

South Puget Sound Prairies

Site Conservation Plan

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Photo by Keith Lazelle

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SOUTH PUGET SOUND PRAIRIES SITE CONSERVATION PLAN

INTRODUCTION

Along the south edge of Puget Sound lies a landscape unusual in the Pacific Northwest. In place of steep mountains and massive, closed canopy forests, are open, rolling grasslands interwoven with oak savannas, pine woodlands, and rich wetlands. The intertwining of the prairie and oak woodland supports a rich array of native birds, mammals, flowers and butterflies, some of which are found nowhere else in the state or world.

The prairie/oak woodland mosaic is underlain with outwash from the retreat of the Vashon Glacier about 11,000 years ago. These gravelly, extremely well-drained soils are a major factor in creating conditions conducive to prairies. After glacial retreat, the open grasslands may have been maintained first by harsh conditions, then as conditions and climate became more mesic, about 6,000 years ago, they were likely maintained by fires set by native people to ensure a continuing supply of food. Fire was one of the fundamental processes which helped maintain the structure and composition of the prairies.

Wildflowers are profuse on the prairies, changing from the purples of violets and camas in the spring to the yellows of Puget balsamroot and golden paintbrush as the season progresses. Golden paintbrush is one of the most beautiful members of these prairies and one of the rarest, federally listed as threatened and state listed as endangered. The white-top aster, a federal species of concern, is a northwest endemic with its distribution centered in the South Puget Sound prairies.

About fifty species of butterflies can be found on prairies in the Puget Trough. Seven of those fifty depend on prairies for food and habitat as adults and larvae. Extremely rare butterfly species include the whulge checkerspot and the mardon skipper which are candidates for federal listing. Many invertebrates including various moths, butterflies, gall wasps and spiders are found exclusively in association with Oregon white oak, the oak species of these woodlands.

The prairies also support several rare and declining animal species that prefer the combination of the maritime climate of the northwest with a droughty soil environment. The elusive western gray squirrel, listed as threatened in Washington, dwells among the oaks, using them for food and relying on their extensive canopies as aerial pathways. Recent surveys have shown this species to be declining precipitously in the state. Populations of the Mazama pocket gopher, which appears to require specific types of prairie soils, are disappearing in the Puget Sound region. Pocket gophers are ecologically important as prey items and in influencing soils, microtopography, diversity of plant species, and primary productivity. The intertwining of oak woodland, coniferous and wetland habitats also provides an ideal landscape for a variety of reptile and amphibian species.

Prairies are special beyond their biological uniqueness. In the Puget Sound area, the prairie landscape has an important role in regional human history. From early natives to contemporary society, people have been drawn to prairies, have settled, hunted, and traveled through these open systems because of their unique characteristics of openness, productivity, and difference from surrounding country. The prairies were critical for the Native Americans, generating food

and medicine essential for their survival. The flat, sunny, well-drained area was one of the first in Puget Sound to be converted to agricultural and residential uses by European settlers, beginning in the 1830s.

The South Puget Sound prairie landscape is thought to have extended historically from just south of Tacoma down through the Chehalis River drainage southwest of Oakville (Map 1). This region contained several plant community types, but it is thought that prairie or grassland-savanna occupied at least 10% of this landscape, roughly 150,000 acres. These prairies are now one of the rarest habitats in the U.S. At least 92% of prairie habitat in the South Puget Sound region has been destroyed. It has been estimated that less than 4,000 acres of habitat dominated by native species remains. Another 5,000-7,000 acres of semi-native grasslands remains which is potentially restorable (Map 2).

This landscape was a mosaic of prairies interspersed with woodlands and wetlands, but today it is even further fragmented. The remaining patches of native prairie are, for the most part, small and isolated. With the growth of human population, fire suppression has replaced controlled burns and natural fires. This has allowed weeds and trees to grow unchecked, replacing much of the native landscape.

An informal working group from The Nature Conservancy, the Washington Department of Natural Resources, the Washington Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service began meeting early in 2000. Their goal was to clearly identify conservation and management needs of prairies and oak woodlands in the South Puget Sound region. Through this effort it became clear that the prairie/oak mosaic is one of the most threatened landscapes in the Pacific Northwest. The long-term survival of this habitat and the species dependent on this increasingly fragmented mosaic, require a public-private initiative focused on active management and protection of the remaining high quality remnants, and a renewed commitment by decision makers to fund such activities.

VISION

A healthy, productive prairie/oak woodland landscape which:

- ♦ supports viable populations of all species representative of this prairie landscape,
- ♦ maintains active ecological processes,
- ♦ provides opportunities for education and research, and
- ♦ has local, state, federal, and NGO support as realized through dedicated staff and continuing financial commitment to maintaining and restoring the health of the prairie landscape.

It is hoped that the development of this site conservation plan will lead to a network of conservation areas that together support the full array of biodiversity that is representative of the prairie and oak woodland habitats of the South Puget Sound. These will be areas where agencies and the public are working cooperatively, using a variety of conservation tools, to manage for the full suite of prairie-dependent species. A partnership of agencies and organizations will be necessary for effective management and research and to identify other sites in the landscape which are important for individual species. Since much of this landscape is privately owned, an approach which invites full participation by private landowners and surrounding communities will be essential. In addition, this plan represents a collaborative process that will need to be maintained and expanded upon if we are to conserve and restore the prairie landscape.

THE PLANNING PROCESS

An informal working group from The Nature Conservancy, Washington Department of Natural Resources, Washington Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service began meeting early in 2000 to work on conservation and management needs of prairies and oak woodlands in the South Puget Sound region.

Members of this Core Group include:

Chris Chappell, Vegetation Ecologist, Washington Department of Natural Resources
 Terry Cook, Director of Science and Stewardship, The Nature Conservancy
 Patrick Dunn, Prairie Restoration Ecologist, The Nature Conservancy
 Robin Dye, Conservation Planner, The Nature Conservancy
 John Fleckenstein, Zoologist, Washington Department of Natural Resources
 Scott Pearson, Westside Ecologist, Washington Department of Natural Resources
 Elizabeth Rodrick, Land Conservation Manager, Washington Dept. of Fish and Wildlife
 Dave Rolph, Conservation Biologist, The Nature Conservancy
 Ted Thomas, Ecologist, United States Fish and Wildlife Service

The Core Group held a series of expert workshops to learn more about the species and natural communities that are of conservation concern in the South Puget Sound landscape. The goals for the workshops were to discuss the current conservation status and health of the conservation targets, find out what the primary threats are to their continued survival, and to begin to formulate strategies to reduce the threats and increase the health of these elements of biodiversity. Attached as Appendix I is a list of the participants of these workshops.

PURPOSE OF THE SITE CONSERVATION PLAN

This document summarizes the work of the Core Group and four experts workshops. The first sections discuss the focal conservation targets (a subset of species and communities which are representative of the biodiversity at the site), describes the key ecological processes that maintain these targets, identifies the main stresses to these systems and then summarizes the critical threats to the prairies and oak woodlands. The final section, the conservation plan, describes four planning areas where conservation and management actions will first be focused, and presents strategies to address the critical threats.

This document is not intended to be a management plan with detailed prescriptions, nor is it a comprehensive document containing all relevant background material. Instead, the plan is meant to present a vision for the conservation of this landscape and to describe broad strategies for realizing that vision.

Note: This plan focuses on two components of the South Puget Sound landscape – the prairie/savannas and the oak woodlands. Many other natural communities occur within the site boundary, including other coniferous forests, wetlands, and riparian areas, but they are not specifically addressed in this plan – these communities are more common in the region and are not thought to have the same level of conservation urgency associated with them.

CURRENTLY PROTECTED AREAS

There are several publicly owned sites within the south sound landscape which contain prairie and oak habitats. These areas total 5,781 acres, not all of which are prairie or oak woodland. They provide varying levels of conservation protection (Map 4).

<u>Protected Area</u>	<u>Ownership</u>	<u>Acres</u>
Mima Mounds Natural Area Preserve	WA Dept. of Natural Resources	445
Rocky Prairie Natural Area Preserve	WA Dept. of Natural Resources	47
Black River-Mima Prairie-Glacial Heritage Preserve	Thurston County	1,020
Scatter Creek Wildlife Area	WA Dept. of Fish and Wildlife	1,200
13 th Division Prairie Research Natural Area	US Army – Ft. Lewis	234
Weir Prairie Research Natural Area	US Army – Ft. Lewis	1,096
Bower Woods Research Natural Area	US Army – Ft. Lewis	<u>1,739</u>
		5,781

ELEMENTS OF CONSERVATION CONCERN

SPECIES AND NATURAL COMMUNITIES

A list of all the plant and animal species and the natural communities that are of conservation concern at the South Puget Sound Prairies is attached as Appendix II. The list includes - imperiled and endangered plant and animal species, declining species, peripheral or disjunct species, historic species, and natural plant communities. More detailed information about the sources of information and criteria used to develop the list is contained in the “Introduction” page of the appendix. This list was referred to during the planning process to make sure all elements of conservation concern were addressed by strategies developed for the Focal Conservation Targets.

FOCAL CONSERVATION TARGETS

The list of conservation targets described above contains too many elements to individually assess for conservation goals and strategies. To plan efficiently, the list has been screened to select a subset of targets that are indicative of the threats to and viability of the biodiversity at the site. The screening process involved consolidating species and communities into major assemblages and identifying species with special requirements not adequately covered in the assemblages. The resulting subset – referred to as “focal conservation targets” – guided the conservation strategies developed for the site.

Seven focal conservation targets were identified. The first two, “prairie oak mosaic” and “prairie butterflies”, group together species and communities that function similarly and have similar protection needs. Another, “extirpated species”, captures a group of species which were important components of the ecosystem and will probably require reintroduction programs.

The four other focal targets are composed of single species. These were treated separately because they have unique life history traits leading to protection needs that would not be addressed by protecting the larger groups: the western gray squirrel requires mixed oak and coniferous habitats with some canopy closure and proximity to water, and needs corridors which connect different habitats; the streaked horned lark is found only at sites with disturbed soils and low vegetation height; golden paintbrush only exists at one site in the region; and the Mazama pocket gopher only occurs at sites with specific soils.

The following section describes each of these focal targets in more detail – their ecology, important processes, conservation status, and threats. Appendix III is a printed version of a computerized workbook developed by The Nature Conservancy which houses more detailed information on the focal targets, viability analysis, threats analysis, and strategy development – the “Site Conservation/Measures of Success” workbook.

FOCAL CONSERVATION TARGET DESCRIPTION AND ANALYSIS

PRAIRIE OAK MOSAIC

As a focal conservation target, prairie oak mosaic is intended to encompass all of the natural plant communities listed in Appendix II. It also includes the suite of animals and plants that are dependent or strongly associated with grassland and oak woodlands.

The South Puget Sound prairie landscape extended historically from just south of Tacoma down through the Chehalis River drainage southwest of Oakville (Map 1). This area was a mosaic of prairies, oak woodlands and savannas, and coniferous forests. Freshwater lakes and wetlands dotted the area and the Nisqually, Deschutes, and Black River systems crossed the area and emptied into southern Puget Sound estuaries. It is thought that prairie or grassland-savanna occupied at least 10% of this landscape, or roughly 150,000 acres¹.

Grasslands are the major structural plant community of South Puget Sound prairies. Under pristine conditions, Roemer’s fescue, a bunchgrass, dominates these communities with up to 70 percent cover. Only a few other native grasses or sedges are significant in terms of percent cover. None of these grasses, including Roemer’s fescue, form thick swards over large areas that preclude other species. This leaves room for a suite of forbs, the diversity of which can be tremendous, with dozens of species occurring in a square yard. Interestingly, the majority of these species are perennials; there are few annuals on South Puget Sound grasslands.¹

Savannas and open woodlands, a secondary structural plant community of the South Puget Sound prairie, can look like they are merely grasslands with a few scattered trees. Yet this is deceiving. Although the understory of savannas can be similar to open grasslands, stands with more continuous oak tree canopies have dramatically different understory composition. Even in the most open savanna, the presence of trees, especially oaks, creates habitat for a whole host of different animals.¹

Oak woodlands that occur adjacent to streams or wetlands tend to be more dense and have well-developed shrub layers². These more moist habitats provide conditions suitable for many species of plants and animals that do not occur in the open dry woodlands and savannas. In addition, the transition zones between these riparian woodlands and the adjacent prairies are often inhabited by birds, such as chipping sparrow and western wood-pewee, that favor the open structures of savannas. These edges may now be very important for some species given the current rarity of savannas in the landscape.

The prairie oak mosaic was shaped by conditions and processes that include porous soils formed of glacial outwash, summer drought periods, periodic fires set by Native Americans, and soil disturbances¹. These conditions created the open grasslands and savannas of the prairie landscape and continue to help retard the invasion of Douglas-fir and subsequent forest formation.

Several types of disturbances play a significant role in shaping the prairie landscape. Fire has already been mentioned as a force that limits trees and other woody vegetation, a positive effect when managing for prairie grasslands. Fire has several other important effects, including creation of bare soil suitable for seed germination and establishment. The combination of periodic fires and a bunchgrass as the dominant grassland species helps ensure that an entire suite of forbs and grasses will have sufficient sites for establishment.¹

Another type of disturbance that creates sites for plant establishment is the digging of pocket gophers. The disturbances caused from excavating extensive tunnel systems have significant effects in a variety of ecosystems, including prairies. The Mazama pocket gopher of the South Puget Sound prairies is also a focal target in this plan and its effects on prairie habitat are discussed further in the summary for that species.

The conditions and processes that define these prairies and oak woodlands, coarse-textured glacial outwash soils and low summer precipitation, are still in place in South Puget Sound. Fire still occurs or is applied in many locations and can be partly simulated by other management measures. In addition, relatively large tracts of the prairie oak mosaic remain on Fort Lewis Army Base and McChord Air Force Base as a consequence of military training which requires large open areas and ignites sporadic fires.

There are many ongoing threats to the prairie oak mosaic. Historically, conversion of prairie habitat took a tremendous toll, destroying more than 90% of the habitat³. This destruction continues today as prime prairie is replaced by housing developments or agriculture. Only seven prairie areas, a total of less than 6,000 acres, have been set aside for conservation. Non-native pest plants are another significant threat to this landscape. These invade native habitats and can change the composition, structure, and ecological processes of these communities.

In grasslands, non-native pasture grasses typically form dense sods which displace other plants, especially forbs. With disturbance these pasture grasses can increase dramatically. The impacts of woody pest plants are more obvious than those of the pest grass species. A mature invasion of Scotch broom, for example, forms a single-species thicket that eliminates native plant and animal species, changes a low-stature grassland into a shrubland, and alters soil chemistry through nitrogen fixation. Other woody pests include forest trees, especially Douglas-fir. If left unchecked by fire or mechanical thinning, Douglas-fir will displace the prairie.

Savannas and woodlands can be degraded in ways similar to grasslands. Invasion of pest plants, especially Scotch broom, is a problem. Douglas-fir can invade most oak woodlands, quickly overtopping mature oaks and creating shade, which leads to the death of the oaks. These invasions are especially prevalent if fire has been suppressed in the stand. Even without the presence of pest species, fire suppression can lead to degraded conditions where the trees form dense stands. These dense stands are used rarely by animals that inhabit the open structures of savannas.¹

The conservation of the prairie oak mosaic is key to saving the six other focal targets as well as the whole suite of grassland and oak woodland species. Birds that were once common in the state but are now rare are found in these habitats. The Oregon vesper sparrow, for example, was once described as rather common but has now dwindled to a population of only 125 singing males, with 80% of the population occurring at a single location. Other birds, including the band-tailed pigeon, western wood-pewee, MacGillivray's warbler, and short-eared owl, are still fairly common in Washington but their populations are declining. Each of these bird species is

dependent on other members of the mosaic – native plants produce seed which birds eat, and invertebrates, ranging from beetles to gall wasps, are food for the birds and pollinate the plants.

The mosaic of communities within this landscape is not static. Historically, several natural processes and disturbances, including the fires of Native Americans, caused dynamic changes in the extent and composition of the communities. This created an ever-shifting mosaic of grasslands and woodlands. Conservation efforts directed at the landscape level are essential to restore and retain natural processes and truly conserve what remains of these dynamic communities and the suite of species dependant on them.

CONSERVATION STATUS: Prairie or grassland-savanna once occupied at least 150,000 acres of the South Puget Sound landscape (Map 1). Today, these prairies are now one of the rarest habitats in the U.S. Only an estimated 3,000-4,000 acres of prairie dominated by native species remains (Map 2, Map 3). Most of the state and federally listed species that are dependent on prairie or oak woodlands have been highlighted as separate focal targets and their status is discussed in the summaries which follow. The relative rarity and state and federal status for all of the conservation targets are listed in Appendix II.

The following were identified at the expert workshop as the primary stresses to the prairie oak mosaic of the South Puget Sound Prairies:

- **CONTINUED HABITAT CONVERSION/DESTRUCTION.** There are privately-owned fragments of prairie and oak woodlands remaining in the South Puget Sound area. These continue to be plowed for agriculture or converted to residential and urban development.
- **ALTERED COMPOSITION AND STRUCTURE OF HABITATS.** All of the remaining prairie/oak habitats, both privately and publicly owned, are under stress from species encroachment. In the absence of fire the cover of several native woody species (e.g. Douglas-fir, wild rose, snowberry, bracken fern) has increased. Grasslands are also being colonized by non-native species (e.g. Scotch broom, mouse-ear hawkweed, pasture grasses). These species are invasive and can successfully compete with native species, eventually dominating the landscape.
- **HABITAT FRAGMENTATION.** The remaining portions of native-dominated prairie and oak are small and isolated from each other. This makes it difficult for animals species to cross hostile environments to access resources, breed, and disperse. Plant populations may also have difficulty dispersing. Fragmentation greatly increases the difficulty of restoring ecological processes necessary to maintain this dynamic landscape.
- **HABITAT DEGRADATION.** Activities such as cattle grazing, soil compaction, trampling, etc., may also degrade prairie and oak woodlands.
- **ALTERATION OF NATURAL FIRE REGIMES.** Lack of periodic fire allows invasive plants to displace native communities.

PRAIRIE BUTTERFLIES

The group “prairie butterflies” was selected as a focal target for this plan because several of the species are declining or are already rare. Populations of the mardon skipper and whulge checkspot are critically rare. Even though there is still much to learn about butterflies, some factors affecting distribution and abundance of these species are well understood, and we know more about them than any other group of invertebrates. By managing for the species we know to be at risk we hope to reduce negative impacts to other butterflies and to prairie/oak invertebrates as a whole.

Some of the most beautiful things living on the prairies of South Puget Sound are its butterflies. A treat, unusual in western Washington, is to stand on the prairies and watch dozens or even hundreds of butterflies fly, feed, and mate over the grasslands. The subtle beauty of a Sara orange tip, the masses of a good whulge checkerspot population, or the powerful flight of the great spangled fritillary can all be observed here.⁴

About fifty species and subspecies of butterflies have been found on the South Puget Sound prairies⁴. Most of these use plant communities in addition to prairies, such as forests and fields that border the prairies. Seven taxa are prairie obligates, using prairies almost exclusively, and are important components of the prairie ecosystem⁴. These seven were included on the conservation targets list along with the *Propertius'* duskywing, which is found in oak woodlands, usually on the edge of prairies. All eight taxa appear to be declining.

Although each species has a unique pattern of distribution and ecology, all butterflies have the same basic life requirements: a larval food source, a source of nectar and moisture for the adult, and some form of protection in the overwintering stage (various species overwinter as adults, pupa, or eggs).⁵ For example, larvae of the mardon skipper feed on grasses, the Puget blue use lupines, the whulge checkerspot use paintbrush and plantains, and *Propertius'* duskywing use Oregon white oaks^{4,5,6}. Adult mardons nectar on prairie violets while adult whulge checkerspots use lomatiums and camas early in the season and members of the composite family later^{4,6}.

Obviously, the presence of the host and nectar plants is very important for an area to support butterflies. The structure of habitat as well as the juxtaposition of resources is also important. If a nectar plant is surrounded by tall plants, like Scotch broom, the adults may not be able to find them or to access them^{4,5}. Likewise, some species need open display areas to find and attract mates. Some species, such as the great spangled fritillary, seem able to fly long distances to reach different resources while other species are weaker fliers and all of their requirements must be present in a relatively small area⁵.

Distribution of Puget Trough butterflies has probably always been patchy due to the patchy distribution of prairie in the area⁷. As the mosaic of prairie and woodland shifted over time, locations of butterfly populations would move. Survival of populations under these conditions requires maintenance of a metapopulation, a group of subpopulations serving as sources for colonization of unoccupied habitat⁷.

The current distribution of butterflies within South Puget Sound prairies is probably more patchy and localized than it was historically. Large areas of prairie have been replaced by development. Some prairies have maintained robust populations of rare and common species while other sites support only low numbers of a few species, even though habitat appears to be of equally high quality. The factors that control this distribution are not easily discernible⁴. They may relate to an environmental factor that is not immediately obvious or may relate to site history. In any case, planning and management of butterflies in the region will require site-specific actions and consideration of source-sink dynamics and metapopulations.

Long-term survival of these species will require active management, using a variety of techniques, to maintain a mosaic of habitats. Scotch broom, Douglas-fir, and other invasive plants are significant on-going threats to the prairies. However, some of the management practices to control these threats conflicts with conservation of the butterflies (e.g. herbicide use, mowing, and prescribed burning)^{4,6}.

CONSERVATION STATUS:

Prairie-dependent butterflies have been significantly reduced in numbers and are now of conservation concern⁴. The loss of 92% of prairie habitat and fragmentation of the remainder by human development and encroachment of Douglas-fir forest is responsible for much of the population decline. Three of the eight species of butterflies on the conservation targets list (Appendix II) for South Puget Sound Prairies are being considered by the State of Washington for listing as threatened or endangered – the whulge checkerspot, the Puget blue, and the valley silverspot. The mardon skipper is listed by Washington as endangered, it and the whulge checkerspot are candidates for listing under the U.S. Endangered Species Act.

The mardon skipper is one of the rarest butterflies in Washington with fewer than ten recently confirmed populations in the state, three of these populations occur on South Puget Sound prairies⁶. There are only eleven recently confirmed populations in the state of the Puget blue, another northwest endemic butterfly. Six of those populations are on prairies in this area⁴. The whulge checkerspot has only four recently confirmed populations, all on Puget Sound prairies⁶. And the zerene fritillary once occurred from Vancouver Island south through Oregon. It has been extirpated in Oregon and there are only fewer than twenty recently confirmed populations in Washington, on prairies in the South Puget region and perhaps some in the Olympics⁴.

The following were identified at the expert workshop as the primary stresses to butterflies at South Puget Sound Prairies:

- ♦ CONTINUED HABITAT CONVERSION/DESTRUCTION. Prairie and oak woodlands continue to be plowed for agriculture or converted to residential and urban development.
- ♦ ALTERED COMPOSITION AND STRUCTURE OF HABITATS. Invasive plant species can successfully compete with native species, eventually dominating the landscape. Host and nectar plants relied on by butterflies can be reduced in number or even wiped out. Butterflies may have a difficult time reaching or using their host plants or other resources when the formation and configuration of plant communities are altered.
- ♦ HABITAT FRAGMENTATION. The remaining portions of native-dominated prairie and oak are small and isolated from each other. This makes it difficult for butterflies to cross hostile environments to access resources, find mates, or disperse.
- ♦ LOW POPULATION LEVELS AND LOW NUMBER OF POPULATIONS. The number of butterflies in this landscape has been greatly reduced with loss and degradation of major portions of their habitat. The number of populations of each species has also declined. This makes them vulnerable to extirpation from random events, whether due to humans or nature (pesticide spraying, fire management, early frost, etc.). Recolonization following catastrophic events is less likely in small, isolated populations and reduced genetic variability minimizes the chances for a species to adapt to environmental change. Experts at the workshop agreed that more populations and larger populations of these species are needed to ensure their continued existence in the region.

WESTERN GRAY SQUIRREL

The western gray squirrel (*Sciurus griseus*) occurs in northern Baja, California, Oregon, Nevada, and Washington. These squirrels are soft gray with bright white underparts, large ears, and very large, bushy tails. They are also known as the “silver gray” squirrel due to many white-tipped gray hairs. They are the largest native arboreal rodent in Washington state with body length ranging from ~9-12 inches plus a 10-12 inch tail. This squirrel is known to be wary and secretive, avoiding disturbed areas and human activity. They are diurnal and most active in early mornings and late afternoons. They seem to prefer arboreal travel, but also spend

considerable time foraging on the ground. During midday and at night, they primarily rest in large, round stick nests located close to trunks in the upper third of oak and conifer trees.^{8,9}

Western gray squirrels need access to suitable den trees, a variety of food types, and permanent sources of water⁸. It is difficult to know in detail what the requirements of this secretive species are, but it seems that they prefer stands with connected tree canopies and patchy understory with a variety of food-producing trees and shrubs¹⁰. A 1995 study at Fort Lewis concluded that it is important to have continuous tree canopy that allows for arboreal travel for at least 66 yards around nest sites¹¹. The study found that the squirrels do not generally cross open prairies to use isolated trees and prefer oak stands that are at least 5 acres and within 430 yards of water¹¹.

Food types exploited by these squirrels vary with season and locality, and include acorns, conifer seed, fungi, pine nuts, cambium, forbs, and insects and their larvae. Acorns appear to be a critical winter food for western gray squirrels. However, oak mast production is sporadic and unpredictable, with good mast years occurring only once in seven to ten years. The other major food item of the squirrel is hypogeous (subterranean) fungi.⁸

Western gray squirrels are an oak associated species, which means they are primarily found in association with oak woodlands because oaks are a critical component of their habitat requirements. However, they actually prefer mixed oak-conifer woodlands to pure oak stands. Such diversity of tree species provides for a wider range of food sources and nest sites. The availability of a variety of food sources is especially critical for western gray squirrel survival because oak acorn production is unreliable.⁸

In South Puget Sound, oaks most often occur in ecotones, the transitional zone from upland Douglas-fir forest to the prairie¹¹. Western gray squirrels are an important component of the unique ecotonal habitat of oaks, prairie, and conifers. Unrecovered acorns buried by the squirrels propagate new oaks. Also, these animals may be important dispersers of hypogeous fungi through spore dispersal via ingestion and later defecation. These hypogeous fungi are unique to oaks, and they may help prepare grassland soils for invasion by oaks.⁸

CONSERVATION STATUS:

The populations in Oregon, California, and Nevada are not officially considered to be at risk, though a long-term decline is documented in Oregon.^{8,12}

In Washington, western gray squirrels and their preferred habitat of Oregon white oak and conifer communities were historically commonly found both east and west of the Cascade Mountains. Since European settlement, oak woodlands have been increasingly fragmented and the populations of western gray squirrels have declined. The species was listed on the state's threatened species list in 1993. Since then, its numbers have continued to decline.^{8,12}

The current distribution of western gray squirrels in Washington is restricted to three small, scattered populations which are located in the Puget Trough (southern Pierce and northern Thurston Counties), Yakima and Klickitat Counties, and Okanogan and Chelan Counties.^{9,13} The Puget Trough population is centered on Fort Lewis Military Reservation⁸. This population was studied in 1992-1993 and searches on what was believed to be the best squirrel habitat remaining on Fort Lewis found over 80 squirrels¹¹. Further studies in 1998-1999 involving more intensive searches found only 6 squirrels, indicating that the population has declined precipitously since 1992⁸. These Fort Lewis study sites represented the only western gray squirrel habitat in the Puget Trough with repeated and verified sightings in the last decade.

There have been almost no verified observations of squirrels in the Puget Trough outside of Fort Lewis in the most recent years. Thus, it appears that there are very few squirrels left in the Puget Trough population.¹²

The other two populations in Washington may also be at risk. In Yakima County, limited research indicates that populations have declined in recent years. More research is necessary to determine the status of these populations.¹²

The following stresses to western gray squirrels in the prairies and oak woodlands of South Puget Sound were identified at the experts workshop:

- ♦ **LOW POPULATION NUMBERS.** Small isolated populations are vulnerable to random events such as genetic, demographic, and environmental uncertainties, and natural catastrophes. Such events may have little effect on large populations of a species, but small populations may be devastated. Natural factors such as low acorn production years or periods of drought may reduce or eliminate populations which have decreased below a minimum threshold. Western gray squirrel death by motor vehicles was found to be a significant problem for the Fort Lewis population in 1992-1993.¹¹
- ♦ **CONTINUED HABITAT DESTRUCTION OR CONVERSION.** Destruction of oak woodlands by residential development continues on areas adjacent to Fort Lewis⁸ and other sites within the South Puget Sound area. This along with conversion to agriculture or Christmas tree farms has led to a reduced habitat base for western gray squirrels⁸.
- ♦ **ALTERED COMPOSITION AND STRUCTURE OF HABITATS.** When unchecked by fire, rapidly growing Douglas-fir can easily outcompete and overtop mature, shade-intolerant oaks since Douglas-firs grow three to five times faster than oaks. Other invasive exotic species such as Scotch broom and pasture grasses also alter this habitat. Ryan and Carey found that use by squirrels was lower in stands where Scotch broom was most abundant¹¹.
- ♦ **HABITAT FRAGMENTATION.** Oak woodlands in this region are already isolated and fragmented and it is unknown how easily and safely western gray squirrels can travel among habitat patches separated by roads, developed areas, prairies, non-oak forests, or disparate cover types.^{8,11}

In addition, the following potential threats have been identified, but require more investigation:

- ♦ **PREDATION, PARASITISM, DISEASE.** Predation by native animals and domestic dogs and cats may contribute to the decline in western gray squirrel populations in this region. Disease and parasites might also have contributed to their decline. Small, stressed populations are vulnerable to disease and parasite attacks, however, populations of low density are the least likely to suffer or even support epizootic contagious diseases⁸.
- ♦ **HUMAN DISTURBANCE.** These squirrels are known to be secretive and wary. The presence of humans, recreational activities, vehicle noise, and military training activities may cause them to avoid or abandon an area or may disturb them during critical reproductive or foraging times of the year^{8,12}.
- ♦ **COMPETITION FOR RESOURCES.** Competition with the non-native eastern gray squirrel or the native Douglas' squirrel has been suggested as partly to blame for the decline in the Fort Lewis population. Studies in 1992 and 1998 did not support this hypothesis, more study is needed to determine if this is a threat to Washington populations.^{8,11}
- ♦ **HABITAT DEGRADATION.** Grazing cattle may affect oak woodlands by damaging oak root systems, altering soil moisture retention, compacting soils, and destroying young oak saplings⁸. Military training activities on Fort Lewis, especially those involving tanks and other heavy mechanized equipment, may also degrade habitat by damaging roots and compacting soils.

GOLDEN PAINTBRUSH

Golden paintbrush (*Castilleja levisecta*), a Pacific Northwest endemic, is one of the most beautiful plants on the South Puget Sound Prairies with showy whorls of golden-yellow leaf bracts¹⁵. It is also one of the rarest plants, currently listed as threatened under the U.S. Endangered Species Act and as endangered by the State of Washington¹⁴.

The golden paintbrush is a short-lived, perennial herb, of the figwort or Scrophulariaceae family. It inhabits generally flat grasslands and does not tolerate shade. Some sites have mounded topography while others are on steep grassy coastal bluffs. The genus, like many others in this family, is parasitic. The roots of paintbrushes are capable of forming parasitic connections to roots of other plants, although they don't require a host plant to survive. They are not likely to be host specific and little is known about their host preference. Bumblebees are most frequently observed foraging on the flowers of golden paintbrush and are thought to be a primary pollinator. Seedlings are small and inconspicuous.^{14,15}

Caterpillars of several species of butterfly or moths are known to feed on golden paintbrush and have caused considerable damage at several sites. The population at Rocky Prairie Natural Area Preserve has historically harbored a population of the whulge checkerspot which is a potential seed predator. However, the paintbrush is not a specific host so the threat from this butterfly is likely low.¹⁵

Much of the habitat suitable for the golden paintbrush has been converted to agricultural, residential, or commercial development^{14,15}. This loss of habitat is the primary cause of the decline in the number of populations. The remaining habitat is being degraded by encroaching native and non-native species that compete with golden paintbrush and create shade. Fire suppression over the last century has enabled Douglas-fir and non-native woody shrubs to colonize the grasslands. Many biologists familiar with this species suspect that seedling establishment is inhibited by an increase in grass and forb cover. Rhizomatous grasses may be a serious threat to seedlings.^{14,15}

CONSERVATION STATUS:

Historically this species was known from more than 30 sites in the Puget Trough of Washington and British Columbia and ranged as far south as the Willamette Valley of Oregon¹⁴. It has been extirpated from many of these sites, including all sites in Oregon. There are now only eleven known populations of this plant in the world, nine in Washington and two in British Columbia¹⁴. A majority of the populations are small, both in terms of number of individuals and in total area occupied^{14,15}.

Within the prairie/oak mosaic of South Puget Sound, the golden paintbrush is now restricted to one site, on Rocky Prairie Natural Area Preserve. This is one of the largest, and presumably healthiest, populations of the plant. It was known historically from one other site in the area¹⁵.

The golden paintbrush is currently listed as threatened under the U.S. Endangered Species Act and as endangered by the State of Washington¹⁴.

The following stresses to golden paintbrush in the prairies of South Puget Sound are identified in the Draft Recovery Plant for Golden Paintbrush¹⁴:

- ♦ **LOW NUMBER OF POPULATIONS AND SMALL POPULATION SIZES.** The small size of many of the patches and the small area they occupy make golden paintbrush vulnerable to demographic and random environmental events. Grazing and seed predation by native herbivores is one

of the natural pressures historically faced by golden paintbrush, but plant populations that have been reduced or stressed due to other factors are more vulnerable to decline and are less able to rebound after periods of heavy predation.

- ♦ ALTERED COMPOSITION AND STRUCTURE OF HABITAT. Currently, the primary cause of habitat modification is encroachment by native and non-native woody species due to fire suppression. These species can dominate and successfully compete with golden paintbrush for space, light, and nutrients.
- ♦ PREDATION. Predation in the form of livestock and rabbit grazing may have reduced populations from historical levels. Effects of grazing are not known, but it presumably affects seed number and reproductive viability. In some cases, human activities may have caused native herbivore populations to be artificially large, causing unnaturally excessive grazing pressure on golden paintbrush plants. Caterpillars of several species of butterfly or moths are known to feed on it and have caused considerable damage at several sites.
- ♦ TRAMPLING, PICKING, COLLECTING. No commercial uses are known for this plant, but because of its showy golden-yellow bracts, it is vulnerable to trampling, picking, and collection. Trampling as a result of monitoring activities is of concern, particularly at the Rocky Prairie Natural Area Preserve where pathways around plots are evident.

MAZAMA POCKET GOPHER

Pocket gophers occur in northern and central America from central and southwestern Canada through the western and southeastern United States¹⁶. The species of pocket gopher found in the South Puget Sound area is the Mazama pocket gopher (*Thomomys mazama*). This species occurs in prairies, open fields, and subalpine meadows in northwestern California, western Oregon, southwestern Washington, and the Olympic mountains¹⁶.

Pocket gophers are fossorial (living beneath the surface of the ground and adapted to digging) mammals that excavate extensive tunnel systems. Soil is loosened from the faces of new tunnels with incisors and front feet, then pushed out of tunnel openings, bulldozer fashion with the front feet and head¹⁷.

All species of gophers lead subterranean lives and consequently share a similar body plan. Pocket gophers are stocky and tubular in shape, with short necks, powerful limbs, long claws, and tiny ears and eyes. Their short, nearly hairless tails are highly sensitive, a trait thought to assist them in navigation as they move both backwards and forwards through their tunnels. In addition, their skin tends to be very loose, allowing them to execute tight turns within their constricted tunnels.

The pocket gopher's "pockets" are external, fur-lined cheek pouches on either side of the gopher's mouth which they can turn inside out. They use these pouches to transport nesting material and to carry plant cuttings to store in their tunnel systems, but not to carry dirt, as is sometimes suggested. Pocket gophers eat a wide variety of plant material. Above ground they take leafy vegetation and underground they harvest succulent roots, shoots, and tubers. The above-ground harvesting typically takes place close to the gopher's tunnel openings so they do not have to leave the burrow entirely to harvest the plant material.¹⁶

Pocket gophers play vital roles in the ecosystems in which they live. In prairies, pocket gopher activity has been found to be important in maintaining plant species richness and diversity¹⁶. Their burrowing activities bring soil to the surface, thereby returning leached nutrients to the root zone¹⁷. The tunnels formed provide channels for surface drainage with deep penetration of

water and reduction of runoff and erosion. Much of the dirt excavated during tunnel formation is pushed to the surface and forms small piles of bare earth. In the South Puget Sound prairie, pocket gopher disturbances correlate with the occurrence of white-topped aster, an endemic species¹.

Local abundance of pocket gophers is generally determined by the patch size of appropriate soil type and the number of territories that can be supported by food resources. The local spatial distribution of pocket gopher populations depends on the distribution of appropriate habitat.¹⁶

In 1995, surveys were conducted of all sites in western Washington known to have previously supported *Mazama* pocket gophers. One thing that was immediately obvious was that gophers are even more patchy in their distribution than are prairies, as there are many seemingly high-quality prairies within the range of this species that lack pocket gophers¹⁸. The study indicated that the degree of rockiness of the soils contributes to the patchy distribution of pocket gophers¹⁸. The limited number of areas with suitable soil conditions has resulted in small, disjunct populations of pocket gophers²⁰.

The surveys also identified fairly large populations of pocket gophers on the prairies of Fort Lewis¹⁶. It was noted that where pocket gophers occur on Fort Lewis, their distribution tends to be extremely patchy, apparently depending on the local habitat conditions. In general, it was found that *Mazama* pocket gophers did not occur in areas with thick Scotch broom, or where mole populations were particularly dense. The study also noted that it is unusual that there do not appear to be pocket gophers in the vicinity of two prairies on Fort Lewis – Thirteenth Division Prairie or Training Area 6. One possible explanation for this pattern could be that heavy tank use over the years has compacted the soil, collapsing tunnel systems and generally impeding the burrowing activities of these fossorial rodents¹⁶.

Historically, there has been much debate over the taxonomic relationships of pocket gophers in the Pacific Northwest. One reason for this is that these animals tend to respond strongly to local environmental conditions – for instance the fur color of certain populations may be adapted to match closely the soil color in which they live¹⁹, and their body size depends on habitat quality¹⁸. In the past, such morphological traits served as a basis for separating the species into subspecies. Currently, there are six subspecies of *Mazama* pocket gopher which are described from the prairies of South Puget Sound¹⁶. Recent molecular genetic analyses indicate that all Washington prairie subspecies have been genetically isolated from all other populations (those in Oregon and California) for thousands of years²⁰. These analyses also indicate that there is not substantial genetic differentiation among the subspecies and nomenclature should probably be altered to recognize only two prairie subspecies¹⁸.

CONSERVATION STATUS:

With increasing development pressures in the southern Puget Sound area, populations of *Mazama* pocket gopher have been disappearing and are of conservation concern¹⁸. In 1995, thorough surveys were made of all sites in western Washington known to have previously supported pocket gophers. Of the six prairie subspecies currently recognized, two were not found at all and may have gone extinct¹⁶. In 2001, the species was classified as a candidate for federal listing under the U.S. Endangered Species Act.

The fact that five of Washington's subspecies will probably be combined into one taxonomic unit does not mean these populations are no longer of conservation concern. The entire prairie subspecies complex of pocket gophers may be threatened with extinction, because populations tend to be small and isolated, and the geographic distribution of the entire complex appears to

be shrinking. The loss of additional pocket gopher habitat could result in serious threats to the persistence of the complex as a whole, as fossorial rodents tend to have limited dispersal capabilities. Destruction of remaining patches of appropriate habitat could therefore result in the isolation of populations, rendering them vulnerable to permanent extinction due to random population fluctuations.¹⁶

The following stresses to *Mazama* pocket gophers in the prairies and oak woodlands of South Puget Sound have been identified:

- ♦ CONTINUED HABITAT DESTRUCTION OR CONVERSION. Several activities may affect pocket gopher habitat on these prairies. Puget Sound prairies are a good source of gravel and, when market conditions are right, surface mining facilities are developed. Several prairies near Shelton have a higher proportion of soil to gravel and have been converted to commercial forest land. Gopher populations will likely be lost as these and similar areas in other places are converted to commercial forests. Similarly, parts of a few prairies have a fairly deep area of surface soil with little or no gravel and may be suitable for agricultural use. Residential and commercial development may also destroy pocket gopher habitat.²⁰
- ♦ ALTERED COMPOSITION AND STRUCTURE OF HABITATS. The invasion of non-native woody shrubs, such as Scotch broom, can form dense stands which limit native prairie species used by pocket gophers as food. Pocket gopher populations in all prairie situations in the Puget Sound area are effected by this and other invasive plant species. Fire suppression has allowed conifer and other tree species to encroach on the prairies, resulting in the loss of habitat.²⁰
- ♦ HABITAT FRAGMENTATION. Impacts on pocket gophers as a result of conversion to residential or commercial use can be more extensive than the direct habitat destruction. Often developments are not adjacent to each other which may lead to increased fragmentation and the ultimate loss of an entire gopher population.²⁰ Roads constructed for development may also be barriers to dispersal of these animals, increasing fragmentation of the habitat.
- ♦ DISEASE, PREDATION, AND CONTROL MEASURES. Residential and commercial development in areas where pocket gopher populations exist may result in the introduction of new diseases and predation by pets. Control measures are often undertaken when pocket gophers damage conifer seedlings in nurseries and Christmas tree farms, or when gophers damage agricultural crops.²⁰
- ♦ HABITAT DEGRADATION. Compaction of soil from repeated heavy equipment use can limit gopher burrowing and distribution in the rocky soils of Puget Sound prairies. As tank training increases on two Fort Lewis prairies, long term impacts may result to these animals and prairie plants.²⁰
- ♦ LOW NUMBER OF POPULATIONS. The distribution of *Mazama* pocket gophers has always been patchy, with small, isolated populations on those prairies with suitable soils. But both the number of pocket gophers and the number of populations has been greatly reduced, making them extremely vulnerable to extirpation from random events. Dispersal in these fossorial animals is very limited, making recolonization of areas unlikely if a population is lost. Recent genetic studies have shown evidence of some gene flow among the currently recognized prairie subspecies²¹. Destruction of prairies supporting any of these taxa could eliminate potentially critical migration routes and sources of recolonization for all of the remaining prairie populations in the southern Puget Sound Region²¹.

STREAKED HORNED LARK

The streaked horned lark (*Eremophila alpestris strigata*) is one of 24 races of horned lark in North America. In appearance, it is the most colorful and well defined of all the races with a bright chestnut colored nape and intensely yellow face, breast, and belly²².

The streaked horned lark breeds only in the dry prairies of Washington's Puget Trough, in Oregon's Willamette Valley, and sparingly in coastal dunes of Washington. It is a migratory race within the species (some races of horned larks are not migratory). They arrive on their breeding grounds in early to mid February and begin nesting activities by the end of March. By mid to late August they have all but disappeared from their breeding grounds. Many authorities believe they migrate to areas in California, but some have suggested that they migrate over the Cascade Mountains to winter in the bitterly cold and arid regions of eastern Oregon.²²

Although it is difficult to know their nesting habitat needs with great certainty, a recent study in western Washington indicates that they prefer vegetation that is very low (<30cm) and not very dense (>50% bare ground)²². These site conditions are not difficult to manage for and some converted landscapes can provide these parameters (e.g. plowed fields, Christmas tree farms, and airport runways). However, streaked horned larks are semi-colonial nesters. The individual or pair territory is very small, but their nests are only found within a larger landscape of open grassland. They probably need several hundred acres of open grassland for nesting. Given the current small, fragmented nature of the prairies in this region, this larger open grassland will be difficult to achieve²³.

CONSERVATION STATUS:

These birds were a common sight in the south Puget Sound region and the Willamette Valley around the turn of the century. Today, however, the population in Washington is estimated to be no greater than 100 pairs²². The streaked horned lark was recently listed as a candidate for the Washington Endangered Species List and in Oregon they are designated as a sensitive species. In 2001, the species was classified as a candidate for federal listing under the U.S. Endangered Species Act.

In western Washington, there is no doubt that the center of the population was in the South Puget Sound Prairies²³. Today there are only an estimated 50 pairs of streaked horned larks remaining on these grasslands. Recent surveys have located them on only five prairie sites, all of which are airports or airstrips. They have formerly been reported on at least six other prairie sites but were not found during recent surveys²³.

The following have been identified at the expert workshop as the primary stresses to streaked horned larks at South Puget Sound Prairies:

- ♦ ALTERED COMPOSITION AND STRUCTURE OF HABITATS. Encroachment of non-native flora such as Scotch broom, as well as native flora such as Douglas-fir and lodgepole pine threatens these landscapes. In the grasslands that do persist, introduced grasses such as colonial bentgrass and sweet vernalgrass crowd out and replace the native bunchgrass (Roemer's fescue). These non-native pasture grasses increase the height and density of the vegetation to the point that the streaked horned larks no longer find it acceptable.²²
- ♦ CONTINUED HABITAT DESTRUCTION OR CONVERSION. Further residential or commercial development of remaining prairies will make it much more difficult to provide the large open grasslands needed by this species.
- ♦ HABITAT FRAGMENTATION. The size of open prairie habitat is especially important to this species. Even if a large amount of prairie is protected, if it is made up of small patches, it will not be used by the larks.
- ♦ DISTURBANCE. Prairie management activities such as mowing and prescribed fires may disturb the birds during nesting and brooding seasons. Military activities on two of the prairies on Fort Lewis known to have nesting birds may also disturb the birds during these periods. Some of the habitat needs of these larks (low vegetation height and density) may

be met by plowed fields, Christmas tree farms, and airport runways. However, all of these land uses have a high degree of human activity which could affect the reproductive success of birds breeding there. Further study is needed to determine if these areas are population sinks or not. If horned larks can reproduce in these areas, there may be ways to time mowing and plowing activities to least interfere with nesting and the brooding of chicks.

- ♦ PREDATION. Recent surveys suggest there are some areas with appropriate habitat which are not being used, and the five sites with nesting larks have smaller populations than the habitat would seem to support²³. It may be that predation, both from natural predators and domestic pets, is limiting nesting success and not enough young survive to expand into appropriate habitat.
- ♦ LOW POPULATION SIZE AND LACK OF SOURCE POPULATIONS. Once common on the prairies of the South Puget Sound, today only about 50 streaked horned larks nest in five locations in this region. Such small populations are at great risk from random events. Recolonization of the areas if a population is lost is doubtful given the overall low numbers of this bird.

EXTIRPATED SPECIES

Eleven species were identified as conservation targets for the Puget Sound prairie landscape, but either no longer exist in the area or are on the verge of being extirpated from the area. These species were selected because they are thought to have been important components of the ecosystem. It may be important to the long term health and viability of these natural communities to reintroduce those species which are now extirpated or to develop strategies specifically aimed at increasing the numbers of those species which are on the verge of extirpation.²¹

These species include:

Sandhill crane, *Grus canadensis*
 Lewis' woodpecker, *Melanerpes lewis*
 Slender-billed white-breasted nuthatch, *Sitta carolinensis aculeata*
 Pacific gopher snake, *Pituophis melanoleucus catenifer*
 Racer, *Coluber constrictor*
 Sharptail snake, *Contia tenuis*
 Western fence lizard, *Sceloporus occidentalis*
 Rose checker-mallow, *Sidalcea malviflora var. virgata*
 Common bluetop, *Githopsis specularioides*
 Tall agoseris, *Agoseris elata*
 White meconella, *Meconella oregana*

Before initiating reintroduction programs for any of these species, much information would need to be gathered and analyzed, including habitat and management needs of the species, the role they played in the ecosystem, why they were extirpated from the site, and the feasibility of a reintroduction program.

In the meantime, management and protection strategies for South Puget Sound prairies and woodlands should include key habitat characteristics for these species so that when reintroduction programs are undertaken, the required habitat will be available or will at least be on the way. For example, the slender-billed white-breasted nuthatch requires large oaks and extensive woodlands. It may be necessary to establish nest boxes in protected stands of oaks. The Lewis' woodpecker also needs large oaks, but can use single trees. One threat to this species might be from competition for cavities from starlings.

CONSERVATION PLAN

VISION

A network of conservation areas that together contain the biodiversity of the prairies and oak woodlands. These will be areas where agencies and the public are working cooperatively, using a variety of conservation tools, to manage for the full suite of prairie-dependent species. A partnership of agencies and organizations will be necessary for effective management and research and to identify other sites in the landscape which are important for individual species. Since much of this landscape is privately owned, an approach which invites full participation by private landowners and surrounding communities will be essential.

CONSERVATION PLANNING AREAS

Four large areas within the South Puget Sound prairie/oak landscape were selected as conservation planning areas – sites that will be the first priority for planning and for conservation and management actions. It is intended that together these sites contain the full suite of prairie-dependent species and represent the biodiversity of the prairies and oak woodland mosaic of the South Puget Sound region. A variety of conservation tools (acquisition, easements, voluntary agreements, restoration, active management, etc.) will be necessary to ensure connectivity of habitats within these areas.

Map 4 depicts the four broad areas. The planning area boundaries are not intended to be precise, they are only to indicate the general areas of focus. Short descriptions of each of the planning areas follows.

MIMA MOUNDS: The planning area incorporates roughly 4,300 acres and is located southwest of Littlerock. It includes two significant protected prairies, Mima Mounds Natural Area Preserve and Black River-Mima Mound-Glacial Heritage Preserve, the lands adjacent to them, and the large oak woodlands along the Black River and Mima Creek.

The two preserves total over 1,500 acres and provide a core of well-protected prairie habitat. Less than a mile of private lands, consisting of residential development and pasture, separates the two natural areas. This private land may provide the opportunity to create a habitat corridor between the preserves for some prairie species. Another site within the planning area, a portion of the Bordeaux Ranch development, has been set aside for conservation, however its continued protection is uncertain.

Oak woodlands in the area mainly occur along watercourses. These riparian oak woodlands are significant habitats for neotropical birds and conservation target plants. In addition, these woodlands are located strategically within the broader landscape, connecting the extensive state-owned Capitol Forest with the Black River.

Established conservation partners within this planning unit include the Washington Department of Natural Resources, Thurston County Parks and Recreation, and The Nature Conservancy.

SCATTER CREEK: The Scatter Creek drainage, west of Tenino, is almost completely underlain with glacial outwash 'prairie soils'. This planning area consists of roughly 9,400 acres, with the ~1,200 acre Scatter Creek Wildlife Area forming a core protected area. The wildlife area contains habitat for some of Washington's rarest animals, including the mardon skipper and

whulge checkerspot butterflies. Scatter Creek itself is also significant, with some of the largest oak woodlands extending along its watercourse, forming a tremendous corridor for birds and other oak woodland species. The prairie areas in the vicinity of Rock Prairie were once the most significant locations for butterflies in western Washington. Open grassland areas in the planning area, other than the wildlife area, have been degraded by past agricultural practices, yet there are opportunities for conservation as many of the parcels are large and still contain grassland species.

The Washington Department of Wildlife is a central conservation partner in this planning area. Recently, the Thurston County Conservation District has initiated the development of a Habitat Conservation Plan within the area. The Chehalis Indian Tribe owns lands just downstream of the planning area and is a potential conservation partner.

ROCKY AND WEIR PRAIRIES: This planning area, roughly 9,000 acres, includes two protected prairies, a corridor of grassland and oak woodland connecting them, as well as several large private prairie parcels, one of which has been identified as a potential future state wildlife area. This planning area offers the opportunity to expand conservation efforts to larger portions of prairie adjacent to the protected sites. In addition, there are significant mature oak woodlands along the Deschutes River and west of Offut Lake.

One of the two protected prairies is Weir Prairie Research Natural Area on Fort Lewis Military Reservation. Weir Prairie consists of several prairies which contain some of the best prairie grasslands left in western Washington, a substantial population of Mazama pocket gopher, a high quality oak woodland, and habitat for rare prairie butterflies. The U.S. Army has designated these prairies as a Research Natural Area, which protects them from certain types of destructive military training. Oak woodland and prairie grassland management plans are currently being developed by Fort Lewis in cooperation with The Nature Conservancy.

The second protected area, Rocky Prairie Natural Area Preserve owned by the Washington Department of Natural Resources, is habitat for the federally listed golden paintbrush as well as several rare prairie butterflies. Prairie and oak woodlands to the south and west of this preserve, known as West Rocky Prairie, have been identified as a potential state wildlife area and negotiations are ongoing between the landowner and the state.

Conservation partners in the area include the Washington Department of Natural Resources, Washington Department of Fish and Wildlife, Fort Lewis Military Reservation, and The Nature Conservancy.

FORT LEWIS AND MCCHORD: The main section of Fort Lewis and the south approach zone of McChord Air Force Base are included in this planning area, which is roughly 48,000 acres. Only one protected site occurs in the area, the 638 acre 13th Division Research Natural Area on Fort Lewis. Other significant prairies include the 91st Division and 13th Division prairies on Fort Lewis and the oak woodland and grassland habitats of McChord's south approach zone. Many additional prairies and oak woodlands occur in the planning area, some of which harbor populations of conservation targets.

The prairie grasslands in this planning area are the largest remaining in South Puget Sound and portions are of extremely high quality. A reflection of this habitat quality is the presence on and high use of the area by a variety of conservation targets. These lands have remained in open and good condition as a consequence of military training which requires large open areas and ignites sporadic fires which help keep invasive species in check. Fort Lewis has just initiated

the development of management plans for grassland and oak woodlands on their lands and those plans should provide more detailed strategies for the majority of this planning area.

Conservation partners include Fort Lewis Military Reservation and McChord Air Force Base. In addition, The Nature Conservancy is facilitating management of the lands by assisting in the development of the grassland and oak woodland management plans.

CONSERVATION STRATEGIES

Five broad conservation strategies were developed by the Core Group to address the threats identified at the experts workshops. Initially, these strategies will be focused primarily on the four conservation planning areas described above. Connectivity between the four areas as well as identification of other sites in the landscape which may be important to individual species will require ongoing efforts.

Each strategy is briefly described below, along with a list of measures needed to implement the strategies. Appendix IV is a table of the strategies and measures with estimates of timeframe, lead responsibility, cost, and sources of funds. More detailed actions will be developed over the next year.

The successful completion of these strategies will call for a partnership of agencies working cooperatively to ensure continued and sufficient funding and management efforts. It will also require a community-based approach to encourage active participation by private landowners and local communities.

STRATEGY 1: MAINTAIN AND ENHANCE MANAGEMENT AT CURRENTLY PROTECTED AREAS

Prairies and oak woodlands have been actively managed by humans for thousands of years. This active management is needed due to the nature of these ecosystems, the rarity of several conservation targets, and the prevalence of non-native pests.

Unfortunately, conservation management efforts to date have been insufficient to maintain the quality of the protected areas, including the Natural Area Preserves, Scatter Creek Wildlife Area, and the Research Natural Areas on Fort Lewis (Map 4). Plant pests such as Scotch broom and invading Douglas-fir are imminent threats to specific conservation targets and the prairie and oak woodlands landscape as a whole. Immediate action is needed to control these pests and restore critical ecological processes. It is hoped that as increased management efforts bring the pest species under control, the efforts can then be decreased.

The following measures are necessary to successfully implement this strategy:

- ◆ Develop site management plans for protected areas.
- ◆ Control habitat modifying pest plants, such as Scotch broom, pasture grasses, and blackberries.
- ◆ Reverse Douglas-fir invasion in oak woodlands, prairies, and prairie edges.
- ◆ Selectively restore the composition and structure of prairie habitats through active restoration, including prescribed fire, seeding, and planting.
- ◆ Minimize physical disturbances that are detrimental to high quality prairie communities.
- ◆ Develop a regional plan for the detection of weed invasions.

STRATEGY 2: PROTECT PRIORITY HABITATS WITHIN THE CONSERVATION PLANNING AREAS

Threats from urbanization and agriculture are increasing dramatically within the South Puget Sound landscape. Development and agriculture have recently destroyed high quality prairie sites and other critical sites are currently for sale. Protection of high quality sites that contain a matrix of native habitat is an extreme priority (Maps 3 and 4). These habitats cannot be replaced quickly or cost-effectively. Conserving the last remaining prairie sites is critical for all seven of the focal targets identified in this plan.

Other sites that have significance from a landscape perspective or contain large oak woodlands also need to be protected. These sites are essential to complete recovery of rare species and to obtain habitat appropriate for reintroduction of locally extinct species. Restoration efforts may be key to the success of these sites. Large farms that are taken out of production may fall into this category. Owners of large acreages who do not want to see their land developed can benefit from partnerships with public agencies or land trusts.

The following measures are necessary to successfully implement this strategy:

- ◆ Develop strategies to protect priority lands within the four conservation planning areas.
- ◆ Protect all areas of remaining highest quality prairie and oak woodland habitat through acquisitions, conservation easements, life estates, cooperative agreements, etc.
- ◆ Maintain the protection status of existing sites.

STRATEGY 3: DEVELOP AND IMPLEMENT RECOVERY PROGRAMS FOR THE RAREST SPECIES

Many species dependent on prairies and oak woodlands have already disappeared from the South Puget Sound and a small set of additional species are severely threatened, with a few nearing extinction from the region. These species include: two prairie butterflies, the whulge checkerspot and mardon skipper; a grassland bird, the streaked horned lark; and two mammals, the western gray squirrel and Mazama pocket gopher.

Recovery programs for these species need to be initiated as further declines in the species may result in local or global extinction. For most of these species, the necessary habitat matrix is still in place and actions taken now will be easier and less costly than waiting until the habitat declines further. For species without the needed habitat, recovery will be more difficult and will require longer timeframes and innovative techniques.

Develop and implement recovery programs for: the whulge checkerspot, Puget blue, and mardon skipper butterflies; Mazama pocket gopher; western gray squirrel; streaked horned lark; and golden paintbrush.

STRATEGY 4: COORDINATE AND FOCUS RESEARCH AND MONITORING

There are several critical information gaps which must be filled in order to initiate critical conservation actions. Focusing prairie research on priority questions for regional conservation is necessary. In addition, a higher proportion of research funding should come from outside conservation funding sources. Today, much of the research conducted on prairies is coming from sources that could use the funds for direct conservation actions.

Tracking success of conservation efforts through monitoring is critical to evaluate the effectiveness of the programs and determine whether they are reaching their goals. Coordinated monitoring across prairies throughout the region combined with the use of adaptive management techniques will increase the knowledge obtained from each conservation action.

The following measures are necessary to successfully implement this strategy:

- ♦ Develop a cohesive, priority driven research program integrating university, agency, and private researchers.
- ♦ Monitor critical species and indicators across the prairie landscape with quantitative methods that allow for assessment of management and conservation success.

STRATEGY 5: PUBLIC OUTREACH AND AWARENESS

Only a small portion of the human community in the South Puget Sound is aware of the unique prairie and oak woodland habitats that surround them. Public outreach and education are needed to inform the public and to secure on-going support for conservation actions. This is especially important in maintaining or strengthening specific public policies, including critical land-use regulations and regulations affecting prescribed burns.

The following measures are necessary to successfully implement this strategy:

- ♦ Increase community awareness and support for prairie conservation.
- ♦ Develop an outreach program to enhance conservation on private lands.
- ♦ Increase private sector volunteer and financial support.

CONCLUSION

This site conservation plan is intended to provide a basic framework for the efforts of The Nature Conservancy and our partners. It presents information gathered from the work of the planning team and experts about the species and natural communities of conservation concern in the prairies and oak woodlands of South Puget Sound. The primary threats to the continued survival of these species and systems are identified and discussed. The plan also presents broad strategies developed by the team to reduce the threats to and increase the health of this landscape. More detailed plans with specific actions necessary to accomplish the broad strategies will be developed over the next year.

It is hoped that the development of this site conservation plan will lead to a network of conservation areas that together support the full array of biodiversity that is representative of the prairie and oak woodland habitats of the South Puget Sound. These will be areas where agencies and the public are working cooperatively, using a variety of conservation tools, to manage for the full suite of prairie-dependent species. A partnership of agencies and organizations will be necessary for effective management and research and to identify other sites in the landscape which are important for individual species. Since much of this landscape is privately owned, an approach which invites full participation by private landowners and surrounding communities will be essential. In addition, this plan represents a collaborative process that will need to be maintained and expanded upon if we are to conserve and restore the prairie and oak landscape of the South Puget Sound.

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- 24 Personal communication at the experts workshop on extirpated species. Meeting held August 11, 2000 in Olympia, Washington. [Appendix I contains a list of participants]

Appendix I

SOUTH PUGET SOUND PRAIRIES EXPERT WORKSHOP PARTICIPANTS

Prairie Oak Mosaic - July 27, 2000

Bob Altman, American Bird Conservancy, Boring Oregon

Chris Chappell, Vegetation Ecologist, Natural Heritage Program, Washington Department of Natural Resources, Olympia

Rex Crawford, Vegetation Ecologist, Natural Heritage Program, Washington Department of Natural Resources, Olympia

Birdie Davenport, Washington Department of Natural Resources, Chehalis

Patrick Dunn, Prairie Restoration Ecologist, The Nature Conservancy, Seattle

Connie Harrington, Pacific Northwest Research Station, U.S. Forest Service, Olympia

Angel Lombardi, Fort Lewis Military Reservation

Kelly McAllister, Washington Department of Fish and Wildlife, Olympia

Scott Pearson, Natural Areas Program, Washington Department of Natural Resources, Olympia

Chris Regan, University of Washington.

Russell Rogers, Olympia

Michelle Zuckerberg, Washington Department of Natural Resources

Prairie Butterflies and Moths - July 24, 2000

Dave Clouse, Fort Lewis Military Reservation

Lars Crabo, Bellingham

Patrick Dunn, Prairie Restoration Ecologist, The Nature Conservancy, Seattle

John Fleckenstein, Zoologist, Natural Heritage Program, Washington Department of Natural Resources

Dave Hays, Washington Department of Fish and Wildlife, Olympia

Angel Lombardi, Fort Lewis Military Reservation

Jonathon Pelham, Seattle

Ann Potter, Washington Department of Fish and Wildlife, Olympia

Ted Thomas, Ecologist, U.S. Fish and Wildlife Service, Olympia

Western Gray Squirrel - July 28, 2000

Rana Bayrakci, Pacific Northwest Research Station, U.S. Forest Service, Olympia

Dave Clouse, Fort Lewis Military Reservation

Patrick Dunn, Prairie Restoration Ecologist, The Nature Conservancy, Seattle

Matt Vander Haegen, Washington Department of Fish and Wildlife, Olympia

Mary Linders, Wildlife Science Group, College of Forest Resources, University of Washington, Seattle

Elizabeth Rodrick, Land Conservation Manager, Washington Department of Fish and Wildlife, Olympia

Todd Wilson, Pacific Northwest Research Station, U.S. Forest Service, Olympia

Streaked Horned Lark - August 11, 2000

Bob Altman, American Bird Conservancy, Boring Oregon

Patrick Dunn, Prairie Restoration Ecologist, The Nature Conservancy, Seattle

John Grettenberger, U.S. Fish and Wildlife Service, Olympia

Scott Pearson, Natural Areas Program, Washington Department of Natural Resources, Olympia

Russell Rogers, Olympia

Dave Rolph, Conservation Biologist, The Nature Conservancy, Seattle

Appendix II. South Puget Sound Prairies Conservation Targets Worksheet

This workbook contains the full list of conservation targets - the elements of biodiversity that are the focus of conservation efforts - for the South Puget Sound Prairies site. It also contains summary information on the rarity, range, distribution, and reason for including each target in the list. The list of conservation targets for the South Puget Sound Prairies includes:

- ~ Imperiled and endangered plant and animal species (global ranks of G1T1 to G3T3) known to occur at the site.
- ~ Historic species - imperiled or endangered species which are known to have occurred in the area and appropriate habitat for them still exists, but there are no recent records.
- ~ Declining species – species known to occur at the site whose populations are undergoing a documented decline. It should be noted that only a few groups, like neotropical migrant birds, are being studied for such trends.
- ~ Predicted species - imperiled or endangered species for which there are no recorded occurrences at the site, but the appropriate habitat exists and it is expected that they do occur but simply have not been inventoried.
- ~ Peripheral species – species which are more commonly found in other ecoregions. Studies have shown that sites along the edge of a species' historic range may be of high conservation value to the species.
- ~ Natural communities, as defined by the Washington Natural Heritage Program, which occur at the site.

Note: Ideally this list would be a subset of the targets list developed for the ecoregion the site is a part of. However, the list for the Puget Trough ecoregion has not been completed. When it is, the following targets list for this site will be reviewed and, if necessary, revised.

Definitions: A complete list of definitions for the categories in the targets list is on another page in this workbook. To view, click on the tab below labeled "Definitions"

Sources of Data and Criteria for Inclusion:

Washington Natural Heritage Program databases - the Heritage Program, part of the Washington Department of Natural Resources, tracks information on natural communities and rare and imperiled species of plants and of some animals. Periodically, the TNC Washington Field Office obtains a subset of these databases, in GIS form. The most recent GIS layer (1999) was queried for any Heritage records occurring at this site. The following criteria were used to determine which elements should be included as conservation targets:

- natural communities with recent records
- species with recent records which are federally listed or have a Global Rank of G1-G3 (see Definitions page)
- species meeting the above criteria which have not been observed recently but its habitat exists at the site

Washington Department of Fish and Wildlife databases - the Department tracks information on rare and imperiled species of animals. Periodically, a subset of these databases are also acquired. The most recent information (1999) was queried for records occurring at this site. The following criteria were used:

- species with recent records which are federally listed or have a Global Rank of G1-G2
- species meeting the above criteria which have not been observed recently but the habitat exists at the site

Partners in Flight - this group, made up of agencies, conservation organizations, academic community, and professional organizations, gathers information on many land bird species. Their report on population trends for coniferous forest species in the Cascade Mountains and Southern Pacific Rainforest was reviewed. Species known to occur at this site which were listed as having significantly declining population trends were included on the targets list.

Washington State Gap Analysis reports - these were reviewed to identify species known to occur at the site but whose populations there are peripheral to or disjunct from the major portion of their range. (These likely are not tracked by the Heritage Program or WDFW since they may be common elsewhere in their range.)

Note: For butterflies, the taxonomy in "An Atlas of Washington Butterflies" by John Hinchliff, was used.

**SOUTH PUGET SOUND PRAIRIES
Conservation Targets List**

SCIENTIFIC NAME	COMMON NAME	FOCAL CONSERVATION TARGET	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	AREA OR POPULATION SIZE	GLOBAL RANGE	DISTRIBUTION	ECOREGIONAL SIGNIFICANCE	LAST OBSERVATION	REASON INCLUDED ON TARGETS LIST
Known species:												
<i>Sciurus griseus</i>	Western gray squirrel	3	G5	S1	SC	T		M?			2000	Federal SC
<i>Thomomys mazamae</i>	Western pocket gopher	6	G4G5	S4	C	C		M?			1996	Federal SC
<i>Eremophila alpestris strigata</i>	Streaked horned lark	4	G5T2	S1	C	C					1987	G5T2
<i>Sialia mexicana</i>	Western bluebird	1	G5	S3		M		W?			1988	Declining
<i>Poocetes gramineus affinis</i>	Oregon vesper sparrow	1	G5T3	S2		C					1989	G5T3
<i>Sturnella neglecta</i>	Western meadowlark	1	G5	S5				W?				
<i>Columba fasciata</i>	Band-tailed pigeon	1	G5	S4				W				Declining
<i>Contopus sordidulus</i>	Western wood-pewee	1	G5	S5				W				Declining
<i>Oporornis tolmiei</i>	MacGillivray's warbler	1	G5	S5				W?				Declining
<i>Asio flammeus</i>	Short-eared owl	1	G5	S4				M				Declining
<i>Icterus bullockii</i>	Bullock's oriole	1	G5	S4S5				W				
<i>Polites mardon</i>	Mardon skipper	2	G2G3	S1	C	E		RE?			1997	Federal SC
<i>Euphydryas editha taylori</i>	Whulge checkerspot	2	G5T1	S1	C	C		RE?			1984	G5T1
<i>Incisalia polia obscura</i>	Obscure elfin	2	G5TU					RE?			1972	
<i>Plebejus icarioides blackmorei</i> *	Puget blue	2	[G5T?]	[S5T?]		C		W				
<i>Hesperia comma oregonia</i>	Oregon branded skipper	2	[G5T?]	[S5T?]		M						
<i>Polites sonora siris</i> *	Sonora skipper	2	[G4T?]	[S4T?]		M						
<i>Speyeria cybele pugetensis</i> *	Great spangled fritillary (= Puget Sound fritillary)	2	[G5T?]	[S4T?]				W				
<i>Speyeria zerene bremnerii</i>	Valley silverspot	2	G5TU	S2		C						
<i>Erynnis propertius</i>	Propertius' duskywing	2	G4	S3		M						
<i>Aster curtus</i>	White-top aster	1	G3	S3	SC	S		RE			1998	Federal SC
<i>Castilleja levisecta</i>	Golden paintbrush	5	G1	S1	LT	E		RE			1996	Federally listed
<i>Trillium parviflorum</i>	Small-flowered trillium	1	G3	S2S3		S		RE			1997	G3
<i>Balsamorhiza deltoidea</i>	Deltoid balsamroot	1	G5	S2?				W			2000	Disjunct
<i>Delphinium nuttallii</i>	Upland larkspur	1	G5	SR				RE			1999	Endemic to ecoregion
<i>Eirgeron speciosus</i> var. <i>speciosus</i>	Oregon fleabane	1	G5T?	SR				W			2000	Disjunct
<i>Erythronium oregonum</i> var. <i>oregonum</i>	Giant fawn-lily	1	G4T?	SR				RE			2000	Endemic to ecoregion
<i>Gaillardia aristata</i>	Great blanket-flower	1	G5	SR				W			2000	Disjunct
<i>Lomatium dissectum</i> var. <i>dissectum</i>	Fern-leaved parsley	1	G3G4T4	SR				W			1986	Disjunct
<i>Poa howellii</i>	Howell's bluegrass	1	G3G5	SR				W			1986	Disjunct
<i>Senecio macounii</i>	Siskiyou mountains butterweed	1	G5	SR				W			2000	Disjunct
<i>Silene scouleri</i> ssp. <i>grandis</i>		1	G5TU	SR				RE			1986	Disjunct
<i>Sisyrinchium idahoense</i> var. <i>segetum</i>	Idaho blue-eyed grass	1	G5T3?	?				RE			1970	Endemic to ecoregion
<i>Triteleia grandiflora</i> ssp. <i>howellii</i>	Howell's triteleia	1	G5T5	SR				W			2000	Disjunct
<i>Viola praemorsa</i> var. <i>praemorsa</i>	Upland yellow violet	1	G5T3	SR				W			2000	G3

**SOUTH PUGET SOUND PRAIRIES
Conservation Targets List**

SCIENTIFIC NAME	COMMON NAME	FOCAL CONSERVATION TARGET	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	AREA OR POPULATION SIZE	GLOBAL RANGE	DISTRIBUTION	ECOREGIONAL SIGNIFICANCE	LAST OBSERVATION	REASON INCLUDED ON TARGETS LIST
Extirpated (or Nearly Extirpated) Species:												
<i>Grus canadensis</i>	Sandhill crane	7	G5	S1		E		M				
<i>Melanerpes lewis</i>	Lewis' woodpecker	7	G5	S3		C		M				Declining
<i>Sitta carolinensis aculeata</i>	Slender-billed white-breasted nuthatch	7	G5TU	S1		C						
<i>Coluber constrictor</i>	Racer	7	G5	S5				W				
<i>Contia tenuis</i>	Sharptail snake	7	G5	S1		C		M				
<i>Sceloporus occidentalis</i>	Western fence lizard	7	G5	S5				M				
<i>Sidalcea malviflora</i> var. <i>virgata</i>	Rose checker-mallow	7	G4G5T?	SX		X						
<i>Githopsis specularioides</i>	Common bluetop	7	G5	S3		S						
<i>Agoseris elata</i>	Tall agoseris	7	G4	S2		S						
<i>Meconella oregana</i>	White meconella	7	G2	S1		T						G2
Other:												
Neotropical migrant bird aggregation:		1										
Communities:												
<i>Festuca roemerii</i> - <i>Aster curtus</i> herbaceous vegetation	Roemer's fescue - white-topped aster	1	G1	S1							1994	
<i>Pinus ponderosa</i> / <i>Carex inops</i> - <i>Festuca roemerii</i> woodland	Ponderosa pine / long-stolon sedge - Roemer's fescue	1	G1	S1							1993	
<i>Pseudotsuga menziesii</i> - <i>Quercus garryana</i> / <i>Symphoricarpos albus</i> forest	Douglas-fir - Oregon white oak / common snowberry	1	G4	S3								
<i>Quercus garryana</i> - (<i>Fraxinus latifolia</i>) / <i>Symphoricarpos albus</i> forest	Oregon white oak - (Oregon ash) / common snowberry	1	G2	S2							1995	
<i>Quercus garryana</i> / <i>Carex inops</i> - <i>Camassia quamash</i> woodland	Oregon white oak / long-stolon sedge - common camas	1	G1	S1							1995	
<i>Quercus garryana</i> / <i>Festuca (roemerii, rubra)</i> wooded herbaceous vegetation	Oregon white oak / (Roemer's, red) fescue	1	G1	S1							1993	
<i>Quercus garryana</i> / <i>Symphoricarpos albus</i> / <i>Carex inops</i> forest	Oregon white oak / common snowberry / long-stolon sedge	1	G2	S1							1995	
* Not sure of ranks, only the species was listed in BioSource & the NHP website, not the subspecies.												

Definitions

FOCAL CONSERVATION TARGET - the list of conservation targets represented in this worksheet contains too many elements to individually assess for conservation goals and strategies. To plan efficiently, the list has been screened to select a subset of targets that are indicative of the threats to and viability of the biodiversity at the site. The screening process involved consolidating species and communities into major assemblages and identifying species with special requirements not adequately covered in the assemblages. The resulting subset is referred to as "focal conservation targets". The number in this column in the worksheet identifies which focal target the species or natural community has been grouped under.

- 1 - Prairie Oak Mosaic
- 2 - Prairie Butterflies
- 3 - Western Gray Squirrel
- 4 - Streaked Horned Lark
- 5 - Golden Paintbrush
- 6 - Western Pocket Gopher
- 7 - Extirpated Species

GLOBAL RANK - the relative rarity or imperilment of the conservation target worldwide.

- G1 = critically imperiled globally (typically 5 or fewer occurrences)
- G2 = imperiled globally (6 to 20 occurrences)
- G3 = rare or uncommon (21 to 100 occurrences)
- G4 = widespread, abundant, and apparently secure, but with cause for long-term concern (100+ occurrences)
- G5 = demonstrably widespread, abundant, and secure
- A "T" rank is for subspecies. (e.g., G5T1 would be a rare subspecies, T1, of a widespread species, G5)

STATE RANK - the relative rarity or endangerment of the target in Washington. The numerical ranks correspond to the global ranks above (e.g., S1 is critically imperiled in the state, typically with 5 or fewer occurrences)

FEDERAL STATUS - the standard abbreviation for the category on the U.S. Endangered Species List

- E - listed endangered (in danger of extinction in the foreseeable future in all or a significant part of its range)
- T - listed threatened (likely to become endangered in the foreseeable future in all or a significant part of its range)
- E and T - endangered in part of range, threatened in rest
- PE - proposed endangered
- PT - proposed threatened
- PE and PT - proposed for endangered in part of range, proposed threatened in rest
- C - candidate for listing
- SC - special concern (not an official category)

STATE STATUS - the official, legal status assigned by the State of Washington

- E - endangered (seriously threatened with extinction throughout all or a significant portion of its range in the state)
- T - threatened (likely to become endangered within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats)
- S - sensitive (vulnerable or declining and is likely to become endangered or threatened in a significant portion of its range within the state without cooperative management or removal of threats)
- C - candidate (species that the Department will review for listing as state endangered, threatened, or sensitive)
- M - monitor

EO RANK - Element Occurrence Rank - a comparative evaluation of the occurrence of the target, summarizing several factors including quality, condition, viability, and defensibility.

- A - excellent
- B - good
- C - marginal
- D - poor

AREA OR POPULATION SIZE - For natural communities, this is the area in acres of the occurrence.

For species, it is the relative size of the population compared to other occurrences for that species.

U - unknown L - low M - medium H - high

GLOBAL RANGE - the size of the present global range of the target.

NE - narrow endemic (less than 100 square miles)

RE - regional endemic (100 - 10,000 square miles)

M - moderately widespread or widespread with spotty distribution (10,000 - 1,000,000 square miles)

W - widespread (greater than 1,000,000 square miles)

Modifiers: D - disjunct (e.g., WD would indicate that the species is widespread but this site is disjunct, or widely separated, from the main portion of the species' range.)

P - peripheral (e.g., MP would indicate the species is moderately widespread, but this site is on the edge of the species' range)

DISTRIBUTION S - small patch L - large patch M - matrix-forming

ECOREGIONAL SIGNIFICANCE - a comparative evaluation of the value of this site for preserving this target within this ecoregion.

H - high. Protecting this site would best ensure the conservation of the target in this ecoregion, these occurrences are ecoregional priorities.

M - medium. This site contains occurrences of the target that are not critical but should be protected when opportunity arises.

L - low. This site contains occurrences of the target that if protected will not significantly contribute to the conservation of the element. This includes occurrences that are considered not viable or not defensible.

U - unknown

Appendix III: Site Conservation/Measures of Success Workbook Overview

Directory		
Site:	South Puget Sound Prairies <small>(Click the "Site Description and Target Selection" button again to make this text box disappear.)</small>	
Target #1:	Prairie Oak Mosaic	
Target #2:	Prairie Butterflies	
Target #3:	Western Gray Squirrel	
Target #4:	Streaked Horned Lark	
Target #5:	Golden Paintbrush	
Target #6:	Mazama Pocket Gopher	
Target #7:	Extirpated Species	
Target #8:		
Office:	WAFO	
Contact:	Pat Dunn	
Date:	January-01	format: Month-Yr

Site Description and Target Selection:
(Click the "Site Description and Target Selection" button again to make this text box disappear.)

Site Description:
The South Puget Sound Prairies consist of bunchgrass-dominated communities typically surrounded by stands of Oregon white oak. They represent a relict from a drier, warmer period 4-7,000 years ago when such ecosystems were more widespread. In an area dominated by massive, closed canopy forests, open canopy systems are unique and contain plants and animals that are less common in the region. Some species that are either quite rare or are rare this far north or west are found in this system.

The prairie/oak woodland mosaic is underlain with outwash from the Vashon ice sheet. These gravelly, extremely well-drained soils are a major factor in creating conditions conducive to prairies. The dry conditions favor drought tolerators, part of the unique character of the system.

After glacial retreat, the open grasslands may have been maintained first by harsh conditions, then as conditions and climate became more mesic, they were likely maintained by fires set by native people to ensure a continuing supply of food.

These prairies are one of the rarest habitats in the U.S. At least 92% of prairie habitat in the South Puget Sound region has been destroyed. Only about 3,000 acres of habitat dominated by native species remains, from about 150,000 acres of historical grassland.

Today, prairies and oak woodlands are being eliminated by encroachment of Douglas-fir due to fire suppression and by development of the flat, easy to build on, plains. The basic ecological processes that maintain prairies have disappeared or been altered on the few protected prairie sites – fire regimes are altered, pocket gophers may be missing, and invasive alien species are replacing the native plants and animals.

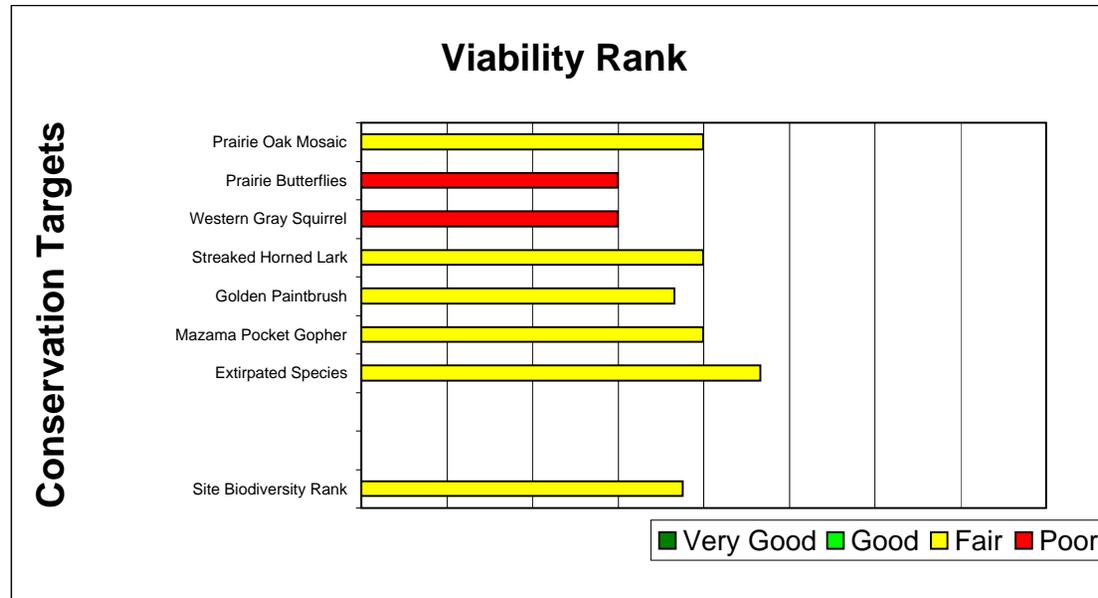
The site boundary for this plan includes major portions of Pierce and Thurston Counties and a small part of Mason County, just south of the Puget Sound. The area includes a variety of natural communities, but we have limited this plan to terrestrial communities that have a component of prairie species – prairie grasslands and oak woodlands, and closely associated ponderosa pine and Douglas-fir savannas. Wetlands or riparian communities are not included.

Target Selection:
We grouped conservation targets at the site into a total of 7 “systems”. The first two, prairie oak mosaic and prairie butterflies, group together ecoregional targets that function similarly and have similar protection needs. The last, extirpated species, captures a group of species which were important components to the system and will probably require reintroduction programs.

The four other systems are composed of single species. These species were treated separately because they have unique life history traits that lead to protection needs that would not be addressed by protecting the larger systems. The western gray squirrel requires mixed oak and coniferous habitats with some canopy closure and proximity to water. It occurs at multiple sites but needs corridors to connect habitat. The streaked horned lark are found only at sites with disturbed soils and low vegetation height. Golden paintbrush only exists at one site in the region. The Mazama pocket gopher only occurs at sites with specific soils.

Systems Viability Worksheet
South Puget Sound Prairies

Systems(Target) Viability	Size		Condition		Landscape Context		Viability Rank
	Grade	Weight	Grade	Weight	Grade	Weight	
Prairie Oak Mosaic	Fair	1.0	Fair	1.0	Poor	1.0	Fair
Prairie Butterflies	Poor	1.0	Fair	1.0	Poor	1.0	Poor
Western Gray Squirrel	Poor	1.0	Poor	1.0	Fair	1.0	Poor
Streaked Horned Lark	Poor	1.0	Fair	1.0	Fair	1.0	Fair
Golden Paintbrush	Poor	1.0	Good	1.0	Poor	1.0	Fair
Mazama Pocket Gopher	Fair	1.0	Fair	1.0	Poor	1.0	Fair
Extirpated Species	Poor	1.0	Good	1.0	Fair	1.0	Fair
		1.0		1.0		1.0	
Site Biodiversity Health Rank							Fair



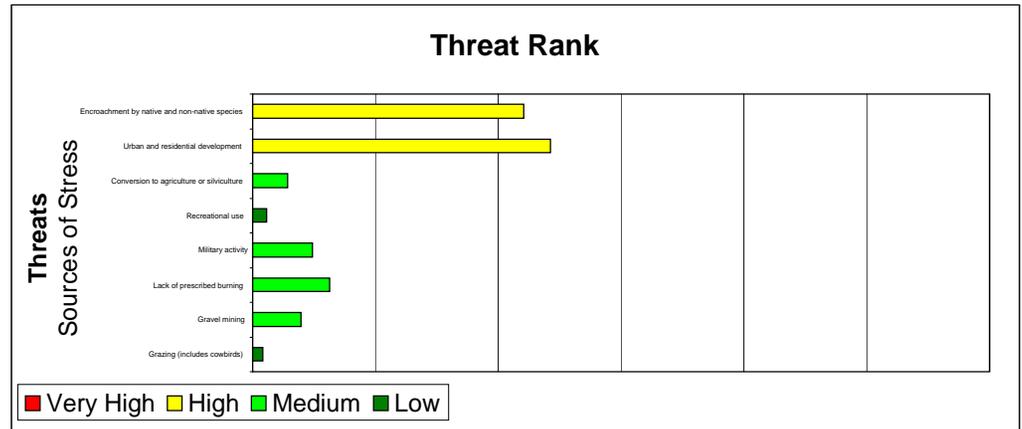
Stresses/Sources/Strategies Worksheet

South Puget Sound Prairies

System/Focal Conservation Target:

Prairie Oak Mosaic

Stresses	Severity	Scope	Stress	User Override
Altered composition/structure	High	Very High	High	
Habitat destruction or conversion	Very High	High	High	
Habitat fragmentation	High	High	High	
Habitat disturbance	Medium	Medium	Medium	
Alteration of natural fire regimes	Medium	Very High	Medium	
Human disturbance	Medium	High	Medium	
Hostile landscape or excessive predation/pa	Medium	High	Medium	
			-	



Sources of Stress	Contribution	Irreversibility	Override	Source	Altered composition/structure		Habitat destruction or conversion		Habitat fragmentation		Habitat disturbance		Alteration of natural fire regimes		Human disturbance		Hostile landscape or excessive		Threat to System Rank
					High	High	High	High	High	High	High	High	High	High	High	High	High		
Encroachment by native and non-native species	Active Threat	Very High	High	High	Very High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Urban and residential development	Active Threat	Very High	High	High	Very High	High	Very High	High	High	High	High	High	High	High	High	High	High	High	High
Conversion to agriculture or silviculture	Active Threat	Medium	Medium	Low	Medium	Medium	Medium	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Medium
Recreational use	Active Threat	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Military activity	Active Threat	High	Low	Low	High	Medium	High	Medium	High	Medium	High	Medium	Low	Medium	Low	Medium	Low	Low	Medium
Lack of prescribed burning	Active Threat	High	Medium	Medium	High	Medium	Medium	Medium	High	Medium	High	Medium	High	Medium	Low	Medium	Low	Low	Medium
Gravel mining	Active Threat	Low	Medium	Low	Low	Medium	Low	High	Medium	Medium	Low	Low	Low	Low	Low	Low	Low	Low	Medium
Grazing (includes cowbirds)	Active Threat	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low

Prairie Oak Mosaic			Altered composition/structure		Habitat destruction or conversion		Habitat fragmentation		Habitat disturbance		Alteration of natural fire regimes		Human disturbance		Hostile landscape or excessive predation/parasitism/d		-		Strategy Benefit by Source	Overall Strategy Benefit	
Strategies for Threat Abatement and Restoration		Source	High		High		High		Medium		Medium		Medium		Medium		-				
		Enter Sources from Selected Source Menu	Active Threat or Historical Source	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)		
Coordinate and focus research and monitoring.		Encroachment by native and non-native species	Active Threat	High	Yes	-	-	High	No	-	-	Low	No	-	-	Medium	No	-	-	High	High
Coordinate and focus research and monitoring.		Grazing (includes cowbirds)	Active Threat	Low	Yes	-	-	-	-	Low	No	-	-	-	-	Low	No	-	-	Low	
Coordinate and focus research and monitoring.		Lack of prescribed burning	Active Threat	Medium	Yes	-	-	Medium	No	-	-	Medium	Yes	-	-	Low	No	-	-	Medium	
Maintain and enhance management at currently protected areas.		Encroachment by native and non-native species	Active Threat	High	Yes	-	-	High	Yes	-	-	Low	Yes	-	-	Medium	Yes	-	-	High	Very High
Maintain and enhance management at currently protected areas.		Lack of prescribed burning	Active Threat	Medium	Yes	-	-	Medium	Yes	-	-	Medium	Yes	-	-	Low	Yes	-	-	Medium	
Maintain and enhance management at currently protected areas.		Military activity	Active Threat	Low	No	Medium	Yes	-	-	Medium	Yes	-	-	Low	Yes	Low	Yes	-	-	Medium	
Maintain and enhance management at currently protected areas.		Recreational use	Active Threat	Low	Yes	-	-	-	-	Low	Yes	-	-	Low	Yes	Low	Yes	-	-	Low	
Protect priority habitats within the conservation planning areas.		Conversion to agriculture or silviculture	Active Threat	-	-	Medium	Yes	Low	Yes	-	-	-	-	Low	No	Low	Yes	-	-	Medium	Very High
Protect priority habitats within the conservation planning areas.		Gravel mining	Active Threat	-	-	Medium	Yes	Medium	No	-	-	-	-	-	-	-	-	-	-	Medium	
Protect priority habitats within the conservation planning areas.		Grazing (includes cowbirds)	Active Threat	Low	Yes	-	-	-	-	Low	Yes	-	-	-	-	Low	Yes	-	-	Low	
Protect priority habitats within the conservation planning areas.		Lack of prescribed burning	Active Threat	Medium	Yes	-	-	Medium	Yes	-	-	Medium	Yes	-	-	Low	Yes	-	-	Medium	
Protect priority habitats within the conservation planning areas.		Urban and residential development	Active Threat	-	-	High	Yes	High	Yes	Low	Yes	Low	Yes	Medium	Yes	Medium	Yes	-	-	High	
Public outreach and awareness.		Conversion to agriculture or silviculture	Active Threat	-	-	Medium	No	Low	No	-	-	-	-	Low	No	Low	Yes	-	-	Low	Medium
Public outreach and awareness.		Grazing (includes cowbirds)	Active Threat	Low	Yes	-	-	-	-	Low	Yes	-	-	-	-	Low	Yes	-	-	Low	
Public outreach and awareness.		Lack of prescribed burning	Active Threat	Medium	No	-	-	Medium	No	-	-	Medium	Yes	-	-	Low	No	-	-	Medium	
Public outreach and awareness.		Recreational use	Active Threat	Low	No	-	-	-	-	Low	Yes	-	-	Low	Yes	Low	No	-	-	Low	
Public outreach and awareness.		Urban and residential development	Active Threat	-	-	High	No	High	No	Low	Yes	Low	Yes	Medium	Yes	Medium	Yes	-	-	Medium	
																					-

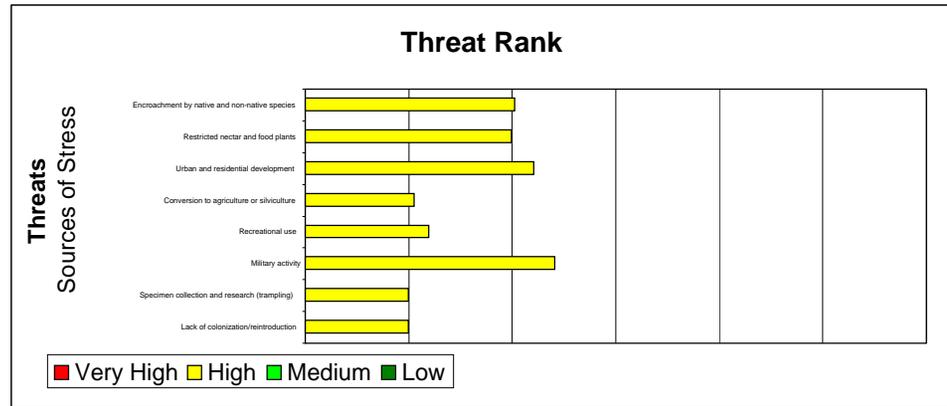
Stresses/Sources/Strategies Worksheet

South Puget Sound Prairies

System/Focal Conservation Target:

Prairie Butterflies

Stresses	Severity	Scope	Stress	User Override
Altered composition/structure	Very High	High	High	
Habitat destruction or conversion	Very High	High	High	
Habitat fragmentation	Medium	High	Medium	
Low population levels	Very High	Very High	Very High	
Low number of populations	Very High	Very High	Very High	
Alteration of natural fire regime/natural process	Medium	Very High	Medium	
			-	
			-	



Sources of Stress		Altered composition/structure	Habitat destruction or conversion	Habitat fragmentation	Low population levels	Low number of populations	Alteration of natural fire regime/natural	-	-	Threat to System Rank
		High	High	Medium	Very High	Very High	Medium	-	-	
Encroachment by native and non-native species <input type="button" value="Active Threat"/>	Contribution	Very High		High		Medium				High
	Irreversibility	High		Medium		High				
	Override Source	Very High		Medium		Medium				
Restricted nectar and food plants <input type="button" value="Active Threat"/>	Contribution				High	Medium				High
	Irreversibility				Medium	High				
	Override Source				Medium	Medium				
Urban and residential development <input type="button" value="Active Threat"/>	Contribution		High	High		Low	Medium			High
	Irreversibility		Very High	Very High		High	High	Low		
	Override Source		High	High		Medium	Medium			
Conversion to agriculture or silviculture <input type="button" value="Active Threat"/>	Contribution		Very High	Medium			Low			High
	Irreversibility		Medium	Medium			High	Low		
	Override Source		High	Medium			Medium			
Recreational use <input type="button" value="Active Threat"/>	Contribution	Medium			Medium					High
	Irreversibility	Medium			High					
	Override Source	Medium			Medium					
Military activity <input type="button" value="Active Threat"/>	Contribution	Medium	Low	Low	Low					High
	Irreversibility	Medium	High	Medium	High					
	Override Source	Medium	Medium	Low	Medium					
Specimen collection and research (trampling) <input type="button" value="Active Threat"/>	Contribution				Low					High
	Irreversibility				Very High					
	Override Source				Medium					
Lack of colonization/reintroduction <input type="button" value="Active Threat"/>	Contribution					High				High
	Irreversibility					Medium				
	Override Source					High				

Prairie Butterflies		Altered composition/structure		Habitat destruction or conversion		Habitat fragmentation		Low population levels		Low number of populations		Alteration of natural fire regime/natural processes		-		-		Strategy Benefit by Source	Overall Strategy Benefit
Strategies for Threat Abatement and Restoration	Source	High		High		Medium		Very High		Very High		Medium		-		-			
		Enter Sources from Selected Source Menu	Active Threat or Historical Source	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)
Coordinate and focus research and monitoring.	Encroachment by native and non-native species	Active Threat	High	Yes	-	-	Low	No	-	-	High	No	-	-	-	-	-	High	High
Develop and implement recovery programs for the rarest species.	Lack of colonization/reintroduction	Active Threat	-	-	-	-	-	-	-	-	High	Yes	-	-	-	-	-	High	Very High
Develop and implement recovery programs for the rarest species.	Restricted nectar and food plants	Active Threat	-	-	-	-	-	High	Yes	High	Yes	-	-	-	-	-	-	High	
Maintain and enhance management at currently protected areas.	Encroachment by native and non-native species	Active Threat	High	Yes	-	-	Low	Yes	-	-	High	Yes	-	-	-	-	-	High	Very High
Maintain and enhance management at currently protected areas.	Lack of colonization/reintroduction	Active Threat	-	-	-	-	-	-	-	-	High	Yes	-	-	-	-	-	High	
Maintain and enhance management at currently protected areas.	Military activity	Active Threat	Medium	No	Medium	Yes	Low	No	High	No	High	No	-	-	-	-	-	Medium	
Maintain and enhance management at currently protected areas.	Recreational use	Active Threat	Medium	No	-	-	-	-	High	Yes	-	-	-	-	-	-	-	High	
Maintain and enhance management at currently protected areas.	Restricted nectar and food plants	Active Threat	-	-	-	-	-	-	High	Yes	High	Yes	-	-	-	-	-	High	
Maintain and enhance management at currently protected areas.	Specimen collection and research	Active Threat	-	-	-	-	-	High	Yes	-	-	-	-	-	-	-	-	High	
Protect priority habitats within the conservation planning areas.	Conversion to agriculture or silviculture	Active Threat	-	-	High	Yes	Low	Yes	-	-	-	-	Low	Yes	-	-	-	High	Very High
Protect priority habitats within the conservation planning areas.	Lack of colonization/reintroduction	Active Threat	-	-	-	-	-	-	-	-	High	Yes	-	-	-	-	-	High	
Protect priority habitats within the conservation planning areas.	Urban and residential development	Active Threat	-	-	High	Yes	Medium	Yes	-	-	High	Yes	Low	Yes	-	-	-	High	
Public outreach and awareness.	Recreational use	Active Threat	Medium	No	-	-	-	-	High	Yes	-	-	-	-	-	-	-	High	High
Public outreach and awareness.	Specimen collection and research	Active Threat	-	-	-	-	-	-	High	Yes	-	-	-	-	-	-	-	High	
Public outreach and awareness.	Urban and residential development	Active Threat	-	-	High	No	Medium	Yes	-	-	High	No	Low	Yes	-	-	-	Medium	

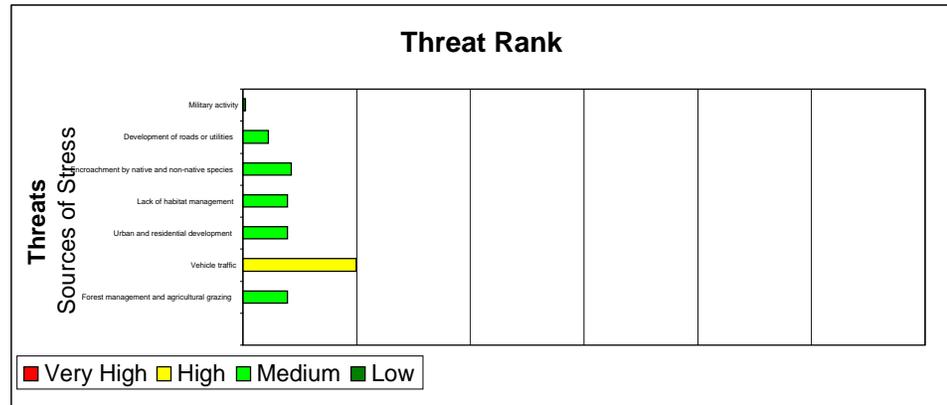
Stresses/Sources/Strategies Worksheet

South Puget Sound Prairies

System/Focal Conservation Target:

Western Gray Squirrel

Stresses	Severity	Scope	Stress	User Override
Habitat degradation	High	High	High	
Habitat fragmentation	High	High	High	
Habitat destruction or conversion	Medium	High	Medium	
Low population levels	High	Very High	High	
	-	-	-	
	-	-	-	
	-	-	-	



Sources of Stress		Habitat degradation	Habitat fragmentation	Habitat destruction or conversion	Low population levels										Threat to System Rank
		High	High	Medium	High										
Military activity	Contribution Irreversibility Override Source	-	-	Low High	Low	-	-	-	-	-	-	-	-	-	Low
Development of roads or utilities	Contribution Irreversibility Override Source	-	Medium High	Medium	Low Very High	Low	-	-	-	-	-	-	-	-	Medium
Encroachment by native and non-native species	Contribution Irreversibility Override Source	High Medium	Medium	High Medium	Medium	Low	-	-	-	-	-	-	-	-	Medium
Lack of habitat management	Contribution Irreversibility Override Source	High Medium	Medium	Medium	Medium	Low	-	-	-	-	-	-	-	-	Medium
Urban and residential development	Contribution Irreversibility Override Source	-	Medium High	Medium	Medium Very High	Medium	-	-	-	-	-	-	-	-	Medium
Vehicle traffic	Contribution Irreversibility Override Source	-	-	-	-	High High	High	-	-	-	-	-	-	-	High
Forest management and agricultural grazing	Contribution Irreversibility Override Source	Medium Medium	Medium	Medium	Medium	-	-	-	-	-	-	-	-	-	Medium
	Contribution Irreversibility Override Source	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Western Gray Squirrel		Habitat degradation		Habitat fragmentation		Habitat destruction or conversion		Low population levels										Strategy Benefit by Source	Overall Strategy Benefit
Strategies for Threat Abatement and Restoration	Source	High		High		Medium		High											
		Enter Sources from Selected Source Menu	Active Threat or Historical Source	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)
Coordinate and focus research and monitoring.	Encroachment by native and non-native species	Active Threat	Medium	Yes	Medium	Yes	Low	No	-	No	-	-	-	-	-	-	-	Medium	Medium
Develop and implement recovery programs for the rarest species.	Lack of habitat management	Active Threat	Medium	Yes	Medium	Yes	-	-	-	-	-	-	-	-	-	-	-	Medium	Medium
Develop and implement recovery programs for the rarest species.	Urban and residential development	Active Threat	-	-	Medium	Yes	Medium	Yes	-	-	-	Yes	-	Yes	-	-	-	Medium	
Maintain and enhance management at currently protected areas.	Encroachment by native and non-native species	Active Threat	Medium	Yes	Medium	Yes	Low	No	-	No	-	-	-	-	-	-	-	Medium	Medium
Maintain and enhance management at currently protected areas.	Lack of habitat management	Active Threat	Medium	Yes	Medium	Yes	-	-	-	-	-	-	-	-	-	-	-	Medium	
Maintain and enhance management at currently protected areas.	Military activity	Active Threat	-	Yes	-	No	Low	Yes	-	-	-	Yes	-	Yes	-	-	-	Low	
Protect priority habitats within the conservation planning areas.	Development of roads or utilities	Active Threat	-	-	Medium	Yes	Low	No	-	-	-	No	-	-	-	-	-	Medium	Missing Data Entry
Protect priority habitats within the conservation planning areas.	Forest management and agricultural	Active Threat	Medium	Yes	Medium	Yes	-	-	-	-	-	-	-	-	-	-	-	Medium	
Protect priority habitats within the conservation planning areas.	Urban and residential development	Active Threat	-	-	Medium	Yes	Medium	Yes	-	-	-	Yes	-	Yes	-	-	-	Medium	
Protect priority habitats within the conservation planning areas.	Vehicle traffic	Active Threat	-	-	-	-	-	-	High	-	-	Yes	-	Yes	-	-	-	Missing Data Entry	
Public outreach and awareness.	Forest management and agricultural	Active Threat	Medium	Yes	Medium	No	-	-	-	-	-	-	-	-	-	-	-	Medium	Missing Data Entry
Public outreach and awareness.	Urban and residential development	Active Threat	-	-	Medium	No	Medium	No	-	-	-	No	-	Yes	-	-	-	-	
Public outreach and awareness.	Vehicle traffic	Active Threat	-	-	-	-	-	-	High	-	-	Yes	-	No	-	-	-	Missing Data Entry	

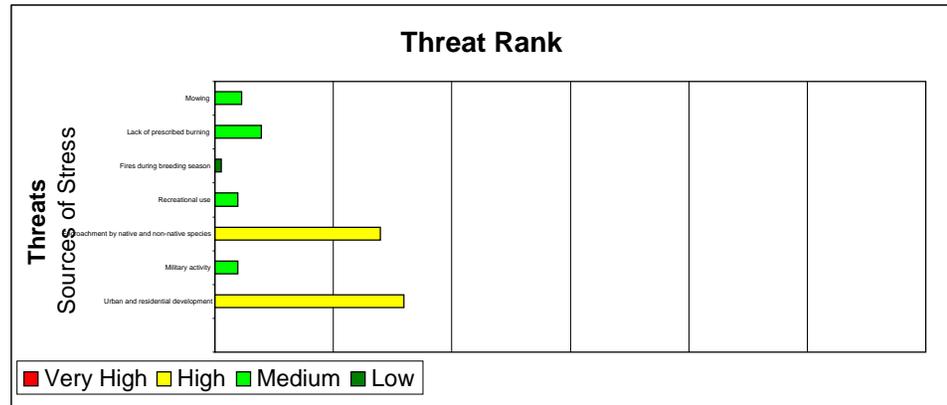
Stresses/Sources/Strategies Worksheet

South Puget Sound Prairies

System/Focal Conservation Target:

Streaked Horned Lark

Stresses	Severity	Scope	Stress	User Override
Habitat degradation	Medium	High	Medium	
Habitat destruction or conversion	Medium	Medium	Medium	
Habitat fragmentation	High	Very High	High	
Extraordinary predation/parasitism/disease	Very High	High	High	
Low population levels	High	Very High	High	
Lack of source populations	High	Very High	High	
			-	
			-	



Sources of Stress	Contribution	Irreversibility	Override	Habitat degradation	Habitat destruction or conversion	Habitat fragmentation	Extraordinary predation/parasitism/di	Low population levels	Lack of source populations	Threat to System Rank
				Medium	Medium	High	High	High	High	
Mowing	Active Threat	Medium	-	-	-	High	-	Low	-	Medium
Lack of prescribed burning	Active Threat	Very High	Medium	-	-	-	-	Medium	-	Medium
Fires during breeding season	Active Threat	Medium	-	-	-	Low	-	Low	-	Low
Recreational use	Active Threat	Medium	-	-	-	Medium	-	-	-	Medium
Encroachment by native and non-native species	Active Threat	Very High	Medium	-	-	High	-	Medium	-	High
Military activity	Active Threat	High	-	-	-	Medium	-	-	-	Medium
Urban and residential development	Active Threat	Very High	Medium	Very High	Medium	Medium	Medium	High	High	High
	Active Threat	-	-	-	-	-	-	-	-	-

Streaked Horned Lark			Habitat degradation		Habitat destruction or conversion		Habitat fragmentation		Extraordinary predation/parasitism/disease		Low population levels		Lack of source populations		-		-		Strategy Benefit by Source	Overall Strategy Benefit
Strategies for Threat Abatement and Restoration	Source		Medium		Medium		High		High		High		High		-		-			
		Enter Sources from Selected Source Menu	Active Threat or Historical Source	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	
Coordinate and focus research and monitoring.	Encroachment by native and non-native species	Active Threat	Medium	Yes	-	-	High	No	-	-	Medium	No	-	-	-	-	-	-	Medium	Medium
Coordinate and focus research and monitoring.	Lack of prescribed burning	Active Threat	Medium	Yes	-	-	-	-	-	-	Medium	Yes	-	-	-	-	-	-	Medium	
Develop and implement recovery programs for the rarest species.	Lack of prescribed burning	Active Threat	Medium	Yes	-	-	-	-	-	-	Medium	Yes	-	-	-	-	-	-	Medium	Medium
Develop and implement recovery programs for the rarest species.	Mowing	Active Threat	-	-	-	-	Medium	Yes	-	-	Low	Yes	-	-	-	-	-	-	Medium	
Develop and implement recovery programs for the rarest species.	Recreational use	Active Threat	-	-	-	-	Medium	Yes	-	-	-	-	-	-	-	-	-	-	Medium	
Maintain and enhance management at currently protected areas.	Encroachment by native and non-native species	Active Threat	Medium	Yes	-	-	High	Yes	-	-	Medium	Yes	-	-	-	-	-	-	High	High
Maintain and enhance management at currently protected areas.	Fires during breeding season	Active Threat	-	-	-	-	Low	No	-	-	Low	Yes	-	-	-	-	-	-	Low	
Maintain and enhance management at currently protected areas.	Lack of prescribed burning	Active Threat	Medium	Yes	-	-	-	-	-	-	Medium	Yes	-	-	-	-	-	-	Medium	
Maintain and enhance management at currently protected areas.	Military activity	Active Threat	-	-	-	-	Medium	Yes	-	-	-	-	-	-	-	-	-	-	Medium	
Protect priority habitats within the conservation planning areas.	Encroachment by native and non-native species	Active Threat	Medium	Yes	-	-	High	Yes	-	-	Medium	Yes	-	-	-	-	-	-	High	Very High
Protect priority habitats within the conservation planning areas.	Fires during breeding season	Active Threat	-	-	-	-	Low	No	-	-	Low	Yes	-	-	-	-	-	-	Low	
Protect priority habitats within the conservation planning areas.	Lack of prescribed burning	Active Threat	Medium	Yes	-	-	-	-	-	-	Medium	Yes	-	-	-	-	-	-	Medium	
Protect priority habitats within the conservation planning areas.	Mowing	Active Threat	-	-	-	-	Medium	Yes	-	-	Low	Yes	-	-	-	-	-	-	Medium	
Protect priority habitats within the conservation planning areas.	Recreational use	Active Threat	-	-	-	-	Medium	No	-	-	-	-	-	-	-	-	-	-	-	
Protect priority habitats within the conservation planning areas.	Urban and residential development	Active Threat	-	-	Medium	Yes	Medium	Yes	Medium	Yes	High	Yes	-	-	-	-	-	-	High	

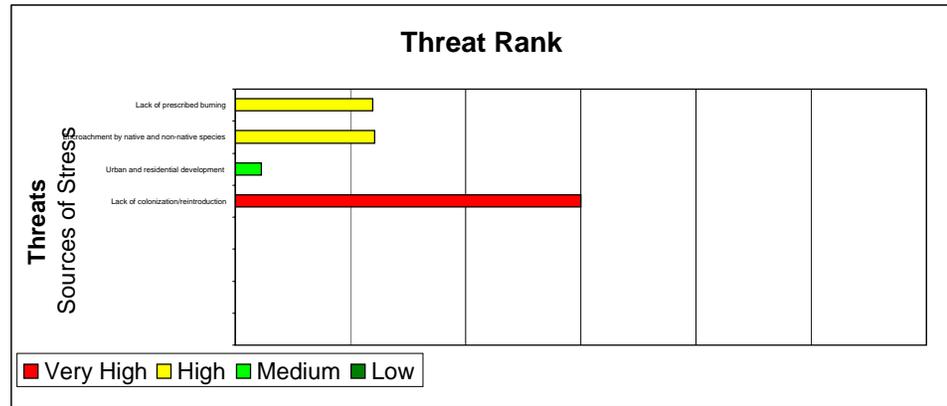
Stresses/Sources/Strategies Worksheet

South Puget Sound Prairies

System/Focal Conservation Target:

Golden Paintbrush

Stresses	Severity	Scope	Stress	User Override
Alteration of natural fire regimes	High	Very High	High	
Altered composition/structure	High	Very High	High	
Habitat destruction or conversion	Medium	Medium	Medium	
Low number of populations	Very High	Very High	Very High	
			-	
			-	
			-	
			-	



Sources of Stress		Alteration of natural fire regimes	Altered composition/structure	Habitat destruction or conversion	Low number of populations	-	-	-	-	-	-	-	-	-	Threat to System Rank	
		High	High	Medium	Very High	-	-	-	-	-	-	-	-	-		
Lack of prescribed burning <input type="button" value="Active Threat"/>	Contribution	Very High	High	Medium												High
	Irreversibility	Medium	High	Medium												
	Override Source	High	Medium													
Encroachment by native and non-native species <input type="button" value="Active Threat"/>	Contribution	Medium	Very High	Medium	Low											High
	Irreversibility	Medium	High	High	Low											
	Override Source	Medium	Very High	High	Low											
Urban and residential development <input type="button" value="Active Threat"/>	Contribution	Low														Medium
	Irreversibility	Medium														
	Override Source	Low			Very High											
Lack of colonization/reintroduction <input type="button" value="Active Threat"/>	Contribution				Very High	Very High										Very High
	Irreversibility				Medium											
	Override Source				High											
<input type="button" value="Active Threat"/>	Contribution															
	Irreversibility															
	Override Source															
<input type="button" value="Active Threat"/>	Contribution															
	Irreversibility															
	Override Source															
<input type="button" value="Active Threat"/>	Contribution															
	Irreversibility															
	Override Source															

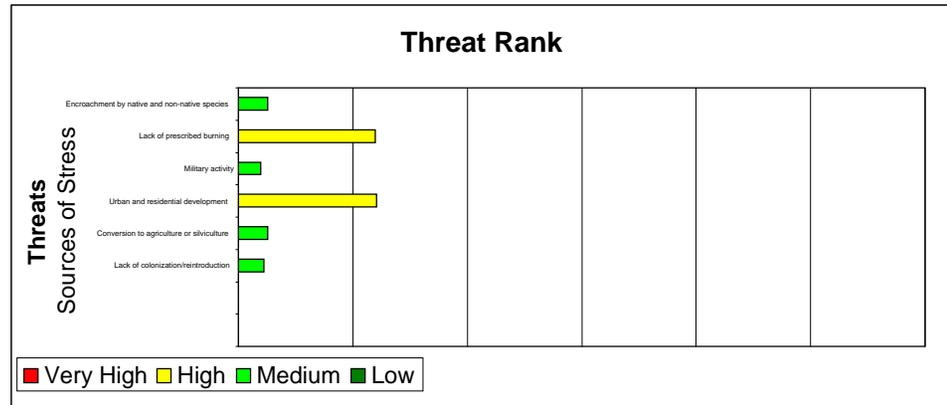
Stresses/Sources/Strategies Worksheet

South Puget Sound Prairies

System/Focal Conservation Target:

Mazama Pocket Gopher

Stresses	Severity	Scope	Stress	User Override
Habitat degradation	High	Very High	High	
Habitat destruction or conversion	High	Very High	High	
Habitat fragmentation	Medium	Medium	Medium	
Alteration of natural fire regimes	High	Very High	High	
Low number of populations	Medium	Very High	Medium	
			-	
			-	
			-	



Sources of Stress	Contribution	Irreversibility	Override	Source	Habitat degradation	Habitat destruction or conversion	Habitat fragmentation	Alteration of natural fire regimes	Low number of populations	-	-	-	-	-	-	Threat to System Rank
					High	High	Medium	High	Medium							
Encroachment by native and non-native species	Active Threat	Medium			High	High	Medium	High	Medium							Medium
Lack of prescribed burning	Active Threat	Medium			Medium			Very High	High							High
Military activity	Active Threat	Medium			Medium											Medium
Urban and residential development	Active Threat					Very High	High	Medium	Low							High
Conversion to agriculture or silviculture	Active Threat					Very High	Medium	High	Low							Medium
Lack of colonization/reintroduction	Active Threat	Low			Low				Very High	Medium						Medium
	Active Threat															
	Active Threat															

Mazama Pocket Gopher			Habitat degradation		Habitat destruction or conversion		Habitat fragmentation		Alteration of natural fire regimes		Low number of populations		-		-		-		Strategy Benefit by Source	Overall Strategy Benefit
Strategies for Threat Abatement and Restoration	Source		High		High		Medium		High		Medium		-		-		-			
	Enter Sources from Selected Source Menu	Active Threat or Historical Source	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)	Current Threat Rank	Future Abatement? (Yes/No)
Coordinate and focus research and monitoring.	Lack of prescribed burning	Active Threat	Medium	Yes	-	-	-	High	Yes	-	-	-	-	-	-	-	-	-	High	High
Develop and implement recovery programs for the rarest species.	Conversion to agriculture or silviculture	Active Threat	-	-	Medium	Yes	Low	Yes	Low	Yes	-	-	-	-	-	-	-	-	Medium	Very High
Develop and implement recovery programs for the rarest species.	Encroachment by native and non-native species	Active Threat	Medium	Yes	-	-	Low	Yes	Low	Yes	-	-	-	-	-	-	-	-	Medium	
Develop and implement recovery programs for the rarest species.	Lack of colonization/reintroduction	Active Threat	Low	Yes	-	-	-	-	-	Medium	Yes	-	-	-	-	-	-	-	Medium	
Develop and implement recovery programs for the rarest species.	Lack of prescribed burning	Active Threat	Medium	Yes	-	-	-	High	Yes	-	-	-	-	-	-	-	-	-	High	
Develop and implement recovery programs for the rarest species.	Urban and residential development	Active Threat	-	-	High	Yes	Medium	Yes	Low	Yes	-	-	-	-	-	-	-	-	High	
Maintain and enhance management at currently protected areas.	Encroachment by native and non-native species	Active Threat	Medium	Yes	-	-	Low	Yes	Low	Yes	-	-	-	-	-	-	-	-	Medium	High
Maintain and enhance management at currently protected areas.	Lack of colonization/reintroduction	Active Threat	Low	Yes	-	-	-	-	-	Medium	Yes	-	-	-	-	-	-	-	Medium	
Maintain and enhance management at currently protected areas.	Lack of prescribed burning	Active Threat	Medium	Yes	-	-	-	High	Yes	-	-	-	-	-	-	-	-	-	High	
Maintain and enhance management at currently protected areas.	Military activity	Active Threat	Medium	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Medium	
Protect priority habitats within the conservation planning areas.	Conversion to agriculture or silviculture	Active Threat	-	-	Medium	Yes	Low	Yes	Low	Yes	-	-	-	-	-	-	-	-	Medium	High
Protect priority habitats within the conservation planning areas.	Encroachment by native and non-native species	Active Threat	Medium	Yes	-	-	Low	Yes	Low	Yes	-	-	-	-	-	-	-	-	Medium	
Protect priority habitats within the conservation planning areas.	Lack of colonization/reintroduction	Active Threat	Low	Yes	-	-	-	-	-	Medium	Yes	-	-	-	-	-	-	-	Medium	
Protect priority habitats within the conservation planning areas.	Urban and residential development	Active Threat	-	-	High	Yes	Medium	Yes	Low	Yes	-	-	-	-	-	-	-	-	High	

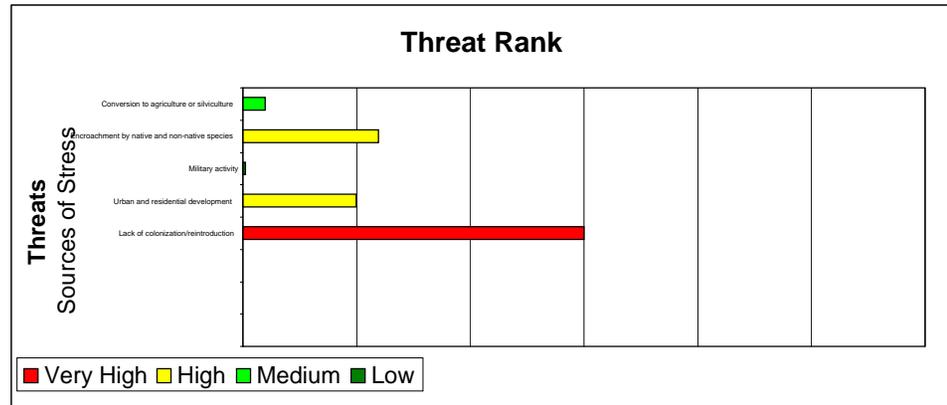
Stresses/Sources/Strategies Worksheet

South Puget Sound Prairies

System/Focal Conservation Target:

Extirpated Species

Stresses	Severity	Scope	Stress	User Override
Altered composition/structure	High	Very High	High	
Habitat destruction or conversion	Very High	High	High	
Extraordinary predation/parasitism/disease	Medium	Medium	Medium	
Low number of populations	Very High	Very High	Very High	



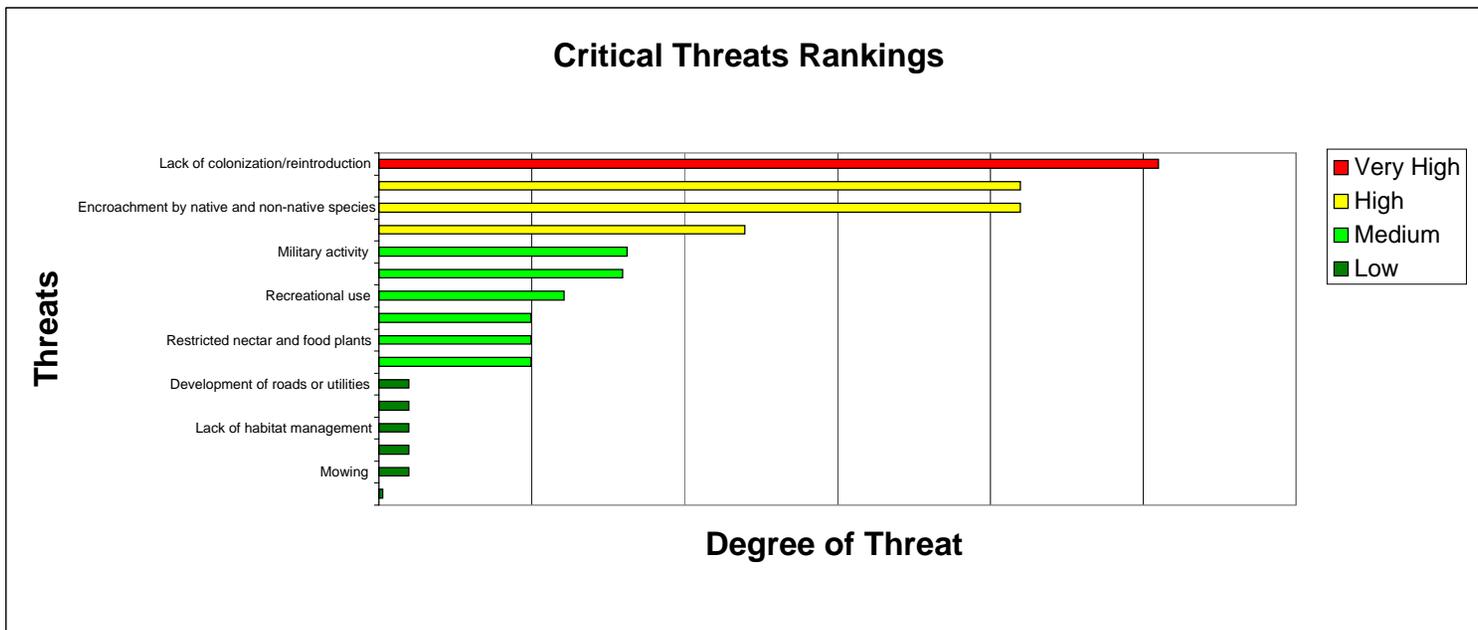
Sources of Stress		Altered composition/structure	Habitat destruction or conversion	Extraordinary predation/parasitism/di	Low number of populations	-	-	-	-	-	-	-	-	-	Threat to System Rank
		High	High	Medium	Very High	-	-	-	-	-	-	-	-	-	
Conversion to agriculture or silviculture	Contribution Irreversibility Override Source		Medium												Medium
	Active Threat		High												
Encroachment by native and non-native species	Contribution Irreversibility Override Source	Very High		Very High	Medium										High
	Active Threat	High		High	Medium										
Military activity	Contribution Irreversibility Override Source		Low												Low
	Active Threat		Medium												
Urban and residential development	Contribution Irreversibility Override Source		High												High
	Active Threat		Very High												
Lack of colonization/reintroduction	Contribution Irreversibility Override Source				Very High	Very High									Very High
	Active Threat				Medium	High									
	Contribution Irreversibility Override Source														
	Active Threat														
	Contribution Irreversibility Override Source														
	Active Threat														

Summary of Active Threats

(Threat Rank Across Systems)

South Puget Sound Prairies

Active Threats Across Systems	Prairie Oak Mosaic	Prairie Butterflies	Western Gray Squirrel	Streaked Horned Lark	Golden Paintbrush	Mazama Pocket Gopher	Extirpated Species	-	Overall Threat Rank	Total Score
Lack of colonization/reintroduction	-	High	-	-	Very High	Medium	Very High	-	Very High	5.10
Urban and residential development	High	High	Medium	High	Medium	High	High	-	High	4.20
Encroachment by native and non-native species	High	High	Medium	High	High	Medium	High	-	High	4.20
Lack of prescribed burning	Medium	-	-	Medium	High	High	-	-	High	2.40
Military activity	Medium	High	Low	Medium	-	Medium	Low	-	Medium	1.63
Conversion to agriculture or silviculture	Medium	High	-	-	-	Medium	Medium	-	Medium	1.60
Recreational use	Low	High	-	Medium	-	-	-	-	Medium	1.22
Vehicle traffic	-	-	High	-	-	-	-	-	Medium	1.00
Restricted nectar and food plants	-	High	-	-	-	-	-	-	Medium	1.00
Specimen collection and research (trampling)	-	High	-	-	-	-	-	-	Medium	1.00
Development of roads or utilities	-	-	Medium	-	-	-	-	-	Low	0.20
Gravel mining	Medium	-	-	-	-	-	-	-	Low	0.20
Lack of habitat management	-	-	Medium	-	-	-	-	-	Low	0.20
Forest management and agricultural grazing	-	-	Medium	-	-	-	-	-	Low	0.20
Mowing	-	-	-	Medium	-	-	-	-	Low	0.20
Grazing (includes cowbirds)	Low	-	-	-	-	-	-	-	Low	0.03
Threat Status for Targets and Site	High	Very High	High	High	High	High	High	-	Very High	



Strategies by Target

(Strategy Threat Abatement Across Systems)

South Puget Sound Prairies

Strategies that apply to mostly Persistent Stresses (with Historical Sources) are in **bold italics**.

Strategies Across Systems	Prairie Oak Mosaic	Prairie Butterflies	Western Gray Squirrel	Streaked Horned Lark	Golden Paintbrush	Mazama Pocket Gopher	Extirpated Species	-	Strategy Benefit Rank	Total Score
Maintain and enhance management at currently protected areas	Very High	Very High	Medium	High	Very High	High	Very High	-	Very High	8.60
Develop and implement recovery programs for the rarest species	-	Very High	Medium	Medium	Very High	Very High	Very High	-	Very High	7.70
Protect priority habitats within the conservation planning area	Very High	Very High	-	Very High	Medium	High	High	-	Very High	7.10
Coordinate and focus research and monitoring.	High	High	Medium	Medium	High	High	High	-	High	4.20
Public outreach and awareness.	Medium	High	-	-	-	-	High	-	High	2.20
	-	-	-	-	-	-	-	-	-	0.00
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-

Summary of Strategies

(Strategy Ranks for Benefits, Feasibility, and Cost)

South Puget Sound Prairies

* Overall Cost

Strategies for Threat Abatement and Restoration	Benefits					Feasibility			Cost	Overall	Rank#
	Threat Abatement Benefit	Restoration Benefit	Leverage (default = Low)	Overall Benefits	Overall Benefits User Override	Lead Individual/Institution	Ease of Implementation	Overall Feasibility	Overall Cost *	Overall Strategy Rank	
Develop and implement recovery programs for the rarest species.	Very High	-	High	Very High		High	High	High	High	Very High	1 A
Maintain and enhance management at currently protected areas.	Very High	-	High	Very High		Medium	High	Medium	High	High	2 A
Protect priority habitats within the conservation planning areas.	Very High	-	High	Very High		Medium	Very High	High	Very High	High	2 B
Coordinate and focus research and monitoring.	High	-	Medium	High		Low	Medium	Low	Medium	Medium	3 A
Public outreach and awareness.	High	-	Medium	High		Low	Medium	Low	Medium	Medium	3 B

Appendix IV: Conservation Strategies for the South Puget Sound Prairies and Oak Woodlands

Strategy				
Implementation measure	Timeframe	Lead Responsibility	Estimated Cost	Sources of Funds
Maintain and enhance management at currently protected areas				
Develop site management plans for protected areas.	1-3 years	Various	150000	Agencies
Control habitat modifying pest plants such as Scotch broom, pasture grasses, and blackberries.	Ongoing	TNC/Partners	110,000/yr	Agencies, Legacy, WHIP
Reverse Douglas-fir invasion in oak woodlands, prairies and prairie edges.	Ongoing	Various	120,000	Fort Lewis Forestry, Agencies, WHIP, PIF
Selectively restore the composition and structure of prairie habitats through active restoration, including prescribed fire, seeding, and planting.	Ongoing	Various	50,000 - 150,000/yr	ITAM*, Agencies
Minimize physical disturbances that are detrimental to high quality prairie communities.	1-3 years	Fort Lewis, WDFW		Fort Lewis, WDFW
Develop a regional plan for detection of weed invasions.	1-2 years	Weed Boards	15,000	Weed Board
Protect priority habitats within the Conservation Planning Areas				
Develop strategies to protect priority lands within the four primary conservation planning areas.	1-2 years	TNC/Partners	15,000	TNC
Protect all areas of remaining highest quality prairie and oak woodland habitat through acquisition, conservation easements, and cooperative agreements.	Ongoing	Various	10 million	WWRP
Maintain protection status of existing sites.	1-2 years	Fort Lewis, WDFW	NA	
Develop and implement recovery programs for the rarest species				
Develop recovery plans and begin implementation for:				
Whulge checkerspot	1-2 years	WDFW	20,000	Legacy, CARA
Mardon skipper	1-2 years	WDFW	20,000	Legacy, CARA, WDFW
Puget blue	3-4 years	WDFW	20,000	Legacy, CARA
Mazama pocket gopher	4-5 years	WDFW	20,000	Legacy, CARA
Western gray squirrel	4-5 years	WDFW	20,000	Legacy, CARA, WDFW
Streaked horned lark	4-5 years	WDFW	20,000	Legacy, CARA
Golden paintbrush	1 year	USFWS/Partners	20,000	USFWS/Section 6
Coordinate and focus research and monitoring				
Develop cohesive, priority driven research program integrating university, agency and private researchers.	1-2 years	TNC/DNR/ITAM*/ENRD*	10,000	
Monitor critical species and indicators across prairie landscape with quantitative methods that allow for assessment of management and conservation success.	1-5 years	Various	100,000/yr	
Public outreach and awareness				
Increase community awareness and support for prairie conservation.	1-5 years	Various	75,000	
Develop outreach program to enhance conservation on private lands.	1-2 years	Various/Conservation Districts	15,000	
Increase private sector volunteer and financial support.	1-5 years	TNC	50,000	
* ITAM - Ft. Lewis' Integrated Training Area Management program. The primary focus of this program, in terms of pest plant management, is to improve military training opportunities, the secondary focus is improving habitat. ITAM has been doing research on the prairies since 1993 and in the oak woodlands since 1995. **ENRD - Ft. Lewis' Environmental and Natural Resources Division.				