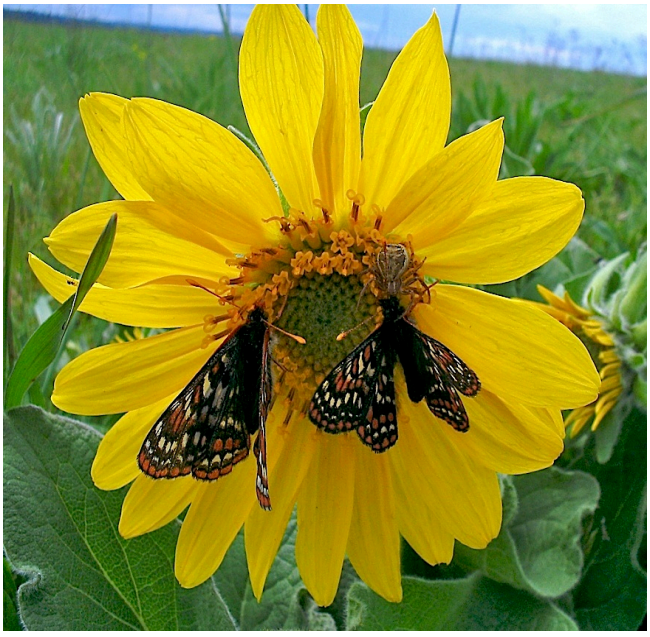
SPECIES FACT SHEET PROVIDED by
Washington Department of Fish and Wildlife

# Taylor's Checkerspot

**Also Whulge Checkerspot**

***Euphydryas editha taylori,*** W.H. Edwards, 1888

Family: Brush-footed Butterflies (Nymphalidae)



Taylor's Checkerspot nectaring on Balsamroot (butterfly on right predated by a spider).
*Photo by Aaron Barna*

**Status Classification:**

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|---|---|
| Federal (USFWS): | Proposed Endangered |
| State (WDFW): | Endangered, SGCN (see below) |
| NatureServe Global status: | G5T1 (Critically Imperiled,) |
| NatureServe State status: | S1 (Critically Imperiled) |

**Conservation Status**

Once so numerous that Dornfeld (1980) described meadows near Corvallis, Oregon as "fairly swarming" with this butterfly, Taylor's Checkerspot is recognized today, throughout its range, as imperiled. Taylor's Checkerspot was identified as a butterfly of conservation concern in the first Washington butterfly conservation status assessment (Pyle 1989) due to its extensive loss of prairie habitat from development, agriculture, and forest succession, small number of populations, clearly important and largely unknown habitat requirements, and existence on unsecured private lands. Since 1989, extensive surveys have been conducted to determine the status of historically documented populations and search for undiscovered sites across the butterfly's range (Fleckenstein and Potter 1999, Shepard 2000, Stinson 2005, Ross 2006, Holtrop 2010, COSEWIC 2011, Potter 2011, B. Bidwell, lepidopterist, unpubl. data, WDFW unpubl. data: K. McAllister, A. Potter, M. Walker, WDFW). Through these efforts, many populations located in the past were determined to be extinct; a few new populations were discovered of which some declined to extirpation and some persist. Some life history and habitat research is recent across the butterfly's range (Hays et al. 2000, Severns and Warren 2008, Page et al. 2009, Severns and Grosboll 2011, Grosboll 2011).

Taylor's Checkerspot is recognized as a butterfly of conservation concern throughout its range. In Washington, it is 1 of 19 butterfly Species of Greatest Conservation Need in *Washington's Comprehensive Wildlife Conservation Strategy* (WDFW 2005). WDFW completed an extensive status review for this butterfly, which includes detailed accounts on Taylor's Checkerspot taxonomy, natural history, habitat, and threats (Stinson 2005). The U.S. Forest Service and Bureau of Land Management list it as a sensitive species (USFS/BLM 2012). In British Columbia, Canada, it is classified as an endangered species under the Species at Risk Act (COSEWIC 2011).

Two other members of the *Euphydryas editha* species are also butterflies of conservation concern: the long and famously studied Bay Checkerspot (*Euphydryas editha bayensis*), located in coastal northern

California is federally threatened (USFWS 1998), and the southern California endemic Quino Checkerspot (*Euphydryas editha quino)* is federally endangered (USFWS 2003).

**Population Trends and Distribution**

*Rangewide.* Taylor's Checkerspot is a Pacific Northwest endemic butterfly once found on over 80 sites in the Willamette Valley, Oregon, western Washington, and Vancouver Island, British Columbia, Canada (Fig. 1) (Stinson 2005, Ross 2006, Holtrop 2010, COSEWIC 2011, A. Potter, WDFW, unpubl. data, P. Severns, lepidopterist, pers. comm.). It was originally described in 1988 by W. H. Edwards from material collected in the Victoria, British Columbia area by a noted amateur lepidopterist, the Reverend George Taylor. In British Columbia, Taylor's Checkerspot historically occupied at least 24 prairie-oak and coastal meadow sites in southern Vancouver Island, but today persists on only 1 site (COSEWIC 2011). In Oregon, the butterfly occurs in the Willamette Valley, where over 14 sites were historically documented but only 2 are extant (Hinchliff 1995, Stinson 2005, Ross 2006, H. Rice, lepidopterist, pers. comm., P. Severns, lepidopterist, pers. comm.). Historically, the Taylor's Checkerspot was likely more widespread throughout its range.

*Washington.* In Washington, Taylor's Checkerspot was historically documented from 24 sites; 1 each in

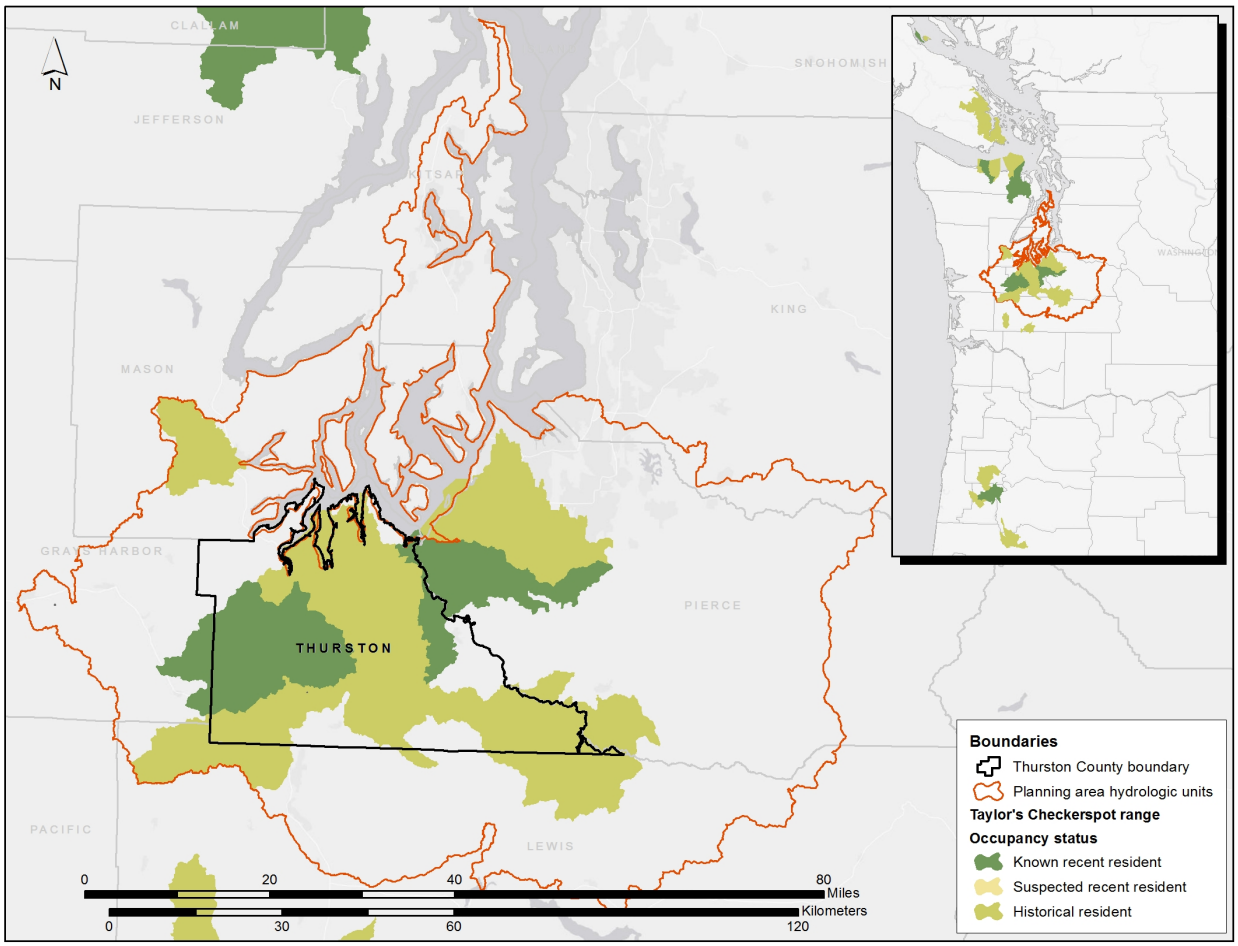


Figure 1. Taylor's Checkerspot range in the south Puget Sound region of Washington and in total (inset). Range is shown using occurrences associated with hydrologic units that intersect the planning area, thus depicting a broad generalization rather than specific extent.

San Juan and Island Counties, 2 in coastal Clallam County, and 20 on south Puget Sound prairies, oak woodlands, and other open habitats (Lewis, Mason, Pierce, and Thurston Counties) (Hinchliff 1996, B. Bidwell, lepidopterist, pers. comm.). By 2004, it was documented extirpated (or likely extirpated) from all historic locales in Island, Lewis, Mason, Pierce, San Juan, and Thurston Counties (Stinson 2005). However, intensive survey efforts initiated in the 1990's located additional populations of the butterfly on 5 south Puget Sound prairies (Char and Boersma 1995, Chramiec 2004; unpubl. data: B. Bidwell, J. Fleckenstein, DNR, and A. Potter, WDFW), forest balds in southeast Thurston County (unpubl. data: M. McCallum, DNR, K. McAllister, WDFW, A. Potter, WDFW, and M. Walker, WDFW), and a few forest balds and coastal sites in Clallam County (Holtrop 2010, A. Frost, entomologist, pers. comm., unpubl. data: A. McMillan, WDFW, A. Potter, WDFW, and T. Stuart, WDFW,).

*Thurston County HCP Area.* At least 24 Taylor's Checkerspot sites have been documented within the HCP area; the butterfly is extant on only 4, and 3 of those are recently reintroduced populations (Fig. 2) (Stinson 2005, Linders 2006, Linders 2012). Extant sites range geographically from southwestern Thurston County (2 populations) to Joint Base Lewis-McChord (JBLM) lands in western Pierce County (2 populations).

Knowledge of the distribution and site occupancy status of Taylor's Checkerspot within the HCP area

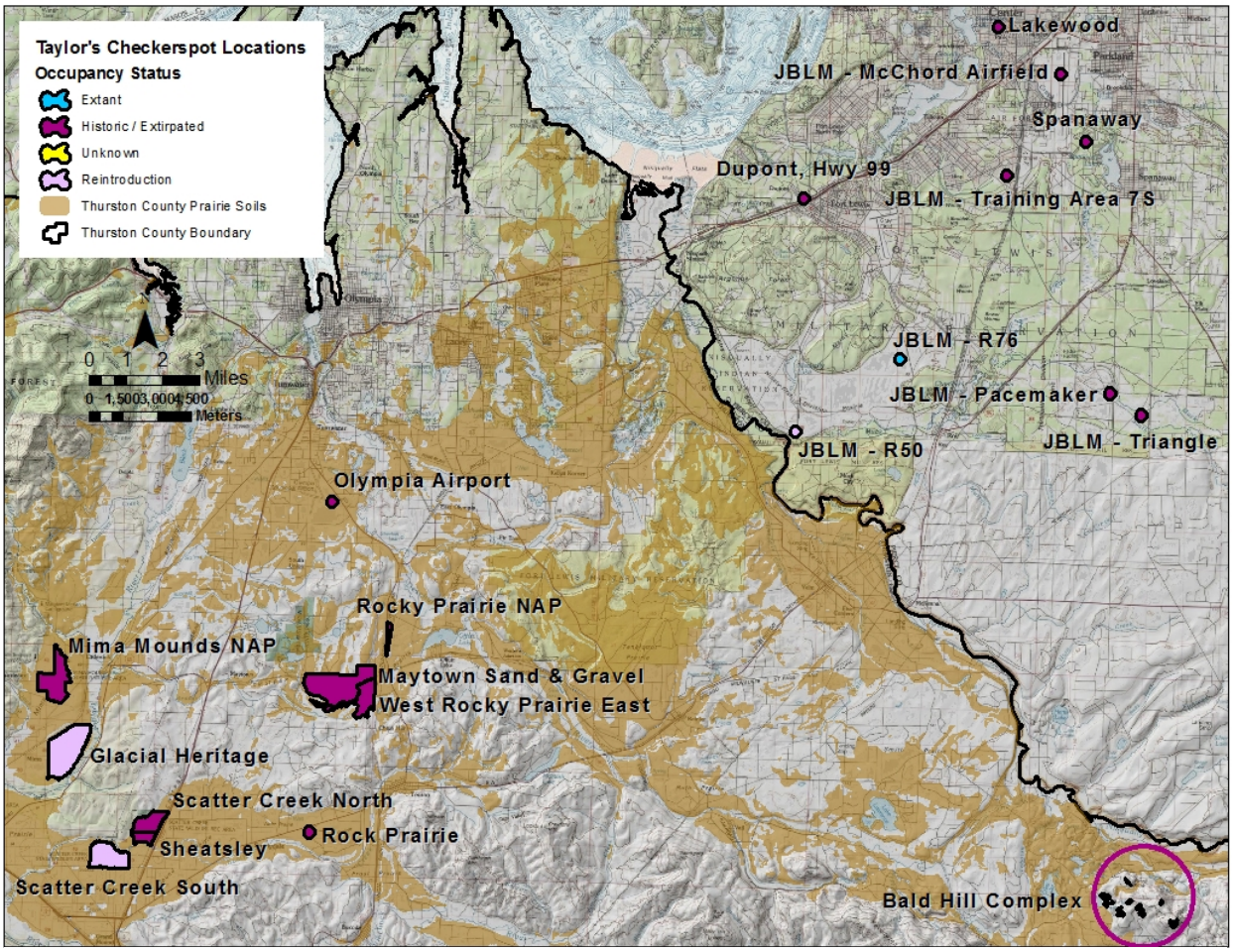


Figure 2. Distribution of Taylor's Checkerspot in south Puget Sound, Washington: extant, historic, unknown status, and reintroduction sites. Polygons depict site boundaries; points depict generalized locations

comes from observation data collected during general prairie butterfly surveys (Char and Boersma 1995, Hinchliff 1996, Fleckenstein and Potter 1999, Wolford et al. 2007, Fimbel 2008, unpubl. data: B. Bidwell, lepidopterist, K. McAllister, WDFW, A. Potter, WDFW), incidental observations (A. Potter, WDFW, unpubl. data, pers. comm.: B. Bidwell, lepidopterist, E. Delvin, UW, C. Fimbel, CNLM, D. Grosboll, TNC, K. McAllister, WDFW, W. Yake, lepidopterist), and focal research on this butterfly (Hays et al. 2000, Grosboll 2011, Potter 2011, Linders 2012). As part of the WDFW Taylor's Checkerspot status review, the agency led a comprehensive effort in the south Puget Sound region to revisit historic locales and identify and survey potential habitat for the butterfly (A. Potter, WDFW, pers. comm.).

Taylor's Checkerspot populations are closely monitored at the 4 extant south Sound sites (Olson and Linders 2010, Linders 2012). Three of these populations were recently established (or in 1 case perhaps augmented) by translocations of captive-reared butterflies (Linders 2006, Linders 2012). The 3 reintroduced populations occur on Scatter Creek Wildlife Area – South, Glacial Heritage County Park, and JBLM Artillery Impact Area – Range 51. During monitoring of the reintroduced populations, small numbers of butterflies have been observed at the first 2 sites, while large numbers of adults, 100s and perhaps 1,000s of individuals have been observed recently at the JBLM reintroduction site (Linders 2012). The sole extant south Sound population that is not the result of recent translocation is located on JBLM Artillery Impact Area – Range 76, and is also the single source population for the south Sound Taylor's Checkerspot captive-rearing effort,. Close monitoring of this population has consistently detected 1000s of butterflies during recent years (Olson and Linders 2010, Linders 2012).

**Life History and Ecology**

*Description.* Taylor's checkerspot is a brightly colored, medium-sized butterfly with a striking checkered pattern of orange to brick red, black, and cream. On south Puget Sound prairies, no other butterfly resembles it. Females are larger than males, though both have the same checker-patterned wings.

*Life cycle and behavior.* Taylor's Checkerspot is univoltine; it completes 1 life cycle annually. They are sedentary insects, inhabiting their sites year-round as an egg, larva, pupa, and adult. In the south Sound, adults (butterflies) typically begin to emerge from their chrysalids (pupae) in late-April, though this and all other life stage dates for this butterfly can vary significantly due to weather conditions (Linders 2006, A. Potter, WDFW, pers. comm.). Although individual butterflies may live only a few days, the entire adult flight period in the south Sound often lasts through late-May (Linders 2006, Olson and Linders 2010, Linders 2012, unpubl. data: D. Grosboll, TESC, K. McAllister, WDFW, A. Potter, WDFW). Butterflies in this region have been observed as early as late-March (A. Potter, WDFW, unpubl. data) and as late as early-June (Hinchliff 1996, Linders 2012, K. McAllister, WDFW, unpubl. data).

Males use 2 strategies for mate-finding: perching and patrolling (Bennett et al. 2011). In perching, males select specific sites to perch and then dart out at passing butterflies to determine if it is a female of its species. In patrolling, males search for females by almost constant flying, often along a regular route or territory. Females lay eggs in clusters, low on their host plants, which in the south Sound are the non-native English Plantain (*Plantago lanceolata*) and native Harsh Paintbrush (*Castilleja hispida*) (Char and Boersma 1995, Hays et al. 2000, Severns and Grosboll 2011, Grosboll 2011, unpubl. data: D. Grosboll, TESC, M. Linders, WDFW, A. Potter, WDFW).

Male and female butterflies feed by using their long proboscis to explore flowers and sip floral nectar. Annual variation in plant phenology and condition affects availability of nectar resources thereby causing variation in plant species use among years. An early pollination study on south Puget Sound prairies (Jackson 1982) found Taylor's Checkerspots nectaring solely on (*Camassia quamash*). Hays et al. (2000) observed (but did not quantitatively study) Taylor's Checkerspot nectar habits on a south Sound prairie

and found them primarily using Common Camas and Nine-leaved Lomatium (*Lomatium triternatum*). Other nectar sources regularly used by Taylor's Checkerspot in the south Sound region include: Deltoid Balsamroot (*Balsamorhiza deltoidea*), Spring Gold (*Lomatium utriculatum*), Wholeleaf Saxifrage (*Saxifraga integrifolia*), and Seablush (*Plectritis congesta*) (Linders 2012, A. Potter, WDFW, unpubl. data).

Adult movement studies of the closely related *E. editha bayensis* and *Melitaea cinxia* have found these butterflies to be consistently sedentary, though a few individuals move some distance, most remain within a few 100 m (USFWS 1998, Nieminen et al. 2004). No research specific to Taylor's Checkerspot has been conducted to determine their movement patterns or distance.

Several scientists have observed Taylor's Checkerspot egg masses and larvae extensively in the south Sound, but their phenology in the wild has not been studied completely (Severns and Grosboll 2011; unpubl. data: D. Grosboll, TESC, M. Linders, WDFW, A. Potter, WDFW). Careful and detailed phenological data for Taylor's Checkerspot larvae has been collected by the Oregon Zoo as part of a captive-rearing program (Barclay et al. 2010). James & Nunnallee (2011: pp. 286-287) provide detailed descriptions and photographs of the species life stages . *Euphydryas editha* eggs hatch in 8-9 days (James and Nunnallee 2011); eggs within a cluster typically hatching in synchrony (Barclay et al. 2010). The resulting caterpillars (larvae) create webbing and feed communally through the spring on the host plant species on which eggs were deposited, continuing to grow and shed their skins to expand, in what are referred to as instar stages. Larvae enter a dormant phase (diapause) in late-June or early-July (M. Linders, WDFW, unpubl. data, A. Potter, WDFW, unpubl. data) when host plants are senescing and no longer provide palatable vegetation. Larvae often diapause in a sheltered location under rocks, logs, or litter (Guppy and Shepard 2001). Diapausing *Euphydryas editha* larvae develop a thick exoskeleton that helps prevent dehydration (Scott 1986). The diapause phase lasts for many months, until early the following spring (January or February in the south Sound). Upon breaking diapause, Taylor's Checkerspot larvae reinitiate feeding on a broader array of plant species. Plant species that held egg masses remain a major component of their diet, but additional post-diapause food sources (Sea Blush, Blue-eyed Mary (*Collinsia parviflora*), and Dwarf Owl-clover (*Triphysaria pusilla*) as available, also are used. Larvae pupate in March or April (M. Linders, WDFW, unpubl, data).

**Habitat Characteristics**

The Taylor's Checkerspot inhabits grasslands in low-elevation prairies and meadows, coastal meadows and stabilized dunes, and montane meadows and balds. Balds are shallow-soiled, grass, herbaceous vegetation, or lichen and moss dominated sites, typically less than 5 ha (12.5 ac), that occur within forested lands (Chappell 2006). A few studies of Taylor's Checkerspot habitat have been conducted outside of the south Puget Sound region, including in Oregon (Severns and Warren 2008), British Columbia (Page et al. 2009), and the north Olympic Peninsula (Severns and Grosboll 2011, Grosboll 2011). Egg-laying (oviposition) habitat is often studied with this and other butterflies because it is a limiting factor, determines the site of pre-diapause larvae, and influences the location of diapause, post-diapause, and pupation. Severns and Warren (2008) found that Taylor's Checkerspots selected habitat for egg-laying that occurred within high cover of short-stature native bunchgrasses and adult nectar resources, indicating that females select egg-laying sites based on habitat condition. Page et al. (2009) found the most common activity of post-diapause larvae was basking and perching, demonstrating the importance of thermal habitats in this life stage. The British Columbia study population had multiple host plant species available and females' selection of egg-laying sites in this environment was influenced by host plant phenology and condition (Page et al. 2009). A characteristic of egg-laying habitat consistently identified in the British Columbia and 3 Olympic Peninsula populations was the abundance of host plants (number or percent cover) (Page et al. 2009, Severns and Grosboll 2011, Grosboll 2011).

Within the south Sound region, the butterfly has been found on prairies and balds. Habitat selection by egg-laying females has been studied in 1 population, the sole extant south Sound site (JBLM Artillery Impact Area – Range 76) by Linders et al. (2009), Severns and Grosboll (2011), and Grosboll (2011). All researchers found that females selected habitat with high host plant density for oviposition. Grosboll (2011) determined that the butterfly selected for host plant patches with >10,000 $cm^3$ volume. Severns and Grosboll (2011) found that the butterfly laid eggs more frequently along 2-track road edges than the open prairie, and explained this may be due to the strong association between the host plant at this site (English Plantain) and the road beds.

Although there has been no quantitative study of Taylor's Checkerspot nectar plant use or preference, several plants have been identified as key nectar sources in south Sound populations (Common Camas, Deltoid Balsamroot, Sea Blush, Wholeleaf Saxifrage, Nine-leaved Lomatium, and Spring Gold) (Jackson 1982, Hays et al. 2000, Linders 2012, M. Linders, WDFW, unpubl. data, A. Potter, WDFW, unpubl. data). Because annual variation in plant phenology and condition determines the availability of nectar resources and causes variation in availability (and therefore use) among years, variety of nectar sources is an important habitat component.

**Threats/Reasons for Decline**

Prairie-oak butterfly species in the Willamette Valley-Puget Trough-Georgia Basin (WPG) ecosystem have declined dramatically due to widespread habitat degradation and loss of prairie-oak ecosystems in the region (Schultz et al. 2011). Also see the *Factors Affecting Continued Existence* section in the Washington State Status Report for Taylor's Checkerspot for more complete and detailed information on threats (Stinson 2005, pp. 99-105).

*Habitat loss and fragmentation.* Habitat loss is the consistent, primary factor driving species extinctions and declines world-wide (Groom et al. 2006), and the most common threat to butterfly populations (New et al. 1995). Prairies and oak woodlands in south Puget Sound have been converted to development, agriculture, gravel mines, and lost to forest succession resulting from the elimination of fire and other beneficial sources of disturbance. In 1997, Crawford and Hall conservatively estimated that over 60,000 ha (>148,263 ac) of prairie existed historically in the south Sound region, and that only 3% of that remained dominated by native vegetation. Prairie loss has likely continued since 1997, but no updated estimates are available for this specific region. Chappell et al. (2001) refined the estimate of grassland habitat for the entire WPG ecosystem, and estimated the total amount of prairie, oak woodland, and grassland bluffs and balds prior to Euro-American settlement was over 72,000 ha (180,000 ac).

Butterflies and other prairie species are also affected by fragmentation of their habitat. Crawford and Hall (1997) found that historically in south Puget Sound there were 233 prairie sites, averaging 250 ha (618 ac) in size, including 18 large prairies (>405 ha), and contrasted that to 1997 conditions: 29 prairie sites, averaging 175 ha (432 ac) in size, with only 2 large prairies extant. Fragmentation of prairies directly threatens prairie butterflies by creating smaller and isolated populations, which increases the potential for population loss and inbreeding. Butterfly habitat fragmentation also occurs within prairies from habitat degradation that results in small, disjunct patches of suitable habitat.

*Invasive species.* Invasive plants have dramatically altered the ecological function of Pacific Northwest prairies (Dunwiddie and Bakker 2011). Woody shrubs, including Scot's Broom, and non-native grasses, especially Tall Oatgrass (*Arrhenatherum elatius*), Bentgrasses (*Agrostis*), and Sweet Vernal Grass (*Anthoxanthum odoratum*) have invaded most extant south Puget Sound prairies. Uncontrolled, these plants dominate native prairie vegetation, including Taylor's Checkerspot larval and nectar plants, and change vegetation structure and soil conditions. Tall grasses (Slender False Brome (*Brachypodium*

*sylvaticum*) and Tall Fescue (*Festuca arundinacea*)) deterred Taylor's Checkerspot egg-laying and reduced cover of larval and nectar plants in the Willamette Valley, Oregon (Severns and Warren 2008).

*Effects from long-term lack of beneficial disturbance.* The prairies and oak woodlands of the south Puget Sound region are the result of glacial history, climate conditions (especially the warm, dry climatic period between 9,000 and 4,000 B.P.: Holocene Climate Optimum or Hypsithermal), topography, and human interaction (Ewing 1997, Crawford and Hall 1997). Native Americans regularly set fire to prairies in the Pacific Northwest to support food production and manage hunting sites (Norton 1979, Boyd 1986, Agee 1993) and this process supported open prairie and savannah. Soil disturbance also regularly occurred from Native American harvest of bulbs and rhizome plant material (Turner 1999) and the activity of burrowing mammals, especially the Mazama Pocket Gopher (*Thomomys mazama*) (Huntly and Inouye 1988).

Cultural practices changed when Euro-Americans began to settle the Pacific Northwest and the prairies; soil and vegetation disturbance from fire setting and prairie plant harvesting ceased. Encroachment by trees and shrubs, first native species and then non-native, combined with the introductions of invasive grasses and herbaceous species, resulted in the loss of prairie to forest, and dramatic alterations to the extant grasslands. However, restoring disturbance regimes to prairies is difficult, and in the case of fire, does not replicate effects of historic burning. Balancing the requisite prairie disturbance with fire or mowing logistics, endangered species management, and weed invasion must be done with a very deliberate and careful approach (Schultz and Crone 1998, Schultz et al. 2011).

*Prairie management.* Fire, herbicide use, mowing, and other prairie management techniques are important tools for re-creating or simulating disturbance mechanisms that historically maintained prairies, reducing invasive species, and restoring endangered species habitat connectivity (Dunwiddie and Bakker 2011, Schultz et al. 2011). These prairie management practices, implemented to restore or enhance prairie vegetation and wildlife habitat, also can directly or indirectly harm butterflies (Schultz et al. 2011). Effects of these practices on butterflies, including Taylor's Checkerspot, are not completely understood. Prairie management in areas occupied by butterfly species of concern is necessary and must be undertaken with special methods and considerations to reduce or eliminate harm to these species.

*Military training:* The sole source population for Taylor's Checkerspot captive rearing and translocation, along with the only other south Sound Taylor's Checkerspot site that currently supports a robust population are located within the Artillery Impact Area (AIA) of JBLM. There are a variety of vegetation conditions within the AIA, most of which have been significantly affected by frequent fires that result from repeated ordnance explosion. The closed nature of the AIA, coupled with a low-intensity, high fire frequency, has in some areas supported significant patches of Taylor's Checkerspot habitat. However, frequency and type of use in the AIA (and JBLM) has changed. In recent years, development within the AIA has increased the footprint and intensity of roads and structures within areas occupied by Taylor's Checkerspot (M. Linders, WDFW, pers comm., T. Thomas, USFWS, pers. comm.). Fire timing, frequency, and intensity also may have changed (R. Gilbert, JBLM, pers. comm.). Buildings and other structures, along with their intense use affect Taylor's Checkerspots directly and reduce the amount of habitat. Vehicle traffic likely crushes eggs, larvae, pupae, and adults (Stinson 2005). Increased fire frequency and earlier fire dates also are likely threats to Taylor's Checkerspots and their habitat.

*English plantain pathogen:* A recently identified potentially significant threat to Taylor's Checkerspot is the widespread presence of a pathogen specific to the primary larval host English Plantain (Stone et al. 2011). This fungal pathogen (*Pyrenopeziza plantaginis*), like the plant it specifically attacks, is native to Europe, and was first documented in the Pacific Northwest (and North America) in 2011; the length of time it has been present in these regions is unknown (Stone et al. 2011). The fungus has infected English

Plantain at Taylor's Checkerspot sites in Oregon (Stone et al. 2011), and Washington (P. Severns, lepidopterist, pers. comm.). Peak necrosis of plantain leaves resulting from infection occurs in late-winter and can overlap with the Taylor's Checkerspot post-diapause larval period (Stone et al. 2011), a time when the plant is needed in abundance to feed larvae.

*Knowledge gaps*. Taylor's Checkerspot appears to be highly selective in its habitat requirements, however, habitat needs have not been fully studied. Knowledge of habitat needs for adults, larvae, and diapause are essential elements to conserving and managing for Taylor's Checkerspot (Schultz et al. 2011). Severns and Grosboll (2011) and Grosboll (2011) studied egg-laying habitat selection, and both identified understanding larval survival in different environments and on different host plants as an important research topic. Methods to reliably develop and manage for Taylor's Checkerspot habitat are needed. Grosboll (2011) identified the need to develop methods for enhancing host plant resources. Harsh Paintbrush and English Plantain have been identified as Taylor's Checkerspot host plants. On most recently known sites, only 1 of these species occurs; additional study is needed to determine the effects of multiple host species availability to short and long-term survival of checkerspot populations.

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