CONSERVATION ASSESSMENT for

Eucephalus vialis [Bradshaw] Blake

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Preface

Management Recommendations

Much of the content in this document was included in a previously transmitted Management Recommendation (MR) developed for management of the species under the previous Survey and Manage Standards and Guidelines (USDA and USDI 1994a,b). With the removal of those Standards and Guidelines, the previously transmitted MR has been reconfigured into a Conservation Assessment (CA) to fit the BLM Oregon/Washington and Region 6 Forest Service Special Status/Sensitive Species Programs (SSSSP) objectives and language.

Since the transmittal of the MR, the Eugene Bureau of Land Management (BLM) has collected new information regarding habitat, number of sites, and distribution relative to land allocation. In addition new sites have been found in southern Oregon on the Siskiyou NF and the Medford District BLM that include several large populations. Three new sites were also found on the Six Rivers NF in California, thus extending the range of the species. This document applies to *E. vialis* populations that have been found and reported in Oregon.

Assumptions on site management

In the Final Supplemental Environmental Impact Statement (FSEIS) and Record of Decision (ROD) to Remove or Modify the Survey and Manage Standards and Guidelines, assumptions were made as to how former Survey and Manage species would be managed under agency Special Status Species policies. Under the assumptions in the FSEIS, the ROD stated "The assumption used in the final SEIS for managing known sites under the Special Status Species Programs was that sites needed to prevent a listing under the Endangered Species Act would be managed. For species currently included in Survey and Manage Categories A, B and E (which require management of all known sites), it is anticipated that only in rare cases would a site not be needed to prevent a listing… Authority to disturb special status species lies with the agency official that is responsible for authorizing the proposed habitat-disturbing activity" (USDA and USDI 2004). This species was in Survey and Manage Category A at the time of the signing of the ROD, and the above assumptions apply to this species' management under the agencies' SSSSP.

Management Considerations

Under the "Managing in Species Habitat Areas" section in this Conservation Assessment, there is a discussion on "Management Considerations". "Management Considerations" are actions or mitigations that the deciding official can utilize as a means of providing for the continued persistence of the species' site. These considerations are not required and are intended as general information that field level personnel could utilize and apply to site-specific situations.

Management of this species follows Forest Service 2670 Manual policy and BLM 6840 Manual direction. (Additional information, including species-specific maps, is available on the Interagency Special Status Species website.)

SUMMARY

Species *Eucephalus vialis* (Bradshaw) Blake (wayside aster)
Taxonomic Group Vascular Plants

Other Management Status NatureServe ranks *Eucephalus vialis* with a Global Heritage Rank of G3, representing a global condition of vulnerable and at moderate risk of extinction due to very restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors (Oregon Natural Heritage Information Center 2004). *E. vialis* is also listed as a State Threatened species in Oregon (OAR 603 – Division 73). *E. vialis* is a Bureau of Land Management (BLM) Bureau Sensitive in Oregon and is sensitive in Oregon under the R6 Regional Forester Sensitive Species List. The Oregon Natural Heritage Information Center ranks the species S3 and Heritage List 1, critically imperiled. The species is not on the Washington Natural Heritage Program list.

Range and Habitat *Eucephalus vialis* occurs in Lane, Douglas, and Linn Counties in Oregon. The global range of the species, until recently considered a Willamette Valley endemic (Gamon 1986), is primarily within the Willamette Valley Physiographic Province (Franklin and Dyrness 1973). The addition of new sites and populations found in Josephine and Jackson Counties in southern Oregon and Del Norte County in northern California extends the range of the species. There are approximately 24 sites in the City of Eugene, Lane County, and private lands. Thirty extant sites occur on BLM lands on the Eugene and Roseburg Districts, and 2 sites have been located on U.S. Army Corps of Engineers land. Potential habitat for *E. vialis* may occur on the Willamette and Umpqua National Forests.

Eucephalus vialis inhabits coniferous forests at elevations of approximately 152 m (500 ft) to 960 m (3,150 ft). The species typically occurs on dry upland sites dominated by *Pseudotsuga menziesii* (Douglas-fir), and is usually accompanied by hardwoods of drier forests such as *Arbutus menziesii* (Pacific madrone), *Chrysolepsis chrysophylla* (golden chinquapin), and *Quercus garryana* (Oregon white oak) (Alverson and Kuykendall 1989). The species also occurs on edges between forest and meadow.

While current populations of *E. vialis* occur in sites representative of all stages of succession from recent clear-cuts to mature forest, the species preferred habitat is thought to have been historically sustained by frequent fire return intervals that create open forest conditions with widely spaced conifers. Particularly important to *E. vialis* are gaps in the canopy where high light levels allow *E. vialis* to flower (Alverson and Kuykendall 1989).

Threats

- Fire suppression leading to excessive under story brush competition, canopy closure, and reduction in suitable light levels.
- Forest management activities including road construction and maintenance; plantation forestry where young stands approach 100 percent canopy closure; and excessive ground disturbance where mineral soil is disturbed.

- Noxious and exotic weeds in and around *Eucephalus vialis* habitat, including *Rubus discolor* (Himalayan blackberry), *Rubus laciniatus* (evergreen blackberry), and *Cytisus scoparius* (Scotch broom).
- Habitat fragmentation and inbreeding depression.
- Uncontrolled roadside maintenance such as brushing, ditching, and blading, and recreational activities that include Off Highway Vehicle (OHV) use, equestrian use, and hiking.
- Browsing of flowering/non-flowering stems by black-tailed deer.
- Seed predation on flowering stems.

Management Considerations

- Avoid negative impacts to individual plants and adverse modification of habitat from road maintenance activities, exotic weed or competitive vegetation control, wildlife and recreation developments, and ungulate browsing.
- Create gaps and edge habitat through fine scale disturbances, open up forest canopy to 50 to 75 percent, and control under story competing vegetation.
- Periodically reduce duff layers in and around individuals to allow for seedling germination and establishment.
- Control noxious and exotic weeds using integrated noxious weed management techniques that do not negatively impact individual *Eucephalus vialis* plants or that will not adversely modify habitat.
- Determine the genetic viability of populations and where inbreeding depression occurs, improve viability by utilizing techniques such as manual pollination.

Data and Information Gaps

- Additional inventories for *Eucephalus vialis* including potential habitat.
- Ecological and habitat requirements of *E. vialis*, especially as they relate to promoting and maintaining seedling recruitment and flowering, and specifically whether 50 to 75 percent canopy cover is optimum.
- The optimum connectivity for genetic exchange and whether inbreeding depression is occurring within populations. Determine if reductions in pollination are causing adverse impacts on the species.
- How seed predation and ungulate browsing are impacting the reproductive capacity of the species.

I. NATURAL HISTORY

A. Taxonomy and Nomenclature

Bradshaw described the species in 1921 as *Eucephalus vialis* from his Eugene, Oregon collection (*Eucephalus vialis*, Bradshaw, Torreya 20: 122. 1921). In 1928 Blake referred to the species as *Aster vialis (Aster vialis* Blake, Rhodora 30: 228. 1928). L.F. Henderson described the plant in 1933 as a new species of *Sericocarpus sipei*; not knowing it had previously been described (*Sericocarpus sipei* Henderson, Madrono 2:105. 1933). The plant was not reported between 1934 and 1980 (Gammon 1986).

The only recent alternative taxonomic treatment of the species was by Thompson (1977), who treated it as a variety of *Aster engelmannii* (*A. engelmannii* var. *vialis*) (Gammon 1986). However, since this has not been formally published, it is not a valid name and *Eucephalus vialis* (Bradshaw) Blake remains the valid treatment.

It has been suggested that the entire *Eucephalus* species-complex in the Pacific Northwest is in need of taxonomic review. Species distinctions in the group, including *Eucephalus vialis*, tend to be weak (Kaye et al. 1991).

B. Species Description

1. Morphology and Chemistry

A perennial, *Eucephalus vialis is* mostly 61 to 122 cm (2 to 4 ft) tall, from a stout base. The lowest leaves are small and somewhat scale-like. The leaves are largest near the middle becoming gradually smaller near inflorescence. The leaves, which are attached directly to the stem without petioles, are dull green and may or may not have irregular teeth. There are several leafy flower heads, which are about 1.27 cm (.5 in) wide (Gammon 1986). Recent observations suggest that scattered plants may have flower heads with an occasional vestigial ray(s). Additional descriptions of the species can be found in Hitchcock et al. 1955; Abrams 1960; and Peck 1961.

Perennial (many-stemmed) from a stout caudex (or creeping rhizomes and stems scattered) mostly 6 to 2 dm (23.62 to 47.24 in) tall; lowermost leaves reduced and scale-like, the others numerous and nearly alike, gradually reduced toward the inflorescence, elliptic, or broadly lanceolate, sessile, entire or with a few irregular sharp teeth, 5 to 9 cm (1.97 to 3.54 in) long, 1.5 to 3 cm (.58 to 1.18 in) wide, glabrous or nearly so above, glandular beneath; heads several or many in a left-bracteate inflorescence, turbinate, the disk 1 to .5 cm (.39 to .59 in) wide; involucre 8 to 10 mm (.31 to .39 in) high, the bracts well imbricate, sharp-pointed, with a strong midvein and tending to be somewhat keeled, greenish above; ray flowers wanting, (disc flowers yellow); pappus commonly with a few short outer setae (Gammon 1986) (Figure 1).

Figure 1. *Eucephalus vialis* drawing (Hitchock et al. 1955).

2. Reproductive Biology

Flowering usually occurs from mid-July to September. Although seed production is evident, seeds often appear sterile. Seedling recruitment appears limited to nonexistent within certain populations. Seeds are primarily wind dispersed, but many remain near the parent plant (Gammon 1986). Vegetative reproduction is common within populations making it often difficult to differentiate between individuals.

Eucephalus vialis pollinators include *Bombus vosnesenskii* (bumblebees), *Lasioglossum* spp. (smaller bees), *Epicanta puncticllis* (blister beetle), and *Ochlodes sylvanoides* (skipper butterfly) (Alverson and Kuykendall 1989). Data from controlled pollination experiments demonstrate that *E. vialis* is an obligate out crosser and almost completely self-sterile (Kaye et al. 1991). Habitat fragmentation for the species may be restricting pollen flow between populations as is evidenced by plants with apparently sterile seed. Because inbreeding depression can occur when pollen flow is restricted to a single site, maintaining as many sites as possible is extremely important to the long-term viability of *E. vialis* (Kuykendall 1991).

Although all germination treatments tested for *E. vialis* resulted in low germination rates, studies indicate that heat treatments 50°C (122 °F) enhance germination (Guerrant 1991). Additional studies are needed to determine the role of heat in breaking dormancy and whether fire or other factors influence germination and the ability to colonize new areas. Seedling germination has been reported from very few sites and, where this has occurred, individuals often do not reach maturity.

3. Ecological Roles

Populations of *Eucephalus vialis* occur in sites representative of all stages of succession from recent clear-cuts to mature forest. Plant vigor and flower production seem to be inversely proportional to canopy coverage, i.e., the more light that reaches the plants, the greater the species vigor and flowering. It is not clear whether plants are moving into younger stands or whether they are being "released" after disturbance events. *Eucephalus vialis* appears to decline as succession proceeds. This is probably due to decreased light, but may also involve competition for other requirements such as nutrients and water (Gammon 1986). Several sites for *E. vialis* occur in stands where canopy closure is occurring, characterized by plants that do not produce flowers.

An important factor affecting the long-term survival of this species is the rate at which new individuals are recruited into previously unoccupied habitat. Observations suggest that because new habitats are not being created in the same way as historical habitat conditions, recruitment into new habitat is probably low. In addition, the reduction in reproductive potential through small effective population size may also contribute to limitations in colonization.

The structure, function, and composition of forests that support *E. vialis* today are probably distinctly different from conditions that supported this species historically. Rather than being characterized by mature *Pseudotsuga menziesii* (Douglas-fir) found in the Cascade or Coast Ranges (where fire return intervals were quite long), the presettlement forest of central Lane County (where several sites of *E. vialis* occur) exhibited a much more open structure due to frequent fire return intervals. Increases in tree density, due to the absence of fire over the last 140 years, suggests that there are no existing stands that resemble those that supported *E. vialis* prior to settlement around 1850.

Patterns of succession in short rotation forestry do not duplicate the presettlement successional patterns that characterized the habitat of *E. vialis* before the arrival of European settlers. While removal of the canopy through clear-cutting or regeneration harvest may appear to be similar to the disturbance created by fire, there are some important distinctions. Fires often did not result in the death of all trees in a stand. Larger individuals of fire tolerant species, such as *P. menziesii* and *Pinus ponderosa* (ponderosa pine), often survived fires, and thus provided some structural diversity and shade to the resulting stand. This is evident from the presence in existing stands of old trees with fire scars. Regeneration of trees was probably patchier, or distributed over a longer time frame, and included a greater diversity of tree species compared to the dense planting of *P. menziesii* in managed stands. As a result, presettlement stands were probably more diverse, in terms of species and

structure, than a typical *P. menziesii* stand, particularly where high light levels would allow *E. vialis* to continue to flower. As fully stocked *P. menziesii* stands mature, the canopy closes, allowing very little light to reach the forest floor, thus greatly reducing diversity and biomass of the under story vegetation. Under a frequent fire interval of every 5 to 25 years, the presettlement forest would not reach the stage of complete canopy closure (Alverson and Kuykendall 1989). This information is important in helping to design effective management treatments for maintaining *E. vialis* habitat.

Limited observations suggest that *E. vialis* seedling establishment may depend on the removal of duff layers. Historically, fire may have contributed to this function. At one site, plants were found on uprooted trees where mineral soil had been exposed. The few sites where seedling recruitment was observed there also were found mineral soil surfaces where some duff was removed. Very few seedlings at these locations have survived to mature plants.

Evidence of seed predation has been observed in many populations. A study completed in 1989 suggested that while many populations exhibited seed damage, plants were still able to produce viable seed. *Eucephalus vialis* appears to compensate for some fruit loss by maturing additional ovules, and thus may minimize some damage from predispersal seed predators (Kaye et al. 1991). Browsing by black-tailed deer has also been observed at many populations and is thought to negatively impact the reproductive output of plants. At some sites, browsing appears variable depending on the year. Because of this fluctuating nature, it is not clear if these impacts are having long-term impacts on viability (Alverson and Kuykendall 1989).

Several populations of *E. vialis* are competing with noxious and exotic weed species including *Rubus discolor* (Himalayan blackberry, *Rubus laciniatus* (evergreen blackberry), and *Cytisus scoparius* (Scotch broom). *Eucephalus vialis* sites will be out competed by these species if not treated.

C. Range and Sites

Eucephalus vialis occurs in Lane, Douglas, and Linn Counties in Oregon. It was until recently considered a Willamette Valley endemic (Gammon 1986) found primarily in the Willamette Valley Physiographic Province (Franklin and Dyrness 1973) with a few sites along valley margins of the eastern Coast Range. The addition of new sites and populations found in Josephine and Jackson Counties in southern Oregon and Del Norte County in northern California extends the range of the species. Approximately 24 sites have been found in the City of Eugene, Lane County, and private lands. In these counties, the species is found in the Willamette Valley, Oregon Coast, California Klamath, Oregon Klamath, and Oregon Western Cascades physiographic provinces. On federal lands, *E. vialis* is located on BLM lands on the Eugene and Roseburg Districts and 2 sites are located on U.S. Army Corps of Engineers land. Since March 1998 sites have been located on the Siskiyou and Six Rivers NFs.

D. Habitat Characteristics and Species Abundance

Eucephalus vialis is primarily a species of coniferous forest at elevations of 152 to 457 m (500 to 1,500 ft). Typically the species occurs on dry, upland sites dominated by *P. menziesii*, where it is usually accompanied by hardwoods typical of drier forests such as *Arbutus menziesii* (Pacific madrone), *Chrysolepsis chrysophylla* (golden chinquapin), and *Quercus garryana* (Oregon white oak). On the xeric end of the spectrum, one population occurs adjacent to grassland under woodland of *Q. garryana* and *P. menziesii*. Anomalous habitats include a few mesic sites and a high elevation site at 960 m (3150 ft) on thin soils associated with rocky outcrops (Alverson and Kuykendall 1989).

Many sites show evidence of fire history. Unmanaged forest stands adjacent to or within *E. vialis* sites show large, old *P. menziesii* trees with large lower limbs, indicating that trees were once open-grown. Around such trees are often younger cohorts that gradually establish into stands. In some areas around and within *E. vialis* sites, remnant stands of *P. ponderosa* are still found, suggesting an environment that was probably fire-dependent. While fire is thought to be critical in maintaining *E. vialis* habitat, other sites suggest that fine scale disturbances themselves or in combination with fire may also have contributed to species maintenance. Fine scale habitat features recorded for the species include gap formation from single trees falling or openings found amid rocky outcrops.

II. CURRENT SPECIES SITUATION

A. Status History

NatureServe ranks *E. vialis* with a Global Heritage Rank of G3, representing a global condition of vulnerable and at moderate risk of extinction due to very restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors (Oregon Natural Heritage Information Center 2004). *E. vialis* is also listed as a State Threatened species in Oregon (OAR 603 – Division 73). *E. vialis* is classified as a BLM Bureau Sensitive Species in Oregon, and is sensitive in Oregon under the R6 Regional Forester Sensitive Species List. The Oregon Natural Heritage Information Center ranks the species S3 and Heritage List 1, critically imperiled. The species is not on the Washington Natural Heritage Program list.

B. Major Habitat and Viability Considerations

In the report of the Forest Ecosystem Management Assessment Team (FEMAT), viability ratings estimated a 48 percent chance that *E. vialis* would stabilize with significant gaps and a 52 percent chance of being restricted to refugia with strong limitations on interactions between populations (Thomas et al. 1993). These ratings reflect concern that there are highly fragmented populations due to fire suppression and plantation forestry. The range and habitat is so fragmented that population interactions on a wide scale probably will not occur. This species requires natural, “delicate” disturbance, with the role of fire probably important to maintaining viability. Restrictive guidelines limiting use of fire and tools that mimic natural disturbance may be detrimental (USDA and USDI 1994a).

The major viability considerations for *E. vialis* are loss or alteration of populations due to activities that directly impact suitable habitat and individual plants. Direct impacts include recreational activities such as hiking, equestrian traffic, and trail bikes; road maintenance activities such as grading, ditching, and blading; urban and rural development; and forest management activities, including regeneration harvest and road building, known to have negatively impacted or extirpated individual populations. Loss of populations and fragmentation of habitat is limiting the ability of this species to outcross with other populations and is thought to be compromising the long-term viability of *E. vialis*.

The greatest reduction of genetic variation in small populations is from the random fixation or loss of genes, which is called random genetic drift. Subsequent generations of crossing among low numbers of related breeding individuals could result in inbreeding depression (Erhart and Liston 2001). Immigration from a large source population can retard, halt, or even reverse the loss of genetic variation, even with only one or a few migrants per generation (Wright 1931).

Natural ecological processes including fire and gap forming have decreased on the landscape, limiting population viability at several locations. Deer browsing and seed predation have been documented as impacting the reproductive capacity of this species. The introduction of noxious and exotic species into several populations is threatening populations with extirpation by competition if not actively controlled.

C. Threats to the Species

Forest Management Activities

A major threat over the long term is fire suppression, which has produced a dense overstory that reduces habitat quality and creates potential for fires too severe for the species to survive. Logging activities that destroy plants or result in extensive soil disturbance are a serious threat for this species, as is logging followed by the development of dense tree plantations that rapidly lead to a closed canopy forest. Logging in the form of selective thinning and targeted tree removal can be used as a management tool if these detrimental practices are avoided. Some populations of *E. vialis* have responded positively to logging in the first 30 years after harvest, but may show signs of decline shortly thereafter due to competition from fast-growing and aggressive weedy species, such as *Rubus discolor* (Himalayan blackberry) and *Cytisus scoparius* (Scotch broom) (Kaye 1995).

Exotic Weed Invasion

Several of the populations of *E. vialis* have a notable presence of invasive weeds either adjacent to or within them. Populations along roadsides and disturbed areas, such as skid roads and clear-cuts, are especially prone to invasion by weedy species, including the shrubs *R. discolor*, *R. laciniatus* (evergreen blackberry), and *C. scoparius*, and to a lesser degree grasses and forbs such as *Dactylus glomerata* (orchard grass), and *Hypericum perforatum* (St. Johnswort). These weeds and others have the potential to dominate the vegetation of nearly all populations of *E. vialis*, and they may impede efforts to successfully restore habitat of the species.

Habitat Fragmentation/Inbreeding Depression
The *P. menziesii* forest habitat of *E. vialis* has been subject to timber harvest activities on public and private lands for several decades, which has resulted in large-scale habitat fragmentation. Urban and rural developments have most likely impacted populations along valley margins. The noncontiguous pattern of existing *E. vialis* habitat isolates populations from one another, thus limiting the frequency of genetic exchange between them. *Eucephalus vialis* requires insects (mainly bumblebees) for pollination, so populations must be within the flight-range of a pollinator for genetic exchange to occur.

Uncontrolled Roadside Maintenance, Road Use, and Recreation
Potential impacts from various roadside maintenance activities include mowing, spraying, brushing, ditching, blading, and snow plowing. Frequent dusting of roadside populations from traffic traveling unsurfaced roads adjacent to plant populations during critical pollination times may impact reproductive capability. Recreational activities in *E. vialis* habitat that have been observed include trail bikes traveling in and adjacent to populations; equestrian use in and adjacent to populations; and trail use through *E. vialis* populations to fishing areas (Kaye 1995).

Browsing
Native wildlife, primarily black-tailed deer, browse populations of *E. vialis* regularly. Browsing intensity differs from site-to-site and year-to-year, but is frequently intense, often affecting the majority of reproductive plants. Deer browsing normally results in the removal of the flowering heads, thus reducing or eliminating the reproductive potential of browsed stems. Minimizing browsing pressure could increase successful flowering and seed production. The role of ungulates in maintaining the long-term viability of this species is unknown (Kaye 1995).

Predispersal Seed Predation
Seed predation has been observed on *E. vialis*. While some studies have been implemented on seed predation, additional studies are needed to more clearly understand how predation affects the reproductive capacity and viability of this species (Kaye 1995).

D. Distribution Relative to Land Allocations
Of the populations located on BLM lands, the majority were reported in the Step 2 Notes of the 2002 Annual Species Review (ASR) to occur in Matrix lands (USDA USDI 2002). Sites on the Roseburg and Eugene BLM Districts occur within special areas on Matrix lands designated Botanical Reserve Areas, which are designed by their respective Record of Decision (ROD) and Resource Management Plans (RMP) to be managed for the long-term viability of *E. vialis* (USDI 1995a, USDI 1995b). One site on the BLM Roseburg District is located within an Adaptive Management Area (AMA) and one site on the BLM Eugene District occurs within an Area of Critical Environmental Concern (ACEC).

III. MANAGEMENT GOALS AND OBJECTIVES

Management for this species follows FS Region 6 Sensitive Species (SS) policy (FS Manual 2670), and/or BLM Oregon and Washington Special Status Species (SSS) policy (6840).

For Oregon and Washington BLM administered lands, SSS policy details the need to manage for species conservation. Conservation is defined as the use of all methods and procedures that are necessary to improve the condition of SSS and their habitats to a point where their Special Status recognitions no longer warranted. Policy objectives also state that actions authorized or approved by the BLM do not contribute to the need to list species under the Endangered Species Act.

For Region 6 of the Forest Service, SS policy requires the agency to maintain viable populations of all native and desired non-native wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands. Management "must not result in a loss of species viability or create significant trends toward federal listing" (FSM 2670.32) for any identified SS.

IV. HABITAT MANAGEMTENT

A. Lessons from History

Observations of sites have provided some insight into effects of various past management actions on this species. Some of these observations are as follows:

- Roadside brushing at the appropriate time of year (when *Eucephalus vialis* is dormant) has probably reduced competing vegetation and helped to maintain open habitat conditions, allowing some populations to persist over time. Road maintenance activities, however, have probably contributed to the spread of noxious weeds into several of these areas and may have directly impacted populations when brushed at the wrong time of year.
- Stands approximately 20 to 30 years old appear to exclude plants and reduce population viability.
- Stands where some thinning has occurred will support flowering individuals, but recruitment still appears to be limited.
- *Eucephalus vialis* occurs in areas with a historically high fire frequency due to hot, dry summers, and lightning. It is also possible that native people, prior to Euro-American settlement, used fire to maintain open land and control wildlife and vegetation. Fire suppression, since pioneer settlement, has altered much of the habitat of *E. vialis*. Many of the sites occur on south-facing slopes in coniferous woodlands that have become closed-canopy forests over the past 100 years. Prior to fire suppression efforts, this habitat was most likely open woodland with many forest gaps and higher light levels available on the forest floor. At this time, however, fire suppression has resulted in increased tree density and reduces light within the habitat of *E. vialis*.

- Studies indicate that the size and reproductive capacity of *E. vialis* are negatively correlated with canopy (Kaye 1993), and thus fire suppression can be detrimental to the viability of *E. vialis* populations. Some populations occur in closed-canopy forest stands and contain no flowering individuals and/or very low levels of new plant establishment, presumably because of limited light availability. Reintroduction of natural or prescribed fires into the habitat of *E. vialis* is one tool for managing the species, although burning is likely to be difficult at populations adjacent to residential areas and private forest land. Without some reintroduction of fire, the largest populations of this species on public lands may continue to decline or may disappear over time.
- Gap formation and small forest openings, not related to fire processes, are also important habitat for *E. vialis*. Other gap forming agents include wind-throw from storms and tree root pathogens. These types of openings are also undergoing forest succession, resulting in canopy closure (Kaye 1995).
- Stands that have been clear-cut provide additional light and induce plants to flower but, within several years, support high levels of competing vegetation, which is thought to reduce population viability.
- Reproduction has been noted where mineral soil has been exposed and duff layers removed.
- Prescribed fire can be effective in reducing competing vegetation and may be an effective tool in maintaining *E. vialis* habitats as is evidenced by past fire history events at *E. vialis* sites.

B. Identifying Species Habitat Areas

All sites of *Eucephalus vialis* on federal lands administered by the FS and/or BLM in Washington and Oregon are identified as areas where the information presented in this Conservation Assessment could be applied. A species habitat area is defined as the suitable habitat occupied by a known population, plus the surrounding habitat needed to support the site.

C. Managing in Species Habitat Areas

The objective of Species Habitat Areas is to maintain habitat conditions for *E. vialis* such that the species will be maintained at an appropriate scale, in accordance with agency policies. Specific management considerations include:

- Minimize browsing damage where site viability is a concern through the use of enclosures.
- Control recreation use, (Off Highway Vehicle, hiking, equestrian trail use) around site using techniques such as gates, signs, fences, and closures.
- Avoid new wildlife and recreation developments where these actions would negatively impact individual plants or adversely modify habitat.
- Create gap and edge habitat with a 50 to 75 percent canopy cover using techniques such as prescribed fire, tree girdling (or other types of snag creation), tree falling, and selective tree harvest in populations that are in poor condition or have a decreasing trend. Consider factors such as aspect, slope, and adjacent stand structure to determine the size of the treatment area (Chen et al. 1995). Where increased light from the above prescriptions has led to high levels of competing under story

vegetation, implement control measures such as prescribed fire, which produce conditions that allow for recruitment. Emphasis should be on fine scale disturbances. Avoid direct impact to plants during implementation of management activities. Monitor to evaluate effects of treatments (see Section V. Research, Inventory, and Monitoring Needs). Avoid timber management activities such as regeneration harvests and salvage logging that would result in the creation of habitat conditions outside of this prescription.

- To facilitate germination, periodically reduce duff layers through the use of such tools as prescribed burning. Monitor to evaluate effects of treatment (see Section V. Research, Inventory, and Monitoring Needs).
- Control noxious and exotic weeds using integrated noxious weed management techniques that do not negatively impact individual *E. vialis* plants or that will not adversely modify habitat.

V. RESEARCH, INVENTORY, AND MONITORING OPPORTUNITIES

The objective of this section is to identify opportunities to acquire additional information, which could contribute to more effective species management. The content of this section has not been prioritized or reviewed as to how important the particular items are for species management. The inventory, research, and monitoring identified below are not required. A regional coordinating body should address these recommendations.

A. Data and Information Gaps

- Additional inventories for *Eucephalus vialis* including potential habitat.
- Ecological and habitat requirements of *E. vialis*, especially as they relate to promoting and maintaining seedling recruitment and flowering, and specifically whether 50 to 75 percent canopy cover is optimum.
- The optimum connectivity for genetic exchange and whether inbreeding depression is occurring within populations. Determine if reductions in pollination are causing adverse impacts on the species.
- How seed predation and ungulate browsing are impacting the reproductive capacity of the species.

B. Research Questions

- What are optimum habitat conditions for this species, and how can they best be maintained; what management prescriptions are biologically and ecologically appropriate for this species; what are the specific light requirements for this species and what percent canopy cover is optimum?
- What are the most important factors affecting low germination of this species and how can they best be evaluated? How does duff removal affect germination and growth, and nutrient cycling?
- What level of genetic analysis that estimates the pattern of genetic variation be used to evaluate whether inbreeding depression due to random fixation or loss of genes is occurring?

- What was the historic fire history for this species; does prefire-suppression-forest structure result in maintaining and increasing population size and number?
- Is fire the best tool for managing populations and, if so, what should the frequency, duration, and intensity of fire be; are there other techniques that can be utilized to maintain this species?
- What are the factors leading to high seed predation and by what predators?
- What are other limiting factors for this species?
- What is the role of ungulates in this system and how is it impacting plant populations?
- What are the key pollinators and what impacts their effectiveness?
- What is the contribution of dispersal to maintaining or expanding populations of this species?
- How is this species most recently classified?

C. Monitoring Opportunities and Recommendations

- Determine if populations are responding to management treatments that prescribed modification of the canopy from 50 to 75 percent, removal of duff layers, and control of competing vegetation and, specifically, that recruitment is occurring within populations and/or plants are colonizing new areas within the managed forest.
- Determine if fine scale disturbances are providing for effective habitat.
- Determine if recreational, road maintenance, and construction/development activities may be currently or potentially impacting species habitat areas and the mitigations associated with their management.
- Evaluate effect of herbivore and seed predation on the viability of the species, and where there are negative impacts, if they are being controlled.
- Evaluate if introduction of forest processes such as prescribed fire enhance populations and maintain conditions necessary to support this species.
- Evaluate whether measures such as controlled pollinations have been taken and are effective in mitigating inbreeding depression/genetic drift.
- Determine if measures are being taken to control noxious, exotic weeds that may negatively impact *E. vialis* and are being implemented so as not to harm this species.
- Report documented sites to Oregon Natural Heritage Information Center.
- Report changes in documented and suspected status as quickly as possible to the interagency BLM Oregon and FS R6 Special Status/Sensitive Species Specialist in the Regional Office/State Office.
- Report sitings and survey work in the appropriate agency database: Geo-spatial Biological Observations (GeoBOB) or the Natural Resource Information System (NRIS).

GLOSSARY

Buffer

An area which is managed to protect a site that can be undisturbed or managed. The buffer is meant to maintain and/or improve the habitat conditions of the site and provide life requisites for the species.

Connectivity

The linkage of similar but separated suitable habitat patches, by corridors or "stepping stones" of like habitat that permits interaction between individuals or populations over time. Connectivity must consider time in the context of its potential effects to genetic drift or isolation.

Fragmentation

The loss, division or isolation of patches of similar habitat at a scale relevant for the species being addressed.

Monitoring

The collection of information used to determine if management actions are meeting objectives of standards and guidelines and if they comply with laws and management policy. Monitoring is used to determine if standards and guidelines are being followed (implementation monitoring), if they are achieving the desired results (effectiveness monitoring), and if underlying assumptions are sound (validation monitoring). Monitoring usually collects information on a sampling basis, provides standardized data, and occurs at multiple levels and scales.

Persistence

The likelihood that a species will continue to exist, or occur, within a geographic area of interest over a defined period of time. Includes the concept that the species is a functioning member of the ecological community of the area.

Range

The limits of the geographic distribution of a species.

Site (Occupied)

The location where an individual or population of the target species (taxonomic entity) was located, observed, or presumed to exist and represents individual detections, reproductive sites or local populations. Specific definitions and dimensions may differ depending on the species in question and may be the area (polygon) described by connecting nearby or functionally contiguous detections in the same geographic location. This term also refers to those located in the future (USDA, USDI 1994a).

Species Habitat Area

The geographic area managed to provide for the continued persistence of the species at the site; may include occupied and unoccupied habitats.

Suitable habitat

Abiotic and biotic environmental conditions within which an organism is known to carry out all aspects of its life history.

Viability

Ability of a wildlife or plant population to maintain sufficient size to persist over time in spite of normal fluctuation in numbers, usually expressed as a probability of maintaining a specified population for a specified period (USDA, USDI 1994).

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APPENDIX

FUEL HAZARD REDUCTION TREATMENTS IN SHORT FIRE RETURN INTERVAL AREAS

The following are management considerations that can be used in project design to create low risks to the continued persistence of an individual site. These are not required mitigations or actions to follow when conducting these activities, but provide general considerations to apply to site-specific situations, should continued site persistence be desired.

Broadcast Burning—Low intensity/low severity broadcast burning within the site. Manage for low severity/low intensity fire by keeping average flame lengths below 4 feet and removing heavy fuels from the site. Avoiding prescribed burning during the growing season (June 1 to October 1) is recommended; early spring burns and fall burns, after senescence, are preferable. Noxious weeds pose a serious threat for this species. Attempt to conduct activities in a manner and season that minimizes noxious weed spread to occupied sites.

Hand or dozer lines—Maintain soil integrity around sites. Provide a buffer around the site commensurate with the width of the line. Hand-line can be placed as close as 5 m (15 ft) from the perimeter of the population if the locations of individual plants are known. Dozer line should generally be a minimum of 20 m (65 ft) from the site perimeter.

Piling and Pile Burning—Hand-pile material and keep mechanized equipment off the site. Locate piles, considering slope and aspect, far enough away from the site so that heat does not disturb the site or burn duff, and trampling of the site does not occur. Keep mechanized equipment away from sites.

Thinning—Canopy cover at the site may be reduced down to 50 to 75 percent. Special care should be taken to avoid mechanical damage from trampling and soil compaction when treatments occur during the spring and summer growing season. Avoid disturbing individual plants or the soil around individual plants when yarding or skidding materials are on the ground near sites. Exclude mechanized equipment from sites.

Pruning—Special care should be taken to avoid mechanical damage from trampling and soil compaction when treatments occur during the growing season (June 1 to October 1).

Chipping, raking—Keep mechanized equipment off sites. Material can be hand pulled from within and around the occupied site to a chipper located away from the site. Chips should be directed away from the site. Any activity within the site should take place after senescence (October 1) and before the growing period (June 1) to avoid trampling of plants.

Crushing, chopping, grinding, or mowing—It is unknown how these activities could be designed to create low risk to site persistence. It is expected that these activities have the potential to increase burn duration of fuels left on the ground. This would increase burn severity and have a negative effect.

Foam surfactant— It is unknown what, if any, impact foam may have upon this species. At a minimum, it is recommended that application of foam directly on *C. fasciculatum* plants be avoided. With ground application, avoid trampling of plants during the spring/summer growing period (June 1 to October 1).