legged Frogs and Pileated Woodpeckers were shown on the report separately because of demonstrated interest from the public, but were rated within the context of the RSS system described below.

Rare Species Suitability (RSS) Index. Within the context of a landscape scale assessment and comparative rating system, it is more logical and useful to assess *potential habitat suitability* for uncommon and rare species, because observable habitat characteristics – rather than specific presence vs. absence – can be used to make that assessment. Documenting presence of species that are nocturnal, small, reclusive or visible only for restricted periods can be very difficult, time-consuming and costly, and documentation of other species often requires extremely thorough coverage (with multiple visits) of an entire study area. Therefore, uncommon and rare species detection is unlikely in a study of this nature and impossible on properties for which no access is granted. For all these reasons, systematic and comprehensive surveys for uncommon and rare species were not included as a part of the SRHS.

The base information used to arrive at potential habitat suitability for uncommon and rare species for the SRHS is the process developed for vertebrate wildlife species by Adamus et al. (2000). First, the 10-point scoring range from Adamus was distilled to a 3 point range. Common species then were eliminated from the list, and then it was expanded to include uncommon and rare invertebrates (2 species) and plants (45 species) relevant to this project. Although some assessment systems have been developed in the Willamette Valley for vertebrate wildlife, no previous system known to the consultant team incorporates plants and vertebrate and invertebrate wildlife and rates them equitably.

The RSS index was arrived at by adding the high-medium-low (equivalent to 3-2-1 points) *status* of each species on the target uncommon and rare species list, to the relative *suitability* of each habitat type for each of those uncommon and rare species. These two factors (status plus suitability) were summed for each uncommon and rare species occurring in each habitat. The RSS index for each habitat was determined by totaling the individual species sums for that habitat. The RSS values are listed below in Table 7.

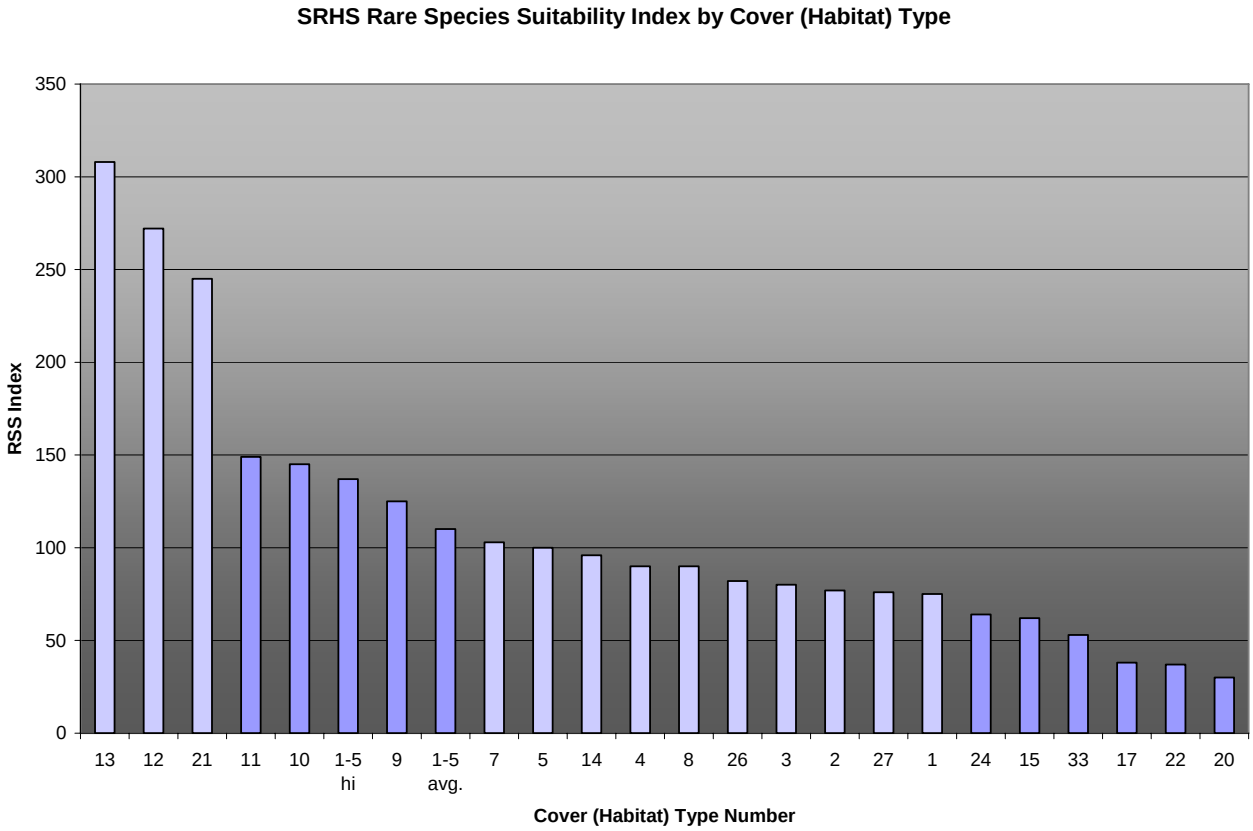
Table 8. Rare Species Suitability Index for each SRHS inventoried cover type, in order from highest to lowest.

Cover Type #	Cover Type	Score
13	Oak savanna	308
12	Other savanna	272
21	Natural grass	245
11	Hardwood woodland	149
10	Mixed woodland	145
1-5	Conifer forest, combined high scores	137
9	Conifer woodland	125
1-5	Conifer forest, comb. avg. scores	110
7	Mixed forest	103
5	Conifer forest 81-200	100
14	Upland shrub	96
4	Conifer forest 61-80	90
8	Hardwood forest	90
26	Seasonal wetlands	82
3	Conifer forest 41-60	80
2	Conifer forest 21-40	77
27	Permanent water	76
1	Conifer >0-20 yrs	75
24	Rock	64
33	Residential habitat	63
15	Wet shrub	62
17	Orchards	38
22	Tall grass	37
20	Short grass	30

The RSS values in the above table are graphed in Figure 4 for comparison to one another. The scores from top to bottom on the table above coincide with left to right on the graph in Figure 4. The alternating shades of blue in Figure 4 correspond to the different RSS point score ranges on the

VMU rating table: the left three cover types (light blue) each scored 5 points (none scored four points, thus the large drop on the figure to cover type 11), the next five cover types to the right (dark blue) each scored 3 points, the next ten to the right (light blue) scored 2 points, and the last six cover types on the right (dark blue) each scored 1 point.

Figure 4. Graph of Rare Species Suitability scores by cover (habitat) type



This graph illustrates the relatively higher RSS value of savanna, prairie and woodland habitats (far left) compared to forest and other habitats. The RSS of oak savanna is 308, other savanna is 272, natural grassland is 245, hardwood woodland is 149 and the highest combined conifer RSS is 137. To arrive at the coniferous forest "combined high" scores, all the conifer forest types were combined, and the highest suitability score for each rare species in any conifer forest type was used for the "combined" score. Similarly, for the "combined average," all the conifer forest types were combined, and for each species, the suitability scores for each species in each type were averaged. Complete RSS scoring tables are contained in Attachment C.

Habitat Rarity. As discussed above, certain habitats are widely recognized by public and private land management agencies as being rare in the Willamette Valley ecoregion. Specifically, oak savanna and woodlands, upland prairies, wetlands and riparian areas are recognized in the Oregon Conservation Strategy as being particularly rare and valuable. The consulting team assigned value in the ratings process to these rare habitats, and also to late successional forest habitats to recognize their value, as expressed by both the City and the general public

Habitat Condition. The *native component* of the herbaceous vegetation layer is a good indicator of the degree to which a prairie, savanna, woodland or wetland habitat is impacted by non-native species. The exotic component is a better indicator in other habitats. Habitats with a higher proportion of native herbs and a lower proportion of exotics score higher in this category.

Direct human *disturbance* of habitat was evaluated by noting any recent, large-scale disturbance of soil or vegetation by grading, application of herbicides, heavy grazing, or similar activities. A lack of disturbance scores higher in the SRHS VMU rating system to reflect higher habitat values.

Special Habitat Features. Fine scale habitat features provide niches for many plant and animal species. Example species categories include: cavity dwellers (which need snags and logs), rotten wood dwellers (which also need snags and logs), mature tree bark dwellers (which need mature and older trees), rock dwellers (which need cliffs or rock piles), and pond or stream breeders (which need temporary or permanent water). These features were recorded during inventories, and VMUs were scored based on how many special feature categories were present.

Habitat Size. At the end of the VMU scoring table an acreage multiplier is used to adjust the VMU score to reflect the higher value a larger VMU would have over a similar but smaller VMU.

Uncommon and Rare Species. Typically, scoring for uncommon and rare species presence is biased toward sites that have been surveyed and have positive reports. Because most of the SRHS area has not been systematically surveyed for uncommon and rare species, or not surveyed to scientific protocols, some areas where no records exist may contain uncommon and rare species populations. Therefore, the presence of any uncommon and rare species was included with the appropriate Vegetation Mapping Unit report, *but was not part of the numerical scoring system*, in order to avoid automatically lowering the score of an area simply because it had not been adequately surveyed.

Because of the specific interest in Northern Red-legged Frog and Pileated Woodpecker occurrence and habitat, specific indicators and habitat suitability features for these species were noted in the field. As above, these factors were noted and rated, but not included in VMU scoring.

Habitat Assessment Unit Rating Table. HAU scores primarily were based on a composite value of the VMUs within the HAU, and were supplemented with three geographic considerations: 1) the overall size of the patch of habitat available at a landscape scale, including adjacent, connected habitats; 2) the juxtaposition within the HAU of rare habitats; and 3) the overall condition of the HAU regarding internal barriers (roads, developed areas, etc.) and shape (compactness). Large landscape scale habitat patches, containing proximate rare habitat patches, lacking barriers and having a compact shape, scored highest using this rating system.

Habitat Patch Size and Connectivity. Larger habitat patches generally contain a greater variety of habitat types, higher number of species, and larger population sizes, however, there are many variables which can limit one or all of these factors. Connected, small patches may function in many ways like similarly-sized large patches, but this can vary greatly based on the life cycle needs and population dynamics of the plant and wildlife species using those habitat patches. Large habitat blocks may have better resilience to disturbances such as wildfire and flooding, but some small, isolated patches of unique habitat types may be of important conservation concern (ODFW 2006).

Habitats in urbanizing areas that remain undeveloped often become "islands" of habitat, surrounded by development, and the plants, animals and other life that reside in them may become isolated from other populations. Although fragmentation of habitat patches in urbanizing areas often is considered only from a wildlife perspective, it can impact plants as well.

Plant and animal populations which need larger, more connected habitats may suffer as development or other changes reduce the amount of available, connected habitat. Habitat size can affect health of individual plants and animals, as well as populations. In general, isolated sites function as smaller habitat patches because they are disconnected, except in cases where species can move from these isolated sites to other habitats in spite of barriers. For example, wind-pollinated plants which can shed pollen to be carried by wind, or songbirds which can fly between habitats, may be able to cross some barriers. A complex of connected habitat patches may function similarly to a single, large patch, providing better long term prospects for healthy populations of both rare and common flora and fauna than those habitat patches which become fragmented.

Habitat patch size and functionality can decrease if land is developed or significant barriers are constructed, or can change if encroaching or invasive plant species achieve dominance. Plants and animals may suffer from inadequate habitat patch size and diversity if they need different types of habitats at different times in their life cycles for breeding, dispersal, feeding and cover. For example, access to compatible mates – which may apply to plants as well as animals – is important for long term survival of a population, and may be dependent both on habitat size and diversity. Because many native species in a functional ecosystem are interdependent, loss of any species in a habitat patch may have a "cascading" negative effect on other species.

For this study, the consulting team did not integrate specific habitat size needs for certain species into scoring. Rather, the team rated larger size habitat patches higher to correlate with the combined positive benefits listed above. HAUs with large connections to adjacent habitats and no barriers were rated higher than those with poor connections, such as narrow habitat areas divided by busy roads.

Internal Connectivity and Shape. Connectivity and clustering of patches of habitat is valuable for native plants, wildlife and invertebrates that live within them – for reasons similar to those presented in the previous section. Cohesiveness (lack of barriers) and compact shape (as opposed to long, narrow configurations) of the HAU can benefit wildlife and possibly some plant species which need larger habitat blocks. Lack of large habitat blocks is limiting, particularly for many species using the habitats ranked "uncommon or rare" for this study.

VMU and HAU Scoring.
Numerical scores for each VMU and HAU represent a combined value of the resources evaluated, and are suitable for overall comparison and ranking. Such numeric scoring cannot accurately convey importance of individual, local features or habitats too small or atypical to be addressed by a systematic rating at a landscape scale – or in other words, only an extremely complex rating system could account for every detail of importance. Therefore, consideration of additional values not used in the scoring is advised by the consulting team if knowledge of specific characteristics is desired. For example, a small, inventoried VMU of rare prairie habitat may not be evident in the numerical rating of a much larger, mostly forested HAU. Additionally, interest in known uncommon or rare target species sightings, not included in the rating system for the reasons mentioned earlier, may warrant future field inventory and assessment beyond the scope of the SRHS.

13. Habitat Suitability Mapping
Maps of potentially suitable habitat were developed for the original eight target plant species and two target animal species (Pileated Woodpecker and Red-legged Frog; Appendix I). These maps were developed based on ratings for each cover type from the species-habitat matrix (Adamus et al. 2000 for vertebrates; Salix Associates for invertebrates and plants), based on each VMU cover type. A second set of potentially-suitable habitat maps was produced for the two animal species, using finer scale habitat features that were recorded during the field observation. For VMUs without access and views in, we again utilized information from a nearby reference site.

14. Draft Report Preparation
For the draft report, the field inventory data were compiled, summarized, and used to generate assessments, and the methodology of the project was explained in detail. Accompanying the report were appendices, a database, GIS shape files, and digital photographs.

15. Public Comments
The City received 37 public comments submitted on the draft report and mapping, nearly all relating to specific vegetation mapping unit boundary issues. No comments were submitted on the report, and none were submitted directly commenting on the methodology. The public comments were forwarded to the consultants, and after careful review, several adjustments were made to the draft inventory and report to reflect minor changes. Most notably, four new VMUs were delineated, inventoried and assessed as a result of the comments.

16. Final Report
After incorporation of the adjustments resulting from public comments, this final report was updated and delivered to the City.

5.0 Inventory and Assessment Results

The following sections discuss the results of the inventory phase and the assessment/rating phase of the SRHS project.

5.1 Inventory Summary.

Consultants inventoried and mapped 324 VMUs in 21 HAUs, totaling 2589 acres. Inventory forms and rating tables were produced for each VMU, and a rating table was generated for each HAU. Habitat suitability maps were produced for the 10 original target uncommon and rare species based on potential occurrence within each of the mapped cover types within each VMU, and for 2 of those species (Northern Red-legged Frog and Pileated Woodpecker), a second map was produced based on inventoried special habitat features.

The complete set of VMU inventory forms and associated rating tables and HAU rating tables is contained in a relational database program which generates the forms and rating tables on demand. This database resides with the City of Eugene Planning Division.

5.11 Cover Type Analysis. Table 9 illustrates the acreage of each cover type mapped during the inventory (by cover type number). Descriptions of each cover type are in Attachment A.

Table 9. Acreage of 2006 cover types inventoried in the SRHS area.

Cover Type #	Cover Type Name	Acres
7	Mixed forest	903
4	Conifer forest 61-80	597
8	Hardwood forest	232
5	Conifer forest 81-200	175
21	Natural grass	165
11	Hardwood woodland	143
14	Upland shrub	109
10	Mixed woodland	67
2	Conifer forest 21-40	51
3	Conifer forest 41-60	49
13	Oak savanna	28
24	Rock	22
1	Conifer >0-20 years	13
9	Conifer woodland	8
33	Built low density	8
12	Other savanna	5
22	Tall grass	4
26	Seasonal wetlands	2
20	Short grass	2
15	Wetland shrub	1
27	Permanent water	1
17	Orchards	1
	TOTAL INVENTORIED ACRES	**2587**

Approximately 78% of the inventoried habitats are forest, and savanna and grasslands occupy approximately 1% and 7% of inventoried habitats, respectively. The remainder is woodland, shrubland and other habitats. Nearly all the herbaceous layer vegetation in prairie and savanna habitats is dominated by exotic species.

The original list of key habitats prepared by the City prior to the study is shown on the table below, with the consulting team's field observations from the SRHS inventory. Data tables submitted concurrently with this project to the City of Eugene contain additional details. It should be noted in regard to the following table that most of the inventory work for this project was conducted off-site, so identification of dominant species within some VMUs was not possible.

Table 5. Key habitats identified prior to SRHS, and findings within the study area.

Habitat/plant community	Documented HAU/VMU	Findings
Old growth Douglas fir/western hemlock	Mature Douglas fir: 10-M, 11-N, 12-A, 12-B, 12-E, 12-J, 12-AH, 12-AK, 18-A, 18-C, 18-D, 20-D Western hemlock: not	There is no habitat within the SRHS that meets the definition of old growth Douglas fir – large old trees, snags and logs, and a well-developed, multi-layer canopy (Old-Growth Definition Task Group, 1986). The

	documented as a dominant.	"Documented HAU/VMU" column to left shows sites that are beginning to achieve these characteristics. Probably the closest to achieving "old growth characteristics" are VMUs 10M, 11N, 12H. Large western hemlock were noted only in 12-C, and small hemlock were noted coming into the understory only in 12H. Grand fir (small to large) exists in several of these VMUs.
Oregon white oak / California black oak woodland	OR White Oak Forest: 3-C, 6-B, 8-D, 9-D, 10-O, 10-Q, 12-AA, 12-Q, 12-X, 12-Z, 13-AE, 14-B, 19-A, 19-H, 21-K, 21-E. OR White Oak Woodland: 3-AA, 3-M, 3-Q, 3-W, 4-C, 8-B, 8-N, 11-O, 12-L, 13-E, 13-Z, 14-A, 21-P. OR White Oak Upland Shrub: 13-AJ CA Black Oak Woodland: 6-F	Oregon white oak forests were recorded in 16 VMUs, and woodlands were recorded in 13. Oregon white oak was recorded as a tree dominant in one upland shrub community. In many of these areas, Douglas fir is coming in the understory. California black oak was recorded as the sole dominant in only one VMU: 6-F, which is around the Wayne Morse Estate. California black oak trees there appear to be in decline.
Oregon white oak savanna	OR White Oak Savanna 4-G, 12-AN, 14-K. OR White/CA Black oak savanna: 14-O. OR White/CA Black oaks and Douglas fir: 5-D.	Although this was the dominant plant community within the study area in the 1851 vegetation mapping, it was found in only three VMUs with Oregon white as the sole dominant, and in one additional VMU as a co-dominant with California black oak. In 5-D, both oaks are co-dominant in savanna with Douglas fir.
Ponderosa pine	None (as sole dominant). Co-dominant in 3-E, 3-T, 9-B, 9-C, 10-AE, 10-AG, 10-C, 10-E, 10-M, 11-H, 12-AD, 12-S, 16-B	No ponderosa pine savanna or woodland was documented in the study area. Ponderosa pine is a component of mixed woodland and forest stands in HAUs 3, 9, 10, 11, 12 and 16.
Old growth grand fir	No old growth grand fir communities noted, nor is it a sole dominant in any stand. Co-dominant with Douglas fir in 11-N and 12-AK. Widely scattered grand fir in 3-Q, 11-N, 12-G, 12-K, 12-AH, 12-AK, 19-B.	No grand fir communities of any age were noted. Some mature grand fir pockets exist in 11-N (Spencer Butte; off-site inventory by previous visit & aerial photo) and 12-AK (Amazon Headwaters). Many of the large grand firs seen are dying, possibly due invasion from an exotic insect (balsam wooly adelgid). Some small grand fir is coming into understories of some of the older Douglas fir stands.
Upland native prairie communities	Recorded in 11 HAUs: 2-5, 8, 10-13, 18 and 21 (see	Nearly all of these grasslands and the rocky areas are degraded from invasive exotic

and natural balds	accompanying data tables). Rocky areas (including balds) occurred in only one HAU (11-J, -K, -L).	species. Probably the best remnants are the rocky areas on Spencer Butte (HAU 11), and the native grassland remnants along the power line in HAU 10 and 12, and in HAU 14.

5.12 Vegetation Layer Observations. Tree layers are comprised almost entirely of native species in undeveloped areas, with some incursion by sweet cherry (an invasive exotic). The most common species include Douglas-fir, bigleaf maple and Oregon white oak. Shrub layers in forested areas are mostly dominated by native species, such as California hazel and osoberry. Exotics such as Armenian blackberry, Scot's broom, and other invasives dominate in many non-forested areas.

Tree removal in the east-west high voltage power line corridors through much of the SRHS area has resulted in retention of some habitats free of conifer encroachment. But such maintenance does not prevent the invasion by shrubs such as Armenian blackberry and Scot's broom, which also can shade out the remaining native, herbaceous prairie plants. Invasion by these shrubs can result in native herbaceous species decline, and management of these invasive shrubs with herbicides or mechanical means may cause further disturbance if not conducted appropriately.

Herbaceous vegetation in open areas is dominated almost entirely by exotic species, with only a few areas having native dominants persisting in small, remnant patches. The native species usually present in these remnants are those most tolerant of disturbance and competition. Examples of these species include self-heal (native variety), broadpetal strawberry and spreading rush. Herbaceous vegetation in forested areas tends to have a higher native component, although this is shifting to an exotic-dominated composition in areas being invaded by false brome and shining geranium. These species are invading primarily in HAUs 12 and 13, although one or more small infestations of false brome have been noted and treated in HAU 11.

5.13 Habitat Changes. Comparison of aerial photography from 1936-44 with current cover types shows that conifer forest and mixed deciduous-coniferous forest have come to dominate what once were large areas of savanna and prairie in the SRHS area. (See comparison in Table 1.) Whereas Oregon white oak, and some ponderosa pine, Douglas fir, and California black oak formerly were scattered in savanna and prairie areas, common habitats observed by the field team are dominated by Douglas fir, and often with bigleaf maple and Oregon white oak present. Forest habitats now occupy approximately 79% of the SRHS area, whereas in 1851, they occupied approximately 5% (Table 1).

Various activities noted by the consulting team throughout the study area are impacting habitat. They are listed and described on the following table.

Table 11. Activities and processes impacting habitats throughout the SRHS inventory area.

Cause	Location	Impacts	Effects
Residential development	Private land developed, or being	Removal of native and naturalized exotic vegetation, alteration of soils	Loss of habitat; reduction of habitat connectivity across the landscape; altered

	developed	and drainage patterns (collection of rainwater into storm sewers, piping of headwater streams)	hydrology. See also: Domestic animals, vegetation management, below.
Fire exclusion (cessation of historic burning)	Undeveloped private land, public land	Reduction of prairie and savanna habitats; increase of conifer-dominated forest lands	Reduction and loss of species dependent on open habitats, both of which are considered uncommon and rare.
Exotic plant species invasion	All areas	Competition with native plants for light, water, nutrients and space.	Conversion of habitats from native-dominated to exotic-dominated; loss of native biodiversity: both the native plants and the wildlife that depend on them.
Exotic animal species invasion and/or introduction	All areas	Habitat alteration, competition with native species.	Many effects, but poorly studied in Willamette Valley; some documentation of competition for breeding and feeding areas (European starling, nutria, etc.)
Timber harvest	Undeveloped areas	Commercial operations generally result in soil disturbance, and disturbance to all vegetation layers; some harvest can decrease encroachment, reducing shade and competition in prairie and savanna habitats.	Soil disturbance can lead to invasion by exotic species; reduction of woody plant encroachment can benefit health of prairie and savanna habitats if done with care.
Human recreation: ORV use, mountain biking, hiking	Undeveloped areas	Removal or crushing of native vegetation; soil compaction & disturbance; noise incursion, weed seed transport	Decrease of native vegetation and associated wildlife, increase of invasive, exotic vegetation; soil erosion; decline of wildlife populations (including invertebrates) from mortality or disruption of breeding cycles (see next section).
Domestic and feral cats and domestic dogs	Undeveloped and developed areas	Wildlife harassment and mortality.	Predation and/or breeding cycle disruption by domestic animals can result in decline of native birds, mammals, reptiles (Link 1999, ABC 2006).
Vegetation management (broadcast herbicide	Developed and occasionally undeveloped	Variable, depending on circumstances; can negatively or positively impact rare habitats and	Potential loss or reduction of uncommon and rare, native vegetation species; potential impact to non-target plant or

spraying, mowing, fertilizing, etc.)	areas	species.	animal species; potential contamination of waterways. Sensitive management of invasives can produce positive impacts.

5.14 Narrative Summary of HAU Inventory Observations. The following section is a narrative description of general findings for each HAU.

HAU 1: Pitchford Road

The Pitchford Road HAU lies just northwest of the west end of West 18th, and just south of the Westlawn Cemetery, south of West 11th. Most of the HAU is forested, and Douglas fir, bigleaf maple, Oregon white oak and California black oak are dominant. Where Douglas fir and oaks are mixed, the fir is overtopping the oaks. The southwest corner of the HAU is dominated by oak woodland which includes some very large oaks 30+ inches in diameter. Good sized madrone are also scattered in this area. Understory vegetation for most of the area could not be viewed due to lack of access. In the southwest corner it appears to be dominated by exotic species. Small openings in the oak woodland have potential to contain remnant native upland prairie. No uncommon or rare species are known to be present in the HAU. This HAU has a compact shape, no fragmentation and good connectivity to undeveloped lands to the east, west and southwest.

HAU 2: Warren Street

The Warren Street HAU is located along the north side of the UGB. A high voltage power line easement and maintenance corridor runs along the southwest side of the HAU. Most of the HAU is either conifer or mixed forest dominated by Douglas fir, oak and bigleaf maple. Oaks are being overtopped and shaded out by Douglas fir in many of the mixed stands. A small stand of oak forest is located at the northeast corner. Several meadow areas scattered through the HAU have potential to harbor remnant native prairie although most are dominated by introduced pasture grasses. Sweet cherry is a common invasive tree in moister forests. Armenian blackberry impacts forest understories and open areas. Meadows have been invaded by a variety of weedy grasses and forbs. Active development is occurring along the southeastern edge of the HAU and new streets have recently been built into the southern portion.

HAU 3: Wild Iris Ridge / Timberline

The Wild Iris Ridge HAU is owned by the City and is one of the largest HAU's with valuable habitats within the study area. A high voltage power line easement and maintenance corridor runs northwest/southeast through this HAU. Hitchcock's blue-eyed grass and white-topped aster were previously recorded in or adjacent to the corridor. The property was logged before it was purchased by the City, leaving much of the historic oak/hardwood and mixed forest character intact, although the understory has been invaded by exotics. City maintenance and management is addressing problems. Armenian blackberry is a major problem in much of the power line corridor.

East and north of the power line corridor the HAU is a mix of forested and open habitats, with active development occurring at edges and within the HAU boundaries. Young to mature conifer and mixed forest are interspersed with open meadow areas, many of which are currently being developed. Dominant tree species include Douglas-fir, bigleaf maple, Oregon white oak and California black oak. Oaks are being overtopped and shaded out by Douglas fir in many of the

mixed stands. Pileated Woodpeckers are present in mature Douglas-fir forest in the northeastern portion of the HAU. Armenian blackberry is invading forest understories and meadow areas.

HAU 4: Blacktail Drive / McClean Boulevard

Most of this HAU has been developed, or is being developed. A population of Hitchcock's blue-eyed grass was found during the survey in Videra Park, and the site was shown to City maintenance staff. Some narrowleaf wild onion and other native herbaceous plants are scattered throughout the open area of the park and adjacent property. Oak woodlands are present on private lands adjacent to the southeast end of the park. Grassland habitat, with some oak savanna, is present north-northwest of the park, where a flowering population of mule's ears (a native herbaceous species) was observed being mowed. Other native herbaceous species may be present but could not be viewed because of access limitations. A small riparian corridor and City-constructed stormwater detention ponds provide small but valuable wetland and riparian habitats for plants and wildlife, including dragonflies and other invertebrates. Armenian blackberry and Scot's broom are present in the park and in other portions of the HAU.

HAU 5: Hawkins Heights

Most of this HAU is conifer or mixed forest dominated by Douglas fir, bigleaf maple, Oregon white oak and California black oak. Oaks are being overtopped and shaded out by Douglas fir in many of the mixed stands. Large mature Douglas fir trees are present in the city park area in the northeast corner of the site and in mature forest throughout much of the rest of the HAU, and foraging excavations of Pileated Woodpeckers are present in these stands. The few open areas that exist are highly disturbed (bladed or filled) and very weedy. Development has occurred and is ongoing along the southern edge and in the western part of the HAU, and considerable habitat fragmentation has occurred in the western portion from development and roads. Forest understories are impacted by a variety of invasive plant species including Armenian blackberry, English/Irish ivy, English holly, sweet cherry, English hawthorn, spurge laurel, Robert's geranium and shining geranium.

HAU 6: Morse Ranch

The Oregon white oaks and California black oaks, particularly around the historic Wayne Morse home, but elsewhere on site as well, are important habitat features of the local area. The black oaks appear to be in slow decline, possibly due to anthracnose. The landscaping around the house contains some species that can be invasive in wildland habitats. Vegetation in the unmaintained areas below the house to the north frequently is dominated in the ground and shrub layers by non-native, invasive species. The park contains an off-leash dog run that was not included in the original inventory area, but is adjacent. A wildlife rehabilitation group resides in the barn. Open habitats are dominated by exotic herbaceous species, but trace native populations may be present.

HAU 7: 34th & Olive

The 34th and Olive HAU is mostly forested with a small grassy area in the east-center. Mixed forest of Douglas-fir, bigleaf maple and Oregon ash occupies most of the site. A stream flows northeast through the southeast corner of the site forming braided channels through an Oregon ash riparian forest. Based on aerial photography the grassy area appears to be mowed and lawn-like, although it may be within the riparian corridor and portions may be wetlands. No access was allowed to this area. Armenian blackberry, English/Irish ivy, reed canarygrass and a variety of other invasives are impacting habitats. Lands adjacent to this HAU are fully developed.

HAU 8: Braeburn / Blanton

Blanton Ridgeline Park system, and other elements of the City's Ridgeline Trail system, comprise much of this HAU. The majority of the HAU is mixed forest dominated by Douglas fir with bigleaf maple or Oregon white oak and California black oak. Douglas fir is overtopping oaks in stands in which they grow together. There are several areas of hardwood forest including moist riparian corridors dominated by Oregon ash. Small patches of oak woodland and oak forest also are present. Large Douglas fir, oak, madrone and ponderosa pine are scattered in forest stands. Open habitats are more limited and are concentrated in the northwest part of the HAU. The open area at the western edge of the HAU has a few remnant prairie species, but is dominated by exotic species.

Western Gray Squirrel and Pileated Woodpecker were documented in several areas and a population of tall bugbane was documented in Douglas fir-bigleaf maple forest in the southern half of the HAU. Yellow-breasted Chat and Mountain Quail have been documented in the area by local birders, although they were not observed during this inventory. Spurred lupine, an uncommon species in the Willamette Valley was noted on private land and Eugene Water and Electric Board land in the southern portion of the area. This species is a potential host for Fender's Blue Butterfly, but surveys during the flight season would be required to ascertain their presence or absence.

Forest invasives include sweet cherry, Armenian blackberry, English/Irish ivy, English holly, English hawthorn, shining geranium and Robert's geranium. Meadow habitats have been impacted by exotic grasses and forbs.

This HAU has a very long narrow shape and has been fragmented by development in the north, middle and south parts. However, it retains good connectivity to undeveloped habitats to the west and southwest.

HAU 9: Resthaven Cemetery

The fringes of this cemetery retain some mixed forest values, including some large Oregon white and California black oak, and ponderosa pine. Suitable wayside aster habitat is present on the north edge, and possibly elsewhere. Oak habitats at the south end of the site were not accessible for this inventory. Active logging, in conjunction with an approved cemetery development permit, was occurring over much of the southern half of the site. The site has no connectivity to other habitats.

HAU 10: Fox Hollow / Willamette

HAU 10 is a diverse area located between Willamette and Donald Streets at the north end and between Fox Hollow Road and Spencer Butte Park at the south end. Most of this HAU is forested with conifer, mixed and hardwood forests. Oaks are being overtopped and shaded out by Douglas fir in some of the mixed stands. A high voltage power line corridor passes east-west through the area near the intersection of Donald Street and Fox Hollow Road. Several headwater streams originate within the HAU and feed upper Amazon Creek and other drainages. A few open habitats exist in the power line corridor and along the southern edge of the HAU. Periodic clearing of the power line corridor has helped to maintain open habitats. All open habitats have potential for remnant upland prairie elements to be present. Moist Oregon ash forest is found in the middle portion of the site and is bisected by Owl Road. Western coneflower and ample-leaved sedge, uncommon in the Willamette Valley, are both present the understory of this area.

The north end of the HAU is fragmented by development and streets, and scattered development and individual residences occur throughout much of the southern half of the area. Despite this, there are

large areas of unbroken natural habitat present and excellent connections to adjacent large blocks of habitat in Spencer Butte Park (HAU 11). This HAU also provides good connectivity between undeveloped areas to the south and HAU 8 to the north and HAU 12 to the east.

Uncommon or rare species that have been documented within the HAU include Little Willow Flycatcher, Mountain Quail, Olive-Sided Flycatcher, Pileated Woodpecker, Northern Red-legged Frog, wayside aster, and tall bugbane.

Armenian blackberry is impacting habitats throughout the HAU, including tall bugbane habitat. A large false brome infestation is present in forested habitats between Owl Road and the power line corridor. Shining geranium, Robert's geranium, English/Irish ivy and introduced grasses are invading forest understories. Despite the presence of a diversity of invasive species, many forest understory communities are dominated by native species and are in good condition.

HAU 11: Spencer Butte Park

The northern end of this HAU primarily is disturbed prairie, but it does contain potential habitat for several uncommon to rare prairie species. The narrow section of the HAU containing the Ridgeline Trail access to Spencer Butte currently is dominated by a stand of Oregon white oak and ponderosa pine, including some very large trees, which is being encroached upon by Douglas fir.

Most of the VMUs comprising the main portion of Spencer Butte Park are forested, but there are several rocky openings near and at the summit, that provide a habitat unique in the SRHS area. Although those areas are dominated in many places by invasive and other exotics, they still hold remnant populations of significant native species. Comparing the early 1930s plant list with current listings, it is evident that some native plant species have disappeared from the rocky and open areas, and that new exotic species have appeared.

Western rattlesnakes have been sighted recently in the rocky area near the summit, and the seepy are to the east of the summit has several plant species otherwise not known from the SRHS area. Spencer Butte is the highest point in the SRHS area, at 2054 feet in elevation. This height, combined with the open habitat, makes it an important migratory bird site; several uncommon to rare migrants have been noted there, including White-throated Swifts.

The designated trails, and much of the rocky area at the top (which lacks a designated trail), receive heavy recreational hiker use, leading to trampling of plants and off-leash dog impacts.

Tall bugbane and wayside aster were previously known from several sites in the park, and several of those were seen again during this inventory. Armenian blackberry is likely the invasive species with the highest existing impact in the HAU. A very invasive grass, false brome, has been pulled from an area near the meadow just southeast of the summit.

The forest stand on the northeast slope of the Butte contains some of the largest Douglas fir and grand fir in the SRHS area.

HAU 12: Amazon Headwaters

Located between Fox Hollow Road and Dillard Road, this HAU encompasses most of the headwaters of Amazon Creek. Much of the area is occupied by mature conifer and mixed forest dominated by large Douglas fir and bigleaf maple. Large grand fir are present in drainage bottoms

although many of these trees have died recently or appear to be in decline, possibly due to an introduced adelgid (insect) which has infested Willamette Valley grand fir. A high voltage power line corridor passes east-west through the area. Most of the power line corridor and a large forested block to the south of it is city park land. Clearing activities for the power line have maintained both open and shrubby habitats. The open habitats contain remnant native upland prairie with Roemer's fescue, California fescue, field checkermallow and other native prairie and savanna species present. Most grassland areas are quite weedy with introduced grasses and forbs.

Dry conifer and mixed forest grow along the ridgeline on the southern edge of the HAU, and along the northern edge of the power line corridor in the northeast part of the area. Very large ponderosa pines are scattered among younger, smaller Douglas firs in these stands, remnants of pine-oak savanna that occupied this area 150 years ago. A few remaining oaks are in decline from being overtopped by Douglas fir.

Wayside aster, tall bugbane, field checkermallow, Northern Red-legged Frog, Little Willow Flycatcher, Mountain Quail and Western Gray Squirrel have been documented in HAU 12. Understory plant communities in many of the forested areas are in good condition although Armenian blackberry is spreading aggressively in some areas, threatening some tall bugbane populations and native understories. A large infestation of false brome is located in forest communities south and west of Fox Hollow School in the northwest corner of the site. Patches of shining geranium are scattered throughout the HAU and a heavy infestation of this species is negatively impacting understory vegetation along Dillard Road in the northeast part of the HAU.

Some fragmentation caused by development has occurred in the western part of the HAU along Fox Hollow Road and West Amazon Drive. Otherwise, this HAU provides good connection with undeveloped habitats to the east, south and southwest.

HAU 13: Mt. Baldy

The southeast section of HAU 13 is a large public park (Mt. Baldy). Conifer encroachment into historic prairie, savanna and oak woodland habitats is common. A few interesting native plants exist in prairie areas, but past grazing history has resulted in overwhelming dominance of exotics in those habitats. An Oregon ash riparian area (VMU 13-F) is in surprisingly good native condition considering its proximity to the urban area, but creeping buttercup is an invasive dominant in the herb layer there. Otherwise, dominants are native in most forest understories. Exotics dominate most prairie, savanna and woodland habitats. A pond (VMU 13-D) located on the southwest side of Mt. Baldy, appears to be a significant breeding site for Northern Red-legged Frogs, but is threatened by encroaching reed canarygrass. Bullfrog tadpoles also were sighted, but they may not survive annual low water or drying of the pond. There is significant trampling by humans and dog intrusion into the pond on the west edge, where a trail from the meadows provides access through large Armenian blackberry mounds.

Many young and mature oaks are impacted by encroachment of Douglas-fir; Oregon white oak is most abundant, but there are quite a few California black oak as well (many of these appear to be in decline, possibly due to infection by anthracnose). Roadsides have significant populations of invasive shining geranium: especially along Dillard Road, Old Dillard Road, Barber Drive and Skyline Loop. One backyard pond was noted off the north side of North Skyline Park Loop. Several seepy drainages in the area may be suitable for Northern Red-legged Frog dispersal and foraging. Western Gray Squirrels were noted at several locations, particularly near the intersection

of Barber Drive and Skyline Park Loop. A roadside population of wayside aster, with other interesting native herbaceous species, was discovered during this survey along Dillard Road adjacent to the HAU.

HAU 14: Shasta Loop

The Shasta Loop HAU lies between Spring Boulevard and East Amazon Drive. It is mostly comprised of small blocks of mixed forest dominated by Douglas fir, Oregon white oak, California black oak and bigleaf maple. Oak woodland and oak forest containing some large, older oaks are present in the northern part of the HAU. Oaks in the mixed stands are being overtopped and shaded out by Douglas fir. Pileated Woodpeckers are present in forested and woodland areas with mature Douglas fir. Degraded savanna and prairie are present, the largest area occurring along the eastern side of the site. A small strip of oak savanna in the northern part of the HAU has rock outcrops and patches of native Lemmon's needlegrass.

Sweet cherry is a common invasive tree in forest areas. Understory invasives include Armenian blackberry, Scot's broom, and Robert's geranium. Maltese starthistle, an uncommon exotic in the Willamette Valley, grows in the rocky savanna area noted above. This HAU is highly fragmented by development and roads. Active development is occurring within the HAU along the east side in an area bounded by 43rd Street, Spring Boulevard and Knoll Drive.

HAU 15: Spring Boulevard

The Spring Boulevard site is a small HAU located between Spring Boulevard and Woodson Street. It is comprised of 3 small patches of young Douglas fir forest with scattered oaks and maples. Oaks in these stands are in decline from overtopping by larger Douglas firs. Invasive species include sweet cherry, English/Irish ivy, English holly and Armenian blackberry. Fresh Pileated Woodpecker foraging excavations were observed in the northeast corner of the HAU. This site is highly fragmented by residential development, and surrounding areas are fully developed.

HAU 16: Pine Canyon Road

HAU 16 lies north and south of Pine Canyon Road. Most of the site is dry mixed forest dominated by Douglas fir, Oregon white oak and California black oak. Pacific madrone is common in some areas. Scattered large, older oaks are present in several of the stands, reflecting the more open woodland and savanna conditions that once existed here. Many oaks are in decline from overtopping by Douglas fir. Western Gray Squirrels were observed in forested areas north of Pine Canyon Road and likely inhabit all forested areas in the HAU.

Sweet cherry has invaded forest stands and understory vegetation is generally weedy with introduced grasses, Armenian blackberry and English/Irish ivy. Sweet cherry, English hawthorn, Armenian blackberry, Scot's broom, spurge laurel and weedy grasses occupy a woodland area at the south end of the site. This HAU is moderately fragmented by development and streets. Surrounding areas are fully developed.

HAU 17: Agate Street / Kimberly

The Agate Street / Kimberly site is located along the south side of 30th Avenue between Onyx Street and Spring Boulevard. The area is mostly mature Douglas fir and mixed forest dominated by large Douglas fir and bigleaf maple. Oregon white oak is overtopped by Douglas fir in small forest stands in the northwest corner of the site. A mowed grassy area in the northern part of the HAU is the only

open habitat present. Pileated woodpecker nesting and foraging excavations were observed in several forested locations within the HAU.

Sweet cherry has invaded forest overstories, and understories are impacted by a variety of invasive plants including Armenian blackberry, English hawthorn, English/Irish ivy, English holly, laurel spurge, and introduced grasses. Cotoneaster, an escaped ornamental, is scattered throughout the site. HAU 17 is quite fragmented by development and streets. Surrounding areas are developed for residential use except along the north side which is bordered by 30th Avenue, a busy four lane road.

HAU 18: Laurelwood / Ribbon Trail

The Laurelwood / Ribbon Trail HAU is located along the north side of 30th Avenue and is bordered on the west and north by the Laurelwood Golf Course and adjacent developed areas, and to the northeast by the Floral Hill neighborhood. Hendricks Park is located directly north of this HAU. The area is characterized by a variety of forested habitats including mixed conifer forest dominated by large mature Douglas fir and bigleaf maple or Oregon white oak/California black oak, dry hardwood forest of Oregon white oak, sometimes mixed with bigleaf maple, young Douglas fir forest and mixed woodlands of Douglas fir and oak. Both white and black oak are being overtopped and shaded out of forest stands where they grow with the taller Douglas fir. A woodland area in the eastern portion of the HAU was logged to remove large Douglas fir several decades ago, and is dominated by smaller Douglas fir and white and black oak. A forested riparian area with a black cottonwood overstory drains northerly into the Floral Hill area. A small grassland area is located in the northwest point of the HAU.

Pileated Woodpecker calls and foraging excavations were observed in several areas within the HAU, and nesting excavations were observed in mature Douglas fir forest on the east side of the golf course. Tall bugbane was documented in the north part of the site. The riparian area has potential breeding and dispersal habitat for Northern Red-legged Frog.

Sweet cherry has infested overstories in forested areas. Most forest understory areas are predominantly native, but English holly, English hawthorn, English/Irish ivy, Armenian blackberry, spurge laurel and Robert's geranium are present and will continue to impact native plant communities. Old skid trails visible on aerial photos likely have dense Armenian blackberry and have served as introduction corridors for other invasives. The grassland area is dominated by weedy introduced grasses.

HAU 18 is somewhat fragmented by development and roads, but contains some large blocks of contiguous habitat. It provides good connectivity to the Moon Mountain area to the east and a narrow connection to Hendricks Park to the north. 30th Avenue constitutes a major barrier along the southern edge of the area.

HAU 19: Hendricks Park

Hendricks Parks comprises this entire HAU. An active Pileated woodpecker nest was sighted in the park in summer 2006 (personal communication, Gleason). Many excavations are visible at the bases of large trees. Two small, northerly-flowing drainages are present, with small amounts of ponding at road crossings. Northern Red-legged Frog breeding is unlikely there, but the forests probably provide dispersal habitat. Some large Douglas fir are present near the drainages.

The Oregon white oaks in the rhododendron garden are large and in good condition because of a careful irrigation plan. A tall bugbane population was confirmed in the southeast portion of the park, and is somewhat threatened by Armenian blackberry and shade encroachment. Bigleaf maple and sweet cherry exist in many portions of the forest understory. Trails are present throughout the forested area, but are not heavily used. The southwest ridge is dominated by Oregon white oak, and the City is considering removal of encroaching fir, invasive Armenian blackberry and other herbaceous species (English/Irish ivy, periwinkle, nipplewort, Robert's geranium, etc.). There is connectivity to the south to HAU 18, but the majority of the HAU is surrounded by residential development.

HAU 20: McDougal

The McDougal site is located southwest of Moon Mountain and is nearly all private land except for a small patch of city park land at the northeast corner. Most of the HAU is cutover hardwood forest that resulted from logging of Douglas fir within the last 30 to 40 years. Dominant tree species include bigleaf maple and Oregon white oak. Douglas fir is present in the stand at subdominant levels. Limited views of the understory suggest that it is probably infested with dense Armenian blackberry. Two patches of uncut conifer and mixed forest are present in the center and western parts of the HAU. The understory along the western edge is in good condition. A small patch of shrubland is located on the city parkland at the northeast corner, and contains bits of remnant prairie with Roemer's fescue, California oatgrass, Hall's aster, Oregon sunshine, barestem lomatium, rose checkermallow, narrowleaf mule's ears and farewell-to-spring. A high voltage power line corridor passes north-south through the eastern edge of the HAU.

A Yellow-breasted Chat was documented in shrubby vegetation in the northern part of the site.

Meadow openings are dominated by exotic grasses and are impacted by invading woody species. Armenian blackberry is severely impacting large portions of the site, especially the cutover forest areas and the power line corridor. Shining geranium is present at the western edge of the area and may extend further into the interior of the site.

Connectivity within the site is excellent, and this HAU provides good connections to undeveloped areas to the west, south, east and northeast. Adjacent development is concentrated on the northwest corner of the HAU.

HAU 21: Moon Mountain

The Moon Mountain HAU is located south and southeast of the Glenwood – I-5 interchange. A portion of the area at the southern end is City parkland. A powerline corridor passes north-south through the HAU. Access to the public land in the southern portion, and other parts of this HAU, was very limited.

Most of the site is vegetated by mixed forest and oak woodlands. Much of the area has been cut over in recent years and appears to have dense Armenian blackberry infestations. The powerline corridor is likewise heavily infested with blackberry. The south and west parts of the HAU have significant areas of upland prairie and savanna, although these areas were not accessible for inventory. From aerial photo interpretation it appears that they have been partially colonized by Armenian blackberry and other woody vegetation. However, they may retain good potential to harbor remnant prairie species. Areas near the Glenwood – I-5 interchange are disturbed by dumping, grading and invasives. ORV disturbance is evident near the interchange, and based on

aerial photo interpretation, may be present in the southern portions of the HAU. Wayside aster previously was found in this HAU as noted in a site planning document. Tall bugbane is known from nearby, but potential habitat in the HAU was not accessible for this inventory.

The northern and western edges of the HAU are developed, or are developing and along with the powerline corridor this has resulted in some fragmentation. Nonetheless, large, unfragmented areas remain and there is excellent connectivity with undeveloped habitats to the south.

5.15 Uncommon and Rare Species Documentation and Habitat Suitability. The following table shows the species from the original and expanded lists of SRHS target uncommon and rare species that either were seen during the inventory or noted by a biological consultant in a report to the City, or listed in ORNHIC records in the study area. The table is sorted to illustrate the relative frequency of SRHS documentation (from highest to lowest) of the uncommon and rare species or signs of their presence. It does not show their *complete* occurrence, however, as structured surveys have not been conducted and some species are more easily detectable than others. Additionally, some detections may represent multiple recordings of a single individual. More information on occurrence, habitat and range is in Appendix B.

Table 12. Target uncommon and rare species documented within the SRHS area.

Species	Value	Source list	ORNHIC record	HAUs by SRHS #	Total # of HAUs	Total # of VMUs
Pileated Woodpecker	H	Original	No	3, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19	14	62
Hitchcock's blue-eyed grass	H	Expanded	Yes	3, 4, 13	3	11
Western Gray Squirrel	H	Expanded	No	6, 8, 13, 14, 16, 19	6	11
tall bugbane	H	Original	Yes	8, 10, 11, 12, 18, 19	6	8
wayside aster	H	Original	Yes	10, 11, 13, 21	4	8
Mountain Quail	M	Expanded	No	8, 10, 12	3	7
meadow checkermallow	H	Expanded	No	12	1	3
Northern Red-legged Frog	H	Original	No	10, 12, 13	3	4
Olive-sided Flycatcher	H	Expanded	No	10, 21	2	3
Little Willow Flycatcher	H	Expanded	No	10, 12	2	2
upland yellow violet	M	Expanded	No	11, 13	2	2
Yellow-breasted Chat	H	Expanded	No	8, 20	2	2
grass widows	M	Expanded	No	11	1	1
Western Rattlesnake	H	Expanded	No	11	1	1

White-breasted Nuthatch	H	Expanded	No	6	1	1

Pileated woodpeckers or their activity were documented in 14 of the 21 HAUs, and in 63 of the 324 VMUs. Tall bugbane and Western Gray Squirrel each have been documented in 6 HAUs, and wayside aster in 4. The remaining species on the table were recorded in 3 or fewer HAUs.

The next table lists the uncommon and rare species documented in each HAU during this study, or previously recorded

Table 13. Documented uncommon and rare species (with SRHS value) by HAU.

HAU	Species
3	Pileated Woodpecker (M) Hitchcock's blue-eyed grass (H)
4	Hitchcock's blue-eyed grass (H)
5	Pileated Woodpecker (M)
6	Western Gray Squirrel (H) White-breasted Nuthatch (H) Pileated Woodpecker (M)
8	Pileated Woodpecker (M) Western Gray Squirrel (H) Mountain Quail (M) Yellow-breasted Chat (H) tall bugbane (H)
9	Pileated Woodpecker (M)
10	Mountain Quail (M) Northern Red-legged Frog (H) tall bugbane (H) Olive-sided Flycatcher (H) Pileated Woodpecker (M) Little Willow Flycatcher (H) wayside aster (H)
11	Pileated Woodpecker (M) Western Rattlesnake (H) wayside aster (H) tall bugbane (H) upland yellow violet (M) grass widows (M)
12	Northern Red-legged Frog (H) Mountain Quail (M) Little Willow Flycatcher (H) meadow checkermallow (H) Pileated Woodpecker (M) tall bugbane (H)

13	Western Gray Squirrel (H) Hitchcock's blue-eyed grass (H) Northern Red-legged Frog (H) Pileated Woodpecker (M) wayside aster (H) upland yellow violet (M)
14	Western Gray Squirrel (H) Pileated Woodpecker (M)
15	Pileated Woodpecker (M)
16	Western Gray Squirrel (H)
17	Pileated Woodpecker (M)
18	tall bugbane (H) Pileated Woodpecker (M)
19	tall bugbane (H) Pileated Woodpecker (M) Western Gray Squirrel (H)
20	Yellow-breasted Chat (H)
21	wayside aster (H)
	Olive-sided Flycatcher (H)

The following paragraphs describe the habitat suitability mapping produced for this project. The VMU maps were produced using field-mapped cover types for each VMU, cross-referenced to the habitat suitability matrix rating (Appendix C). It should be noted that elements of this assessment system were developed originally for use at a coarser scale for regional application. For this study, these elements were refined and adapted to be used at the local level.

Additional information on status, life cycles and habitats of these species, as well as species from the expanded list documented in or near the study area, is contained in Appendix B.

Kincaid's lupine. Cover type habitat suitability mapping for Kincaid's lupine shows high and medium suitability habitats scattered throughout the SRHS area.

Tall bugbane. Habitat suitability mapping for tall bugbane shows medium suitability habitat throughout most of the study area. Tall bugbane would be most likely in moist areas within forested habitats, which occur at a finer scale than the cover type mapping.

Thin leaved peavine. Habitat suitability mapping for thin-leaved peavine shows some high suitability habitat scattered throughout the study area, however, it most likely would occur on edges between mixed forests, oak forests and grasslands.

Thompson's mistmaiden. Cover type habitat suitability mapping for Thompson's mistmaiden shows scattered high and widely scattered medium suitable habitat throughout the study area, generally associated with grassland habitats. Thompson's mistmaiden generally occurs in moist places within grassland habitats that occur at a scale too fine to map in this project.

Wayside aster. Cover type habitat suitability mapping for wayside aster shows low suitability habitat for much of the study area, with some high and medium suitability areas occurring occasionally throughout. Suitable habitat occurs in savanna habitats, as well as in forest gaps and on edges.

Suitable habitat for the following two wildlife species from the original list were mapped using the same coarse scale cover type suitability method that was used for plants, and a second map was produced for each using finer scale features recorded during the inventory.

Northern Red-legged Frog. Because Northern Red-legged Frogs have different requirements for breeding (aquatic) and for foraging/dispersal (terrestrial) portions of their life cycles, these two habitats are mapped separately. Habitat suitability mapping using the coarser scale method shows four small, aquatic (breeding) habitats as "high suitability." The paucity of seasonal ponds in the SRHS area (because of the primarily ridgeline and hillslope topography) likely is the reason for the low amount of suitable aquatic habitat. A large amount of high suitability terrestrial foraging/dispersal habitat was mapped, based simply on presence of forests. This map could be modified in the future assessing finer scale features such as proximity to suitable breeding habitats.

A second habitat suitability map set, based on finer scale assessment of special habitat features, shows widely scattered high and medium potentially suitable habitat for breeding, and a fairly even one-third split between high-medium-low suitability foraging/dispersal habitat. It should be noted that because of a lack of access, some features are assumed based on best professional judgment in comparison with similar, viewed habitat nearby. Again, this suitability mapping could be refined by including inventory and assessment of nearby habitat features.

Pileated woodpecker. Cover type habitat suitability mapping for the Pileated Woodpecker shows high suitability habitats for most of the SRHS area, reflecting forested areas with potential tree size to meet the needs of this large bird. A second habitat suitability map based on finer scale observations of special habitat features such as snags and logs, as well as stand type and age, shows concentrations of suitable habitat near Hendricks Park (where there is confirmed breeding) and the Spencer Butte – Amazon Headwaters area. Other, smaller areas also are mapped.

Nest excavations of Pileated woodpeckers were noted in 6 VMUs, within 5 HAUs: 6A, 10B, 12A, 12AI, 17F, 18H and 19B, but consultants lacked access to much of the inventory area, resulting in a rate of detection that likely is lower than reality. Some of these nest excavations may have been used during the 2006 nesting season, and some may be older and may not have been used recently. Foraging evidence was detected in 56 VMUs within 11 HAUs: 3, 5, 8, 10, 11, 12, 13, 14, 15, 17, 18 and 19. As above, it is likely that lack of access led to under-representation of actual occurrences.

5.2 Assessment Results. Across the project area, VMU scores ranged from a low of 2 to a high of 27, (average 13.8) before an acreage multiplier was applied. With the application of the acreage multiplier, scores ranged from a low of 2 to a high of 76.5 (average 23.5). Highest scoring VMUs were usually rare habitat types (prairie, savanna, wetlands, etc.), were large in size, and often had a significant component of native vegetation.

Table 14. VMU scores by HAU (top 3 VMU highest, average, sum, and HAU score and survey acres in bold face type)

HAU #	# of VMUs	Lowest VMU score	Highest VMU score	Average VMU score	Sum of VMU scores	HAU score	HAU survey acres
1	3	30	37.5	**32.5**	97.5	21.8	35.4
2	17	6	31.5	22.4	380.5	50.1	106.0
3	30	5	**72**	29.8	**892.5**	**101.8**	232.6
4	9	9	46	25.2	226.5	33.2	31.2
5	15	2	26	16.5	247.5	28.8	73.9
6	7	6	30	17.7	124	14.4	31.6
7	3	5	30	21.2	63.5	8.9	16.2
8	22	12	50	26.1	573.5	69.4	220.6
9	4	10.5	32.5	17.1	68.5	8.4	22.5
10	33	9	62.5	27.1	**893.5**	**101.9**	**242.3**
11	15	5	**76.5**	**31.7**	475.5	60.6	**318.6**
12	40	4.5	57.5	24.8	**994**	**112.4**	**411.6**
13	38	6	45	19.8	753	87.8	150.1
14	18	7	57.5	25.3	455.5	49.6	97.3
15	3	9	11	9.7	29	3.9	3.1
16	7	6	24	13.9	97.5	10.8	21.7
17	12	3	30	13.4	160.5	17.1	48.2
18	12	15	45	29.3	352	47.7	178.0
19	9	8	35	14.1	126.5	17.7	78.2
20	4	7	56	**32.8**	131	25.1	93.2
21	23	7.5	**65**	22.4	515.5	64.6	176.5
TOTAL	324	---	---	---	---	---	2588.6

The number of VMUs within an HAU varied from a low of 3 (HAU 1) to a high of 40 (HAU 12). The three highest individual VMU scores were in HAUs 3, 10 and 21 (shown in bold above). The highest VMU average scores were in HAUs 1, 11, and 20. HAUs 3, 10 and 12 had the highest sum total VMU scores and highest HAU scores. The three largest HAUs were 10, 11 and 12.

HAU scores ranged from 3.9 (HAU 15) to 112.4 (HAU 12), with an average of 44.5. Larger HAUs with more rare habitats mapped within them, and greater connectivity to large habitat patches scored highest. Because in some areas HAU boundaries were created arbitrarily, primarily in recognition of development barriers, the HAUs vary greatly in size: the smallest (excluding DV areas) is 3.1 acres (HAU 15), and the largest is 412 acres (HAU 12). HAUs that are significantly larger will score higher than smaller HAUs that score equal in other aspects. This is intentional, as larger habitat areas have more values than smaller areas – other factors being equal. The potential limitation of this method is that valuable VMUs may be overlooked if they are contained within smaller, lower-scoring HAUs. To more accurately compare HAU values within the SRHS, both the HAU scores and the individual VMU scores within the HAU should be consulted and it is recommended that individual qualities shown on each VMU rating table be considered when comparing VMU scores. Some VMUs have values that may not stand out when simply comparing total VMU scores.

The following table provides summary HAU scoring information.

Table 15. HAU scores in order from highest to lowest.

HAU #	HAU Name	Score
12	Amazon Headwaters	112.4
10	Fox Hollow / Willamette	101.9
3	Wild Iris Ridge / Timberline	101.8
13	Baldy Mountain	87.8
8	Braeburn / Blanton	69.4
21	Moon Mountain	64.6
11	Spencer Butte Park	60.6
2	Warren Street	50.1
14	Shasta Loop	49.6
18	Laurelwood / Ribbon Trail	47.7
4	Blacktail Dr. / McClean Blvd.	33.2
5	Hawkins Heights	28.8
20	McDougal	25.1
1	Pitchford Road	21.8
19	Hendricks Park	17.7
17	Agate Street / Kimberly	17.1
6	Morse Ranch	14.4
16	Pine Canyon Road	10.8
7	34th & Olive	8.9
9	Resthaven Cemetery	8.4
15	Spring Boulevard	3.9

The highest scoring HAUs are in the Amazon Headwaters – Fox Hollow/Willamette – Baldy Mountain and Wild Iris Ridge areas. In general, these HAUs are large, contain valuable habitats and are connected to larger habitats both inside and outside the UGB. The lowest scoring areas include HAU 7 (south of Morse Ranch), HAU 9 (Resthaven Cemetery), and the Spring Boulevard to Agate Street HAUs – primarily because they have few or no valuable habitats, and are small and isolated. Figures 5 and 6 show the HAU scores in two formats: in order from west to east, and from high to low score.

Figure 5. HAU scores in geographic order west (left) to east (right).

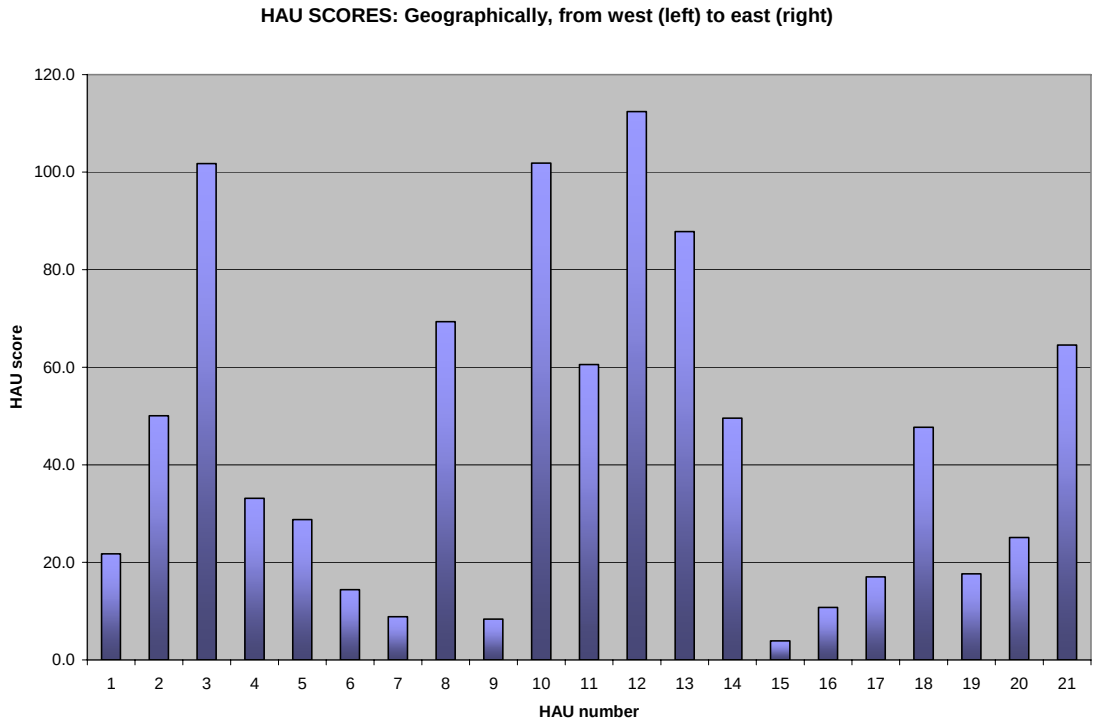
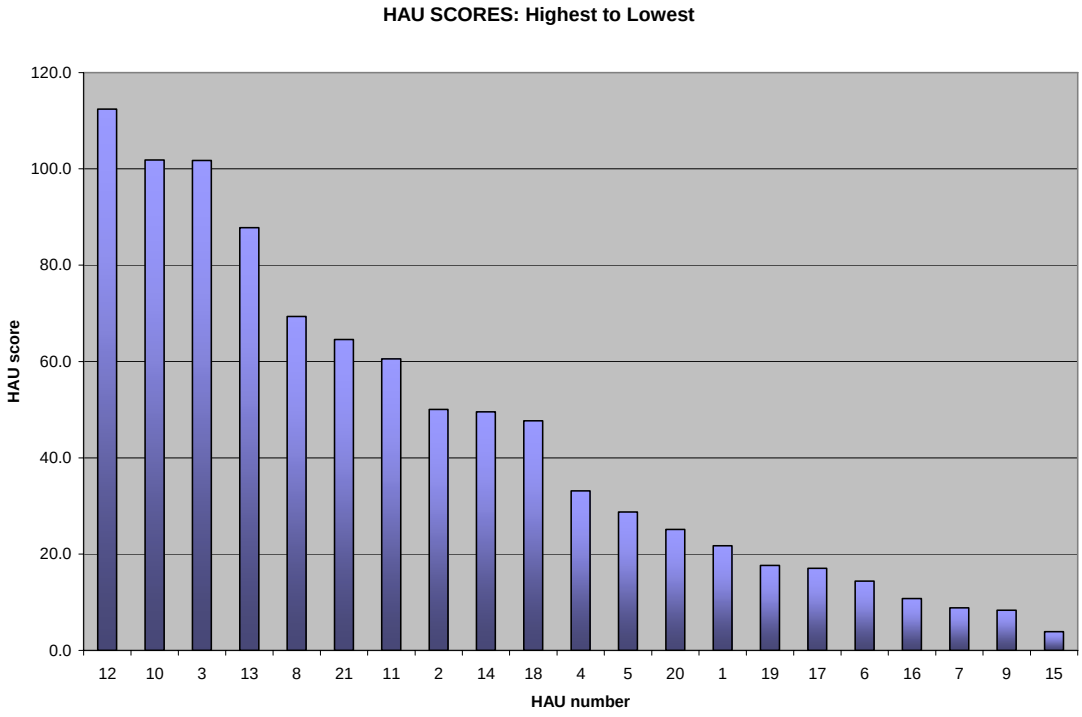


Figure 6. HAU scores in scoring order, highest (left) to lowest (right)



6.0 Conclusions

The most important conclusion to be drawn from this study is the rarity of savanna and prairie habitats in the SRHS area. This is most obvious in the comparison of 1851 acreage of those two categories to the 2006 acreages (Table 1), demonstrating the decline of the open habitat types and increase of forested habitat types. The local decline in these rare habitat types evidently is representative of habitat changes occurring on a larger scale throughout the Willamette Valley.

Evaluation and comparison of the rare habitats using the uncommon and rare species suitability indices (RSS) matches regional assessments of uncommon and rare species. The highest value RSS indices calculated in this study are for oak savanna (308) other savanna (272), and natural grasslands (245) habitats. By comparison, the highest RSS for a conifer forest category mapped during this study is the combined high scores at 137. This difference is not surprising, in that the reduced acreages of the rare, open habitats directly cause the decline in associated species dependent on those habitat types – such as Fender's Blue Butterfly, Kincaid's lupine, and Willamette daisy. It also is noteworthy that some of the uncommon and rare species (Spotted Owl, Red Tree Vole, Pileated Woodpecker, etc.) that add to higher scores in forested habitats are more widespread in neighboring ecoregions (e.g., Western Cascades and Coast Range) where forested habitats have been more common historically. Other uncommon and rare species present in the SRHS area often are found in forested habitats associated with oaks (e.g., Western Gray Squirrel), or in gaps and on edges (tall bugbane, wayside aster). Some of the oak-associated species more commonly use woodlands or savannas (Western Gray Squirrel, wayside aster, etc.), and they score higher habitat suitability in those habitats.

It is evident that the rare species values of the open habitats being lost in the SRHS area greatly exceed the values of the forested habitats that are increasing. This shift has resulted in a large reduction in native biodiversity in the SRHS area.

Although many invertebrates are known to associate with open habitats, they are very seldom inventoried, and their local extirpations usually go unnoticed. For example, in this ecoregion, there are approximately 400 pollinators known in open areas, of which about 300 may be at risk – and vastly fewer are present in forested areas (Moldenke, pers. comm.). The decrease in open habitats that has occurred since the mid-1800s likely has resulted in an associated decrease in the number of invertebrate species present in the SRHS area.

As observed during this field inventory, private lands are undergoing rapid residential development. Impacts to habitats are direct, primarily from conversion to other uses, and also, indirect, such as from the introduction of invasive plant and animal species.

The City of Eugene presently owns many of the lands with the highest habitat value within the study area (for example, all or portions of HAUs 3, 11, 12, 13). The highest value habitats include open prairie and savanna remnants (including rocky areas), woodlands, wetlands and late successional (old growth) forests. Most of these areas, particularly the historic prairie and savanna habitats, are degraded from encroachment of native woody vegetation, and invasion by exotic plant species. Some of the high-value habitats remain in private ownership (for example, HAUs 10-14, 18, 20, 21), and are subject to development pressure not expected in publicly-owned parcels.

The consensus of all recent regional studies of habitat trends, is that the once-widespread, but now rare prairie and savanna habitats and the species associated with them are the most important conservation priority for the Willamette Valley (some wetland and riparian habitats are high value as well). Many federal and state agencies and private landowners have undertaken restoration of prairie and savanna habitat remnants to address this concern.

7.0 Recommendations

The following recommendations are offered to the City of Eugene and the general public by the consulting team, based on past ecological planning experience, including field inventory and assessment completed for this project. These recommendations coincide with general and specific direction provided in the various regional ecological studies cited previously in this report:

- continue inventory and assessment for additional lands which provide important habitat; include lands both within the SRHS where onsite access was not obtained for this survey, and expand to nearby upland habitats
- examine historic cultural landscape restoration and education opportunities with Native American groups
- survey periodically for uncommon and rare plant, animal (vertebrate and invertebrate) and fungi species and rare habitats on all City-owned lands; encourage surveys on privately-owned lands
- work to prevent entry of new invasive species to the site ("exclusion") and survey periodically for "early detection" of invasive species on all City-owned lands; encourage surveys on privately-owned lands
- respond rapidly to detection of invasive species, especially where rare habitats or species may be at risk; coordinate with private landowners
- comprehensively plan and implement conservation and ecological restoration of rare habitats and associated rare species populations on private and public lands, focusing on Strategy Habitats identified in the Oregon Conservation Strategy (ODFW 2006)
- develop habitat protection, restoration, and enhancement guidelines for residential development and individual homeowners in the SRHS area to improve habitat values within the developed area (e.g., planting native species) and to reduce impacts in adjacent habitat areas (e.g., from exotic plant and animal species, including pets).

.

References

ABC. 2006. Impacts of Feral and Free-Ranging Cats on Bird Species of Conservation Concern. American Bird Conservancy.

Adamus, P.R., J.P. Baker, D. White, M. Santelmann, and P. Haggerty. 2000. Terrestrial Vertebrate Species of the Willamette River Basin: Species-Habitat Relationships Matrix. Internal Report. U.S. Environmental Protection Agency, Corvallis, OR. http://www.fsl.orst.edu/pnwerc/wrb/access.html (select "Related Data")

Alverson, Ed. 2005. Preserving Prairies and Savannas in a Sea of Forest: a Conservation Challenge in the Pacific Northwest. *Plant Talk,* Vol.40. http://www.plant-talk.org/stories/40forest.html

Aubrey, K and C. Raley. 2002. The Pileated Woodpecker as a Keystone Habitat Modifier in the Pacific Northwest. USDA Forest Service Gen. Tech. Rep. PSW-GTR-181.

Campbell, B. 2004. Restoring Rare Native Habitats in the Willamette Valley. Defenders of Wildlife. West Linn, OR.

City of Eugene. 2006a. Request for Proposal: South Hills Upland Habitat Study. City of Eugene. Eugene, OR.

City of Eugene. 2006b. South Ridgeline Habitat Study web site. City of Eugene. Eugene, OR. http://www.eugenenr.org/

DLCD. 1996. Statewide Planning Goal 5. Department of Land Conservation and Development. Salem, OR. http://www.lcd.state.or.us/LCD/docs/goals/goal5.pdf

Gabrielson, Ira and Stanley Jewett. 1944. Birds of Oregon. Oregon State College. Corvallis, OR.

Hayes, M., T. Quinn, K. Richter, J. Schuett-Hames, J. Serra Shean. 2006. Maintaining Lentic-Breeding Amphibians in Urbanizing Landscapes: The Case Study of the Northern Red-Legged Frog (*Rana aurora*). Herpetological Conservation Volume 3.

Johannessen, C. L., W. A. Davenport, A. Millet, and S. McWilliams. 1971. The vegetation of the Willamette Valley. Annals of the Association of American Geographers 61: 286-302.

Kagan, J. and P. Wiley. 2002. DRAFT Report and Recommendations: OWEB Land Acquisition Priorities. Oregon Natural Heritage Information Center. Corvallis, OR.

Link, Russell. 1999. Landscaping for Wildlife in the Pacific Northwest. Washington Department of Fish and Wildlife. Olympia, WA.

Marshall, D., M. Hunter, A. Contreras editors. 2002. Birds of Oregon: A General Reference. Oregon State University Press. Corvallis, OR>

NRCS. 1981. Soil Survey of Lane County Area, Oregon. Natural Resources Conservation Service (formerly Soil Conservation Service). Eugene, OR.

NPPC. 2004. Willamette Subbasin Plan. Northwest Power and Conservation Council. Portland, OR.

Old-Growth Definition Task Group. 1986. Interim Definitions for Old-Growth Douglas-Fir and Mixed-Conifer Forests in the Pacific Northwest and California. USFS – PNW Research Station. PNW-447.

ODFW. 1997. Oregon Sensitive Species List. Oregon Department of Fish and Wildlife. Keizer, OR.

ODFW. 2006. Oregon Conservation Strategy. Oregon Department of Fish and Wildlife. Keizer, OR.

ORNHIC. 2003. Oregon Natural Heritage Plan. Oregon Natural Heritage Information Center. Corvallis, OR.

ORNHIC. 2004. Rare, Threatened and Endangered Species of Oregon. Oregon Natural Heritage Information Center. Corvallis, OR. http://oregonstate.edu/ornhic/2004_t&e_book.pdf

Pearl, C. and M. Adams, N. Leuthold, R. B. Bury. 2005. Amphibian Occurrence and Aquatic invaders in a Changing Landscape: Implications for Wetland Mitigation in the Willamette Valley, Oregon, USA. Wetlands, Vol. 25 No. 1. Society of Wetland Scientists.

PNWERC (Hulse, D. et al., editors). 2002. Willamette River Basin Atlas (2nd. Ed.). Oregon State University Press. Corvallis, OR. (Pacific Northwest Environmental Research Consortium)

Secretary of State. 2006. OAR 660-023-0000: Land Conservation and Development Department, Division 23 Procedures and Requirements for Complying with Goal 5 (http://arcweb.sos.state.or.us/rules/OARS_600/OAR_660/660_023.html). Oregon Secretary of State. Salem, OR.

Thieman, C. 2000. Long Tom Watershed Assessment. Report to Long Tom Watershed Council. Eugene, OR. http://www.longtom.org/assessment2.html

Thilenius, J. 1968. The *Quercus garryana* Forests of the Willamette Valley, Oregon. Ecology. Vol 49, No. 6.

Thorson, T.D et al. 2003. Ecoregions of Oregon map. Reston, Virginia, U.S. Geological http://www.epa.gov/wed/pages/ecoregions/or_eco.htm

Titus, J. et al. 1996. Native Wetland, Riparian, and Upland Plant Communities and their Biota in the Willamette Valley, Oregon. Oregon Natural Heritage Program (now ORNHIC) and The Nature Conservancy. Portland, OR.

TNC. 2004. Willamette Valley – Puget Trough – Georgia Straight Ecoregional Assessment. The Nature Conservancy.

Vesely, D. & G. Tucker. 2004. A Landowner's Guide for Restoring and Managing Oregon White Oak Habitats. Pacific Wildlife Research. Corvallis, OR.

Wilson, M. V. 1998. Upland Prairie: contributed chapter to Part I of the US Fish and Wildlife Service Willamette Basin Recovery Plan. US Fish and Wildlife Service. Portland, OR.

Wilson, M. V. 2002. Value and limits of understanding early human cultural impacts on the Willamette Valley landscape. Invited presentation in the seminar "Can human cultural activities be included in reference ecosystems?" Bulletin of the Ecological Society of America (Supplement).

Winterbrook Planning. 2004. City of Corvallis Natural Features Inventory: Wildlife Habitat Assessment. Winterbrook Community and Resource Planning report to City of Corvallis. Portland, OR.

Site-Specific Documents Consulted

Document Name	Applicable HAU/VMU
City of Eugene. 2004. Environmental Assessment for the Dillard Hollow Acquisition. Prepared by Public Works Department, Parks and Open Space Division. (Citizen submittal #1.)	12
City of Eugene. 2006. Mariposa Woodland Oak Habitat Enhancement Project. Prepared by Public Works Department, Parks and Open Space Division.	11
City of Eugene. 2007. Public comments submitted on draft SRHS. Planning and Development Department, Planning Division.	Several
Environmental Consultants Oregon. 2005. Natural Resource Assessment for Dillard Heights PUD. Prepared for Metro Planning, Land Use and Consulting Services / Olson & Morris. (On file with the City of Eugene.)	12
Environmental Solutions LLC. 2004a. Rare Plant Survey for Wild Iris Ridge. City of Eugene Parks and Open Space Division, Public Works Department. (On file with the City of Eugene.)	3
Environmental Solutions LLC. 2004b. Wildlife Assessment Report for the Proposed Timberline Hills Subdivision Project, Eugene, Lane County, Oregon, T18S, R4W, Sections 10 and 11. Prepared for Breeden Homes. (On file with the City of Eugene.)	3
Environmental Solutions. 2006. Natural Features Assessment for the Green Valley Glen PUD Site, Master Plan Concept "N," T18S, R3W, sections 17 and 20, Tax Lot 101, Eugene, Lane County, Oregon. Prepared for Joe Green Investments, Inc. (On file with the City of Eugene.)	12
Integrated Resource Management. 1999. Transplanting *Aster vialis* from a region of proposed development to a conservation sanctuary in the southern Eugene, Oregon area of the Willamette Valley. Prepared for Leslie Beverly of	12

South Park Associates, LLC. (On file with the City of Eugene.)	
Lane Council of Governments. 2004. Wild Iris Ridge Interim Management Plan. Prepared for the City of Eugene Parks and Open Space Division.	3
Newhouse, B. 2006. Vascular Plant List for Spencer Butte (composite list, including 1934 – present). Personal collection, and on file with the City of Eugene. Eugene, OR.	11
Salix Associates. 2000. Natural Resources of Hendricks Park. Salix Associates report to City of Eugene. Eugene, Oregon.	19
Salix Associates. 1995. Vascular Plant List for Mountain Bike Trail corridor of Baldy Ridge. Report to City of Eugene. Eugene, Oregon.	13
Satre Associates. 2005. Moon Mountain Planned Unit Development Wetland Delineation Report. Prepared for Mark Vukanovich, The Reid Company, LLC. (On file with the City of Eugene.)	21
Satre Associates. 2006. Moon Mountain Planned Unit Development Natural Features Assessment. Prepared for Mark Vukanovich, The Reid Company, LLC. (On file with the City of Eugene.)	21
Wilson, Loverna. 1999. Letter to Martin and Leslie Beverly of South Park Associates, LLC regarding wayside aster transplanting. (On file with the City of Eugene.)	12

Individual and Agency Contacts

Alton, Cliff. Oregon Natural Heritage Information Center, OSU, Corvallis, OR.
Alverson, Ed. The Nature Conservancy, Eugene, OR.
Boulay, Margaret. Oregon Department of Fish and Wildlife, Keizer, OR.
DeWitt, D. Birder. Eugene, OR.
Mickel, T. Birder. Eugene, OR.
Moldenke, Andy. Entomologist, Oregon State University. Corvallis, OR.
Oregon Birders on Line (internet list-serve information request).
Stringer, Darin. Forest Ecologist, Integrated Resources Management. Eugene, OR.
Yee, Chris. Oregon Department of Fish and Wildlife, Springfield, OR.
US Fish and Wildlife Service, Oregon State Office, Portland, OR.

Glossary

ARA number	ARA stands for Adamus Resource Associates. A publication cited in the references (Adamus et al. 2000) contains a list of cover (habitat) types (therein called "ARA cover types") that were modified for use in this project. That publication also contains a matrix of species-habitat suitability for vertebrates, which was expanded for SRHS use by adding invertebrates and plants.
Cover type	Synonymous in this report with "Habitat Type." Cover type generally refers to what one would see in a bird's-eye or airplane view looking down at the landscape. Cover types can include vegetation such as forest, woodland, savanna, prairie, orchards and row crops, and non-vegetation, such as water, buildings and roads. A cover type has similarity in vegetation structure (e.g., prairie, savanna, woodland, forest) where associated native plants, vertebrates, invertebrates, fungi, and other life occur together. We break down these cover types where possible, into more detailed subcategories.
Dbh	Diameter at breast height (4.5 feet above the ground). This is a common way to measure or estimate the diameter of a tree trunk.
DLCD	Oregon Department of Land Conservation and Development. See: http://www.lcd.state.or.us/
Dominant	A dominant plant species covers 20% or more of the ground, looking down from a bird's-eye view. A list of the dominant species in an area generally can be used to describe a plant community.
Ecosystem	A general term used to refer to physically-associated habitats functioning at a landscape scale.
Exotic	An exotic species, as used in this report, refers to a non-native species introduced generally at or after the time of EuroAmerican settlement in the mid-1850s.
Forest	Generally, habitats with over 70% tree cover (See Prairie.)
GIS	Geographic Information Systems are a standard, computer-based technique where each stored layer of information for a study area graphically depicts a specific type of information which can be linked to text or tabular information. See also: http://www.nww.usace.army.mil/gis/definition.htm
Goal 5	Statewide Land Planning Goal 5, which requires "To protect natural resources and conserve scenic and historic areas and open spaces." See: http://www.oregon.gov/LCD/goal5explan.shtml
Habitat	In this study, "habitat" refers to an undeveloped area where flora, fauna and fungi exist. In other contexts, "habitat" (though not necessarily correctly), is used as a synonym for "wildlife habitat."
Habitat type	See Cover type.

Habitat Assessment Unit	Sub-areas (21) delineated within the SRHS by City of Eugene staff to create units to facilitate inventory and assessment.
Herbaceous	Refers to non-woody vegetation that generally grows low to the ground, or in some cases, climbs on other vegetation or on structures.
Invasive	As used here, "invasive" refers to a subset of exotic species that tend to move into areas previously dominated by native species, and become a dominant species.
Invertebrates	Animals without backbones, including arthropods (includes insects and spiders), mollusks, crustaceans, etc.
LCDC	Oregon Land Conservation and Development Commission. See: http://www.lcd.state.or.us/
Native habitat	Native habitats are dominated by native species. "Native" in this report generally refers to species and habitats that existed in the southern Willamette Valley before EuroAmerican settlement, as widely used by ecologists.
Native species	A species that exists in an area without having been transported by human activity. In general, ecologists in the Willamette Valley consider as native those species present here before EuroAmerican settlement in the mid 1800s. See Exotic, also.
NRLF	Northern Red-legged Frog
ODFW	Oregon Department of Fish and Wildlife. See: http://www.dfw.state.or.us/
Odonates	Members of the order Odonata, which consists of dragonflies and damselflies.
PIWO	Pileated Woodpecker
Polygon	Synonymous with VMU. Areas within HAUs mapped for this study that have generally homogeneous vegetation. Polygon boundaries primarily were determined by field observation and examination of aerial photos.
Prairie	Generally, prairie habitats have less than 5% tree cover. Areas with 5 – 30% tree cover are called "savanna," with 31-70%, "woodland," and over 70%, "forest." These divisions generally follow the National Vegetation Inventory standards, as well as the habitat type definitions modified from Adamus et al. 2000 used for this study.
RFP	Request for Proposal. The City issued an RFP last spring seeking proposals from consultants to conduct the SRHS.
RSS Index	Rare Species Suitability Index. This index was devised for each habitat by totaling scores for each uncommon and rare species potentially using the habitat. Each species score is the sum of two numbers: the species status (3, 2 or 1, which equates to high, medium or low on the Target Uncommon and Rare Species Table, Appendix B), and the suitability (3, 2 and 1, high, medium and low) from the species-habitat matrix (Appendix C).
Savanna	Habitats with 5% - 30% tree cover. See: Prairie.

SRHS	South Ridgeline Habitat Study.
UGB	Urban Growth Boundary
Vegetation Mapping Unit	Sub-areas (polygons) within HAUs that were mapped for this study, and which have generally homogeneous vegetation. Vegetation Mapping Unit boundaries primarily were determined by field observation and examination of aerial photos.
VMU	See Vegetation Mapping Unit and Polygon.
Wildlife	As used in this report, wildlife includes wild, terrestrial vertebrates and birds, invertebrates, and where applicable, fish. In other contexts, "wildlife" commonly is used in a restricted sense to mean wild mammals and birds.
Woodland	Habitats with tree cover of 31% - 70%. See also: Prairie.

Appendices

TEXT

A HAU inventory procedures
Field inventory packet instructions
Field inventory form
Cover type definitions

B1 Uncommon and Rare Species:
Table 1: Value of uncommon and rare species
Table 2: Uncommon and rare animals and plants
Table 3: Habitat and range of uncommon and rare animals and plants

B2 Supplemental information Pileated Woodpecker (Gleason)

C Habitat suitability matrices

D Invasive, exotic plant species list

E Database inventory report form and rating table templates for VMUs and HAUs
Variables document explaining inventory form and rating tables

F Common and scientific (Latin) names crosswalk table

G Project staff and qualifications

MAPS

H Cover types map by VMU

I Habitat suitability maps

J Individual HAU maps (21)

OTHER (available separately)

- Site photographs (on CD)

- Database of VMU Inventory Forms and Rating Tables and HAU Rating Tables

- Summary data tables

- Summary of public comments on draft SRHS inventory and report, and consultant team responses