

Draft Recovery Plan for Taylor's Checkerspot Butterfly (*Euphydryas editha taylori*)

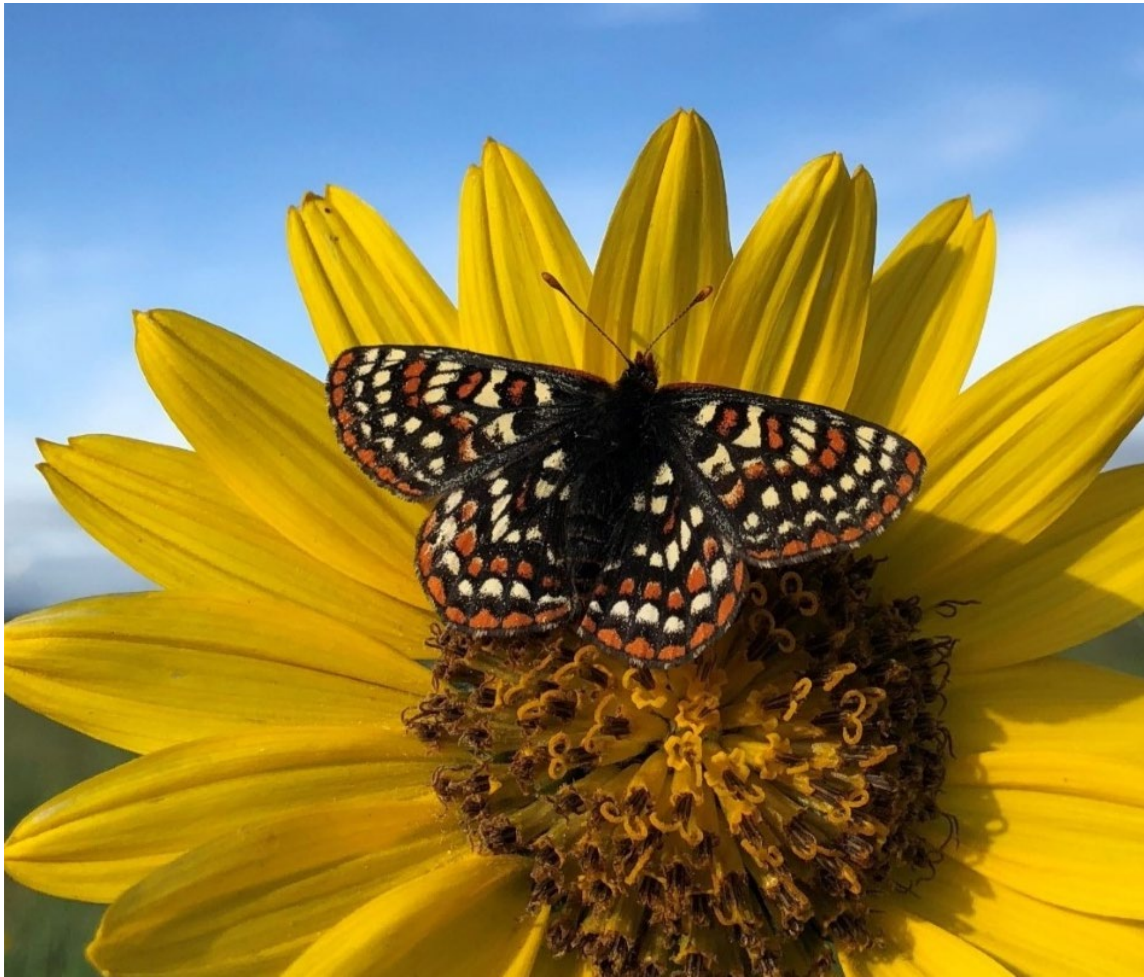


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Draft Recovery Plan
for
Taylor's Checkerspot Butterfly
(*Euphydryas editha taylori*)

U.S. Fish and Wildlife Service
Portland, Oregon

Draft Approved:

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DISCLAIMER

Recovery plans delineate reasonable actions needed to recover and/or protect listed species. We, the U.S. Fish and Wildlife Service (Service), publish recovery plans, sometimes preparing them with the assistance of recovery teams, contractors, State agencies, and others. Objectives of the recovery plan are accomplished, and funds made available, subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities with the same funds.

Recovery plans do not necessarily represent the views or the official positions or approval of any individuals or agencies involved in the plan formulation, other than our own. They represent our official position only after signed by the Director or Regional Director. Draft recovery plans are reviewed by the public and may be subject to additional peer review before the Service adopts them as final. Recovery objectives may be attained and funds expended contingent upon appropriations, priorities, and other budgetary constraints. Recovery plans are guidance and planning documents only; identification of an action to be implemented by any public or private party does not create a legal obligation beyond existing legal requirements. Nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in any one fiscal year in excess of appropriations made by Congress for that fiscal year in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and completion of recovery actions.

Literature citation of this document should read as follows:

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An electronic copy of this recovery plan is available at:

<https://www.fws.gov/pacific/ecoservices/endangered/recovery/plans.html>

and <https://www.fws.gov/node/266264>

The first use of technical terms is underlined, and are defined in the glossary in Appendix A.

ACKNOWLEDGMENTS

We gratefully acknowledge the contributions of the following individuals and organizations in developing this draft recovery plan for Taylor's checkerspot butterfly (*Euphydryas editha taylori*). Many people were involved in the drafting of this recovery plan including Karen Reagan (Washington Fish and Wildlife Office [WFWO]), Tara Callaway (WFWO), Dan Grosboll (WFWO), Zachary Radmer (WFWO), Rich Szlemp (Oregon Fish and Wildlife Office [OFWO]), and Jennifer Siani (OFWO).

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RECOVERY PLANNING PROCESS

The Service uses a three-part framework for recovery planning (click [here for details](#)). This approach is intended to reduce the time needed for recovery planning, increase the relevancy of recovery plans over a longer timeframe, and increase the flexibility of recovery planning documents by making them easier to modify as new information or circumstances arise. Under this process, a recovery plan includes the statutorily required elements under section 4(f) of the Endangered Species Act (Act) (objective and measurable recovery criteria, site-specific management actions, and estimates of time and costs), along with a concise introduction and our strategy for how we plan to achieve species recovery. The recovery plan is supported by two supplementary documents: a species status assessment or species biological report, which describes the best available scientific information related to the biological needs of the species and assessment of threats; and the recovery implementation strategy, which details the particular near-term activities needed to implement the recovery actions identified in the recovery plan. Under this approach, new information on species biology or details of recovery implementation may be incorporated by updating these supplementary documents without concurrent revision of the entire recovery plan, unless changes to statutorily-required elements are necessary.

Thus, this recovery plan document is one piece of a three-part framework:

1. The **Species Status Assessment (SSA)** or **Species Biological Report (SBR)** informs the recovery plan; it describes the biology and life history needs of the species (includes distinct population segments, subspecies, species groups), includes analysis of each species' historical and current conditions, and includes discussion of threats and conservation needs of each species. The SSA or SBR's format is structured around the conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 307-310; Wolf et al. 2015, entire; Smith et al. 2018, entire). This document may be updated as needed based on new information. We discuss the Taylor's checkerspot butterfly's biology and threat status in this recovery plan; however, the SBR contains a more detailed assessment, including the geographic and environmental context of its range in British Columbia, Canada, and in Washington and Oregon, United States (USFWS 2022a).
2. The **Recovery Plan** contains a concise overview of the recovery strategy for the species (indicating how its recovered state will achieve redundancy, resiliency, and representation), as well as the statutorily required elements of recovery criteria, recovery actions, and estimates of the time and costs to achieve the plan's goals.
3. The **Recovery Implementation Strategy (RIS)** outlines how the recovery plan will be implemented. The RIS is a short-term, flexible operational document focused on how, when, and by whom the recovery actions from the recovery plan will be implemented. This document may be updated as needed based on new information, allowing it to be

adapted to changing circumstances with greater flexibility and efficiency. The RIS will be developed and maintained in cooperation with our conservation partners, and will focus on the period of time and activities that work best for our partners to achieve recovery goals. For this recovery plan, we have prepared an RIS in coordination with our conservation partners by identifying the highest priority actions for recovery of this species (USFWS 2022b).

EXECUTIVE SUMMARY

Species Status

Taylor's checkerspot butterfly (*Euphydryas editha taylori*) was identified as a candidate for listing under the Endangered Species Act (Act) in 2001 (USFWS 2001) and received a Listing Priority Number (LPN) of 6. The LPN was revised to 3 in 2004 due to new information indicating that the butterfly faced imminent and significant threats, specifically inadvertent pesticide application in combination with habitat loss, degradation, and fragmentation, which has reduced the overall number of populations and resulted in the remaining populations being small and isolated (USFWS 2004). The LPN was reaffirmed in 2012 (USFWS 2012b). A proposed rule to list the Taylor's checkerspot butterfly as endangered throughout its range and designate critical habitat was published on October 11, 2012 (USFWS 2012a) and the final rules were published on October 3, 2013 (USFWS 2013a; USFWS 2013b).

Recovery Vision

Our recovery vision for Taylor's checkerspot butterfly is one where:

1. Population complexes are sufficiently robust to withstand stochastic events such as drought, fire, and flooding (resilient);
2. a sufficient number of population complexes are distributed across the species' range, reducing the extinction risk from catastrophic events (redundant); and
3. the distribution of population complexes across the range maintains and expands genetic and ecological diversity (representative).

Recovery Strategy

Habitat loss, degradation, and fragmentation are the primary factors that have led to the remaining populations of Taylor's checkerspot butterfly being mostly small and isolated (78 FR 61451). In addition, commercial, military, and recreational use of occupied sites as well as invasive plants and animals result in direct and indirect mortality and degrade habitat. In the long-term, climate change is likely to indirectly affect Taylor's checkerspot butterfly by altering the biotic and abiotic setting and subsequently leading to declines in suitable habitat and altering food plant phenology. The recovery strategy for Taylor's checkerspot butterfly calls for multiple population complexes in recovery regions where threats to the species and its habitat have been addressed. The recovery strategy seeks to improve: (1) resiliency by building and managing habitat sufficient for large, self-sustaining population complexes that are capable of withstanding stochastic events; (2) redundancy by maintaining and reintroducing multiple population complexes within and across recovery regions to withstand catastrophic events; and (3) representation by maintaining and expanding genetic and ecological diversity.

We note that new or emerging threats may arise over time. If any such threats are so significant as to result in a need to change the recovery strategy or the statutorily required elements of the recovery plan under section 4(f)(1) of the Act, we will amend or revise this plan as appropriate.

Recovery Criteria

Downlisting Criterion 1

At least nine population complexes have been reestablished or identified within the range of Taylor's checkerspot butterfly, with a minimum of four population complexes in the North Salish Sea Recovery Region, three population complexes in the South Puget Recovery Region, and two population complexes in the Willamette Valley Recovery Region.

Downlisting Criterion 2

Each population complex in Downlisting Criterion 1 will be maintained or improved to a sufficient level of resiliency for at least 5 years.

Downlisting Criterion 3

Sufficient high-quality habitat has been protected with long-term management commitments to support the population complexes necessary to achieve Downlisting Criteria 1 and 2.

Delisting Criterion 1

At least 12 population complexes have been reestablished or identified within the range of Taylor's checkerspot butterfly, with a minimum of 4 population complexes in the North Salish Sea Recovery Region, 3 population complexes in the South Puget Recovery Region, 2 population complexes in the Willamette Valley Recovery Region, and an additional 3 population complexes anywhere within the species' range.

Delisting Criterion 2

Each population complex in Delisting Criterion 1 will be maintained or improved to a sufficient level of resiliency for at least 10 years.

Delisting Criterion 3

Sufficient high-quality habitat has been protected with long-term management commitments to support the population complexes necessary to achieve Delisting Criteria 1 and 2.

Recovery Actions and their Estimated Cost (in Fiscal Year 2022 dollars): The cost table contains the estimated costs for each action, projected to the estimated date of delisting.

Recovery Actions	Priority	Estimated Cost
1. Maintain and increase suitable habitat and connectivity across the species' range to support population complexes	1	\$20,259,000
2. Reintroduce and reinforce populations within population complexes across the species' range	1	\$18,860,000
3. Pursue acquisitions, conservation easements, and management agreements	1	\$54,782,000
4. Develop and implement survey and monitoring to determine population metrics and assess threats	2	\$4,982,000
5. Conduct scientific investigations to guide conservation efforts by studying the species' ecology, factors limiting demographics such as population size and distribution, and the response to management actions (e.g. habitat enhancement and manipulation, captive propagation, translocation, and/or reintroduction)	2	\$2,000,000
6. Promote and coordinate partnerships, information sharing, and outreach across the species' range	3	\$2,350,000
Total Estimated Cost		\$103,233,000

Date of Recovery: Recovery criteria could be met by 2052, based on the conservative assumption that all recovery plan actions are fully funded and implemented as currently outlined. Recovery will therefore take a minimum of 30 years, assuming effective coordination and cooperation by all partners and stakeholders.

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I. INTRODUCTION

The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act) protects species of wildlife and plants that are listed as endangered or threatened. Recovery is defined as “the process by which listed species and their ecosystems are restored and their future is safeguarded to the point that protections under the [Act] are no longer needed”, according to the 2018 updated National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (Service or USFWS) Interim Recovery Planning Guidelines, Version 1.4 (NMFS and USFWS 2018).

Recovery plans are guidance documents developed to provide recommendations to reduce or alleviate threats to the listed species (includes distinct population segments, subspecies, species groups) and ensure self-sustaining populations in the wild. The Act (section 4(f)(1)) stipulates that recovery plans include: (1) a description of site-specific management actions necessary to conserve the species; (2) objective, measurable criteria that, when met, will allow the species to be removed from the Federal Lists of Endangered and Threatened Wildlife and Plants (Lists); and (3) estimates of the time and cost required to achieve the plan’s goals and intermediate steps.

This recovery plan for Taylor’s checkerspot butterfly (*Euphydryas editha taylori*) is based on the draft species biological report (SBR) (USFWS 2022a, entire), the proposed listing rules (USFWS 2012a; USFWS 2012b), the final listing rules (USFWS 2013a; USFWS 2013b) and the Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington (USFWS 2010, pp. II-36-II-39), which collectively describe the life history and biology of the species, the current status of the species, and the threats that affect the species. These and other Service documents on the species are available at <https://ecos.fws.gov/ecp/species/5907>.

BACKGROUND

Basic Species Information

For a more detailed literature review and full description of the biology, habitat, and distribution of Taylor’s checkerspot butterfly, please refer to the final listing rule (USFWS 2013a) and the SBR (USFWS 2022a). The following is a brief overview of the species’ conservation status and natural history.

On October 30, 2001, the Service identified Taylor’s checkerspot butterfly as a candidate species under the Act (USFWS 2001). The species received a Listing Priority Number (LPN) of 6, which reflected significant but non-imminent threats. In 2004, the LPN was changed to 3 due to new information that indicated that the Taylor’s checkerspot butterfly faced imminent and significant threats, primarily habitat loss, degradation, and fragmentation, leading to small, isolated populations (USFWS 2004). The LPN was reaffirmed in 2012 (USFWS 2012b). From 2001 to 2012, the Service developed annual action plans for the butterfly that set conservation targets and identified actions to achieve those targets over a 5-year period.

On October 11, 2012, a proposed rule to list the Taylor's checkerspot butterfly as endangered and to designate critical habitat was published in the *Federal Register* (USFWS 2012a). The final rules listing Taylor's checkerspot butterfly as endangered and designating critical habitat for the species were published in the *Federal Register* on October 3, 2013 (USFWS 2013a; USFWS 2013b). This document presents the Service's draft plan for the conservation and recovery of the Taylor's checkerspot butterfly.

Taylor's checkerspot butterfly is an early flying, non-migratory species that completes a single life cycle per year. The species inhabits prairies, meadows, coastal bluffs, and coastal beach deposits in the lowlands. At higher elevations, Taylor's checkerspot butterfly is found in montane meadows, old forest clearings, and rocky balds in forested areas.

Primarily associated with expanses of short-statured vegetation, the species' long-term viability relies on large, high-density populations in high-quality habitat. Concentrated patches of high-quality habitat provide food and microsite conditions needed to support large numbers of larvae and adults during the spring growing season. Larvae need relatively dry, warm sites dominated by short-statured forbs and grasses for feeding and sheltering. Where available, larvae use open ground to bask, thus increasing their body temperature and increasing their growth rate. Adults need sites for basking, mating, feeding, sheltering, and reproducing. Conspecific attraction likely affects dispersal of adults. At sites with low densities of adults, individuals likely disperse more quickly than they would from sites supporting a higher density of adults. Conversely at very high densities, adult females disperse more quickly because of constant male harassment. Therefore, Taylor's checkerspot butterflies display density-dependent dispersal behavior such that if the number of adults in a given area is too low or high, adults disperse from where they emerge. This dispersal, particularly in low densities, may result in a breakdown of population cohesion, which increases the difficulty for individuals to find mates.

In this document, we use population complexes and not individual populations (see below) to define what recovery will look like for this species. A population complex (analogous to a metapopulation) is an interconnected group of populations, which historically, was likely the most common population structure of the butterfly. A genetic analysis of samples from the only naturally occurring population complex within the south Puget Sound area and those from a now extirpated population about 23 km (14 mi) away, indicates that there was routine genetic exchange between these populations. This suggests that the species was likely distributed across the landscape as a metapopulation.

A resilient population complex is demographically and genetically robust, maintained without reinforcement, and broadly distributed to include large patches of high-quality habitat and microsites in an open landscape and with corridors to facilitate dispersal among high-quality habitat patches. The final listing and critical habitat rules for Taylor's checkerspot butterfly relied on the number of occupied locations (i.e., populations) to compare the species' historical and

current distribution (USFWS 2013a; USFWS 2013b). Given this species distribution and population dynamics, using the number of occupied locations or individual populations to define recovery would potentially not capture the population dynamics indicative of this species dependence on early seral habitats. Therefore, we do not use number of occupied locations or individual populations as a unit of measure for recovery criteria. We buffered observation records and occurrences using the best available dispersal data (see below) to identify the number and distribution of target population complexes.

Historical and Current Distribution

Some currently occupied sites (analogous to the previously used historical locations) likely belong to the same population complex, and it is suspected that there is genetic exchange between sites due to proximity and lack of barriers to dispersal (Holtrop 2021, *in litt.*). No matter how the species' presence on the landscape is quantified (i.e., occupied sites, populations, or population complexes), we can assume that at the time of listing, the species' range and its population size had declined substantially simply based on the loss of habitat and the extirpation of occupied locations.

The species' precise historical range and abundance are not known. However, both were likely much greater at the time of European contact than today because the species' habitats were more common, larger, and interconnected (USFWS 2013a). Habitat conditions at these sites were created and maintained by repeated glaciation and outwash events occurring over millennia. Sites associated with Taylor's checkerspot butterfly primarily occur on shallow or well-drained soils with native plant communities formed by anthropogenic burning, flooding, freezing, and burrowing mammals. Today, fire suppression, forest succession, land conversion for agriculture and development, and non-native plants have destroyed or altered the structure, composition, and function of remaining habitat. For the habitat that remains, periodic management is necessary to maintain the open habitat or early seral conditions on which Taylor's checkerspot butterfly depends. Thus, active management is crucial to the species' conservation.

Currently, Taylor's checkerspot butterfly is distributed from southern Vancouver Island and adjacent islands in British Columbia, south along the Straits of Juan de Fuca into the Puget Trough in Washington, and the Willamette Valley in Oregon. Nearly all of the remaining sites are small, isolated or substantially degraded and most harbor few of the larval food and nectar plants needed to support viable Taylor's checkerspot butterfly populations (Stinson 2005, p. 98). In British Columbia, Taylor's checkerspot butterfly uses recent clearcuts and coastal meadow habitats. In Washington, populations inhabit large areas of native prairies in the lowlands surrounding the southern tip of the South Puget, a single population near Sequim exists on coastal beach deposit habitat, and six occupied sites occur in the northeastern Olympic Peninsula on balds, old forest clearings, and along forest road edges between 244-1,219 meters (m; 800-4,000 feet) elevation. In Oregon, Taylor's checkerspot butterflies occupy two meadow patches in the Willamette Valley: a powerline corridor and upland prairie (Kaye et al. 2011, p. 19).

Threats

Taylor's checkerspot butterfly is primarily threatened by habitat loss, degradation, and fragmentation, which has resulted in the remaining populations being mostly small and isolated (USFWS 2013a). Habitat loss and fragmentation occurred through habitat conversion, particularly agricultural and urban development, succession of prairie habitat, and the spread of invasive plant species. In addition, commercial, military, and recreational use of occupied sites as well as invasive plants and animals result in direct and indirect mortality and degrade habitat. Climate change is likely to indirectly affect Taylor's checkerspot butterfly by altering biotic and abiotic factors resulting in declines in suitable habitat and altering the food plant phenology.

II. RECOVERY

RECOVERY VISION AND STRATEGY

A recovery vision is an explicit expression of recovery in terms of resiliency, redundancy and representation. It builds on the description of viability for the species and defines what recovery looks like for the species. The recovery strategy provides a recommended approach for achieving the recovery vision, and ultimately, the down- and/or delisting criteria.

Recovery Vision

Our recovery vision for Taylor's checkerspot butterfly is one where:

1. Population complexes are sufficiently robust to withstand stochastic events such as drought, fire, and flooding (resilient);
2. a sufficient number of population complexes are distributed across the species' range, reducing the extinction risk from catastrophic events (redundant); and
3. the distribution of population complexes across the range maintains and expands genetic and ecological diversity (representative).

Recovery Strategy

Under current conditions, Taylor's checkerspot butterfly populations are particularly vulnerable to extirpation because the high-quality habitat needed for population growth and cohesion is rare and insufficient to support viable populations. Therefore, habitat loss is the greatest threat to Taylor's checkerspot butterfly and our downlisting and delisting targets require that sufficient, high-quality habitat is protected and managed appropriately. High-quality habitat provides the necessary food plant resources and open ground for basking as well as the microsites needed for successful development of eggs to adults. In the absence of management (e.g. prescribed fire, herbicide application, mowing, and seeding), non-native plants and forest succession eliminate food resources and the open ground needed for basking while simultaneously altering the structure and integrity of microsites needed for the successful development of eggs to adults

(USFWS 2022a). This makes Taylor’s checkerspot butterfly a conservation-reliant species and long-term management (e.g. prescribed fire, herbicide application, mowing, woody vegetation removal, and seeding) is needed to prevent non-native plant invasions and forest succession and maintain high-quality habitat. However, restoration and management activities can harm or kill individual Taylor’s checkerspot butterflies, so the scale and timing of these activities must be carefully considered.

The recovery strategy for Taylor’s checkerspot butterfly calls for multiple population complexes where threats to the species and its habitats have been addressed in each of the three recovery regions. A population complex is a spatially clustered, genetically linked group of populations.

The recovery strategy relies on the following to reduce the risk of extinction and ensure species’ viability:

1. Improve resiliency to withstand the risk from stochastic events (i.e., demographic, environmental, and genetic) by protecting and managing habitat sufficient to support self-sustaining population complexes. Dispersal among constituent populations should be facilitated by management that ensures high-quality habitat.
2. Improve redundancy by increasing the number of resilient population complexes within and across the three recovery regions. A sufficient number of population complexes are needed to reduce the extinction risk in case of catastrophic events (e.g., drought, wildfire, and/or flooding).
3. Maintain or improve representation to support fitness and evolutionary potential for the species by conserving genetic and ecological diversity. Representation will be maintained or improved by establishing, enhancing, or maintaining connectivity within a population complex and among complexes within a recovery region. Population complexes across the species’ range will include the range of genetic and ecological diversity.

To set targets for the number of population complexes necessary to recover Taylor’s checkerspot butterfly, we drew on available geographic, genetic, and ecological information. To ensure redundancy and representation across the species’ range, we delineated three recovery regions that encompass the genetic and ecological diversity of the species as well as currently unoccupied habitats that we consider less susceptible to perturbations associated with climate change but would provide the opportunity for future reintroductions (Figure 1). Recovery regions were largely drawn using the Environmental Protection Agency Level IV Ecoregions to define boundaries (EPA 2013). Where genetic information was available, it was incorporated into the recovery region. These recovery regions are not designated recovery units and should not be treated as such.



U.S. Fish & Wildlife Service

Recovery regions and critical habitat for Taylor's checkerspot butterfly (*Euphydryas editha taylori*)



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Figure 1. Recovery regions and critical habitat for Taylor's Checkerspot butterfly (*Euphydryas editha taylori*).

Currently, Taylor's checkerspot butterflies occupy a matrix of forested, agricultural, urbanized, and coastal habitats such as, but not limited to, prairies, meadows, coastal bluffs, coastal beach deposits, montane meadows, old forest clearings, and rocky balds in forested areas. These habitats are unevenly distributed throughout the species' historical range with extensive suitable or restorable habitat but unoccupied in the south Puget Sound and with smaller areas of occupied, suitable habitat in the Willamette Valley, North Olympic peninsula, and British Columbia. From 13 populations across the species' range in Washington and Oregon, 5 genetic groupings were identified for Taylor's checkerspot butterfly (Severns et al. 2013, entire). These populations also grouped ecologically into those occupying coastal beach deposits, low elevation balds, mid elevation balds, south Puget Sound prairies and balds, and Willamette Valley prairie (Severns et al. 2013, p. 19). The genetic analysis did not include specimens from British Columbia. However, based on the distance between British Columbia and the nearest known population in the United States, we assume that populations in Canada are genetically distinct from those in Washington.

Within each recovery region, we identified a minimum number of population complexes needed to downlist and delist (see below) the butterfly. The distribution of occupied and suitable habitat along with the species genetic and ecological diversity support the number of resilient population complexes required in each recovery region. The number and distribution of population complexes within and across recovery regions will encompass the range of genetic and ecological representation and support redundancy to facilitate the species' viability. For delisting, we identified the same minimum number of population complexes in each recovery region plus a total of an additional three population complexes anywhere within the species' range. The purpose of these additional population complexes is to further enhance the species' redundancy and representation and improve its viability.

The resiliency of a population complex depends on demographic and habitat factors that may include metrics such as abundance, habitat quality, habitat connectivity, and host plant diversity. However, we do not have sufficient information to determine which factors best define population complex resiliency at this time and future research is needed to determine appropriate metrics.

North Salish Sea Recovery Region

The North Salish Sea Recovery Region occurs in Canada and the United States (Figure 1). The Canadian portion is managed by the British Columbia Ministry of the Environment and Climate Change Strategy while the United States portion is managed by the Service in conjunction with our partners. This region includes an area from Denman Island in Canada south to the northern Olympic Peninsula. For downlisting, we identified a target of at least four population complexes in the North Salish Sea Recovery Region. For delisting, we identified a target of at least four population complexes in the North Salish Sea Recovery Region and an additional three

population complexes anywhere within the species' range. Maintaining and enhancing existing occupied sites such that the number and distribution increases will provide Taylor's checkerspot butterfly with adequate redundancy and representation for downlisting. Reintroducing and establishing three additional resilient population complexes in the species' range will contribute to the species' viability by adding an extra level of redundancy and representation. This aligns with British Columbia's recovery strategy for the species, which recommends the maintenance and enhancement of currently occupied areas and increasing the number of occupied sites within the species' known dispersal distance such that these areas could function as population complexes, although there are currently no specific recovery targets identified (COSEWIC 2016, pp. 3-9).

Taylor's checkerspot butterfly was previously distributed across a greater area of the northern portion of the Olympic Peninsula but it has recently been extirpated from multiple locations (Linders 2021, *in litt.*). Despite these losses, population complexes in the U.S. portion of the North Salish Sea Recovery Region have the highest genetic and ecological diversity of any recovery region (Severns et al. 2013, entire). There are currently three occupied areas that support genetically and ecologically distinct groups, and they have the potential to become three population complexes. By improving their resiliency through maintenance and enhancement of their habitat, they may develop into resilient population complexes that will meet the proposed downlisting criteria. Unfortunately, because current and potential Taylor's checkerspot habitat is extremely limited in the Olympic Peninsula, reintroducing or establishing additional population complexes is unlikely.

South Puget Recovery Region

The South Puget Recovery Region is located entirely within Washington State south of Puget Sound and north of the Nisqually River (Figure 1). Historically, this region was considered the stronghold for the species. Compared to the other recovery regions, it has lost the greatest number of known populations (Stinson 2005, pp. 93-96; Potter 2016, p. 2). Despite these losses, this region still supports the largest naturally occurring Taylor's checkerspot butterfly population complex and includes the largest area of suitable and potentially suitable habitat of any of the recovery regions. Thus, the South Puget Recovery Region provides the greatest opportunity for reintroducing population complexes (i.e., metapopulations). For downlisting, we identified a target of at least three resilient population complexes in the South Puget Recovery Region. For delisting, we identified a target of at least three resilient population complexes in the South Puget Recovery Region and an additional three population complexes anywhere within the species' range.

Maintaining and enhancing existing occupied sites to facilitate development into population complexes will improve resiliency and provide Taylor's checkerspot butterfly with adequate redundancy and representation for downlisting. Three population complexes in the South Puget Recovery Region will preserve the range of genetic and ecological representation and further

enhance the species' redundancy and representation to minimize extinction risk associated with catastrophic events. For delisting, we identified a target of at least three population complexes and a total of an additional three population complexes anywhere within the species' range.

Willamette Valley Recovery Region

The Willamette Valley Recovery Region is located entirely in Oregon (Figure 1) from about Rainier south to Cottage Grove and the habitat consists of native prairie, which was historically common throughout the valley. This recovery region is comprised of two occupied sites and consist of a single genetic grouping (Severns et al. 2013, entire). For downlisting, we identified a target of at least two population complexes in the Willamette Valley Recovery Region. For delisting, we identified a target of at least two population complexes and a total of an additional three population complexes anywhere within the species' range. Maintaining and enhancing existing occupied sites to facilitate their development into population complexes will improve population resiliency and provide Taylor's checkerspot butterfly with adequate redundancy and representation for downlisting. Reintroducing and establishing three additional resilient population complexes in the species' range will enhance the species' redundancy and representation and improve its viability.

RECOVERY CRITERIA

Section 4(f)(1)(B)(ii) of the Act states that each recovery plan shall incorporate, to the maximum extent practicable, "objective, measurable criteria which, when met, would result in a determination... that the species be removed from the List." Legal challenges to recovery plans (see *Fund for Animals v. Babbitt*, 903 F. Supp. 996 (D.D.C. 1995)) and a Government Accountability Audit (GAO 2006) also have affirmed the need to frame recovery criteria in terms of threats assessed under the five listing factors.

Recovery criteria serve as objective, measurable guidelines to assist in determining when an endangered species has recovered to the point that it may be downlisted to threatened, or that the protections afforded by the Act are no longer necessary and the species may be delisted. Delisting is the removal of a species from the Lists. Downlisting is the reclassification of a species from endangered to threatened. The term "endangered species" means any species that is in danger of extinction throughout all or a significant portion of its range. The term "threatened species" means any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Recovery criteria represent our best assessment, at the time the recovery plan is completed, of the conditions that would likely result in a determination that listing under the Act as threatened or endangered is no longer required. However, revisions to the Lists, including delisting or downlisting a species, must reflect determinations made in accordance with sections 4(a)(1) and 4(b) of the Act. Section 4(a)(1) requires that the Secretary determine whether a species is an

endangered species or threatened species because of threats to the species, based on an analysis of the five listing factors in section 4(a)(1). Section 4(b) requires that the determination be made “solely on the basis of the best scientific and commercial data available.” Thus, while recovery plans provide important guidance to the Service, States, and other partners on methods of minimizing threats to federally listed species and measurable criteria against which to measure progress towards recovery, they are guidance and not regulatory documents.

Thus, a decision to delist or downlist a species is informed by the recovery criteria but is ultimately based on an analysis of threats using the best scientific and commercial data then available. When changing the status of a species, we first propose the action in the *Federal Register* to seek public comment and peer review, after which we announce a final decision in the *Federal Register*.

The species addressed in this recovery plan should be considered for downlisting and/or delisting when the following objective[s] and criteria have been met. Downlisting and delisting criteria are subject to change as additional information becomes available about species biology and threats.

Recovery Objectives for Taylor’s Checkerspot Butterfly:

Protect and manage habitat and ameliorate threats to enhance and reintroduce resilient population complexes that conserve maximal genetic and ecological diversity across the species’ range to ensure the species’ long-term viability.

Downlisting Criteria

We expect Taylor’s checkerspot butterfly to be eligible for downlisting consideration when the following criteria are met:

Downlisting Criterion 1

At least nine population complexes have been reestablished or identified within the range of Taylor’s checkerspot butterfly, with a minimum of four population complexes in the North Salish Sea Recovery Region, three population complexes in the South Puget Recovery Region, and two population complexes in the Willamette Valley Recovery Region.

Downlisting Criterion 2

Each population complex in Downlisting Criterion 1 will be managed to a sufficient level of resiliency for at least 5 years.

Downlisting Criterion 3

Sufficient high-quality habitat is protected with long-term management commitments to support the population complexes necessary to achieve Downlisting Criteria 1 and 2.

Rationale

To downlist Taylor’s checkerspot butterfly, the species needs to have at least nine resilient population complexes distributed across the species’ three recovery regions. Our recovery strategy is focused on improving the functionality and connectivity of known populations to create population complexes. The size and distribution of habitat patches needed to support a resilient population complex may vary (see USFWS 2022a for additional information). Population complexes across the species’ range will contribute to the species’ viability because the physical and biological attributes of each are dissimilar and the likelihood of all being equally affected by a stochastic event is low.

The species needs to have at least nine resilient population complexes distributed throughout its range to increase the species chance of surviving catastrophic events; increasing the number of population complexes, all else being equal, improves redundancy. To capture the range of genetic and ecological diversity across the nine population complexes, at least four will be located in the North Salish Sea Recovery Region, three in the South Puget Recovery Region, and two in the Willamette Valley Recovery Region. The ecological diversity of the North Salish Sea Recovery Region includes meadows, shallow wetlands, balds and coastal beach deposits. These habitats support at least three distinct genetic groups (Severns et al. 2013, p. 2); additional genetic groups may occur in British Columbia. The ecological diversity of South Puget Recovery Region includes balds and wet and dry prairie; there is a single genetic group across these habitats. The ecological and genetic diversity of Willamette Valley Recovery Region includes Willamette Valley prairies and a single genetic group.

Individual Taylor’s checkerspot butterflies generally live 1 year from an egg through the end of an adult’s life, and therefore, have a generation time of 1 year. As in other *Euphydryas*, a few individuals may live for 2 or more years by reentering diapause (Linders 2011, p. 9; Singer and Ehrlich 1979, p. 54). With this in mind, we identified 5 years (or five generations) as a sufficient amount of time to determine whether a population complex is resilient and self-sustaining; this timeframe is similar to recovery plans for a suite of other butterfly species (e.g., USFWS 2010 [5 years]; USFWS 2019b [4 years]; USFWS 2019c [4 years]; USFWS 2019d [minimum of 8 years]; and USFWS 2015 [at least 10 years]). The WDFW defines a translocated population as “established” when it is self-sustaining (i.e., received no reinforcement or augmentation) for 5 consecutive years, while also meeting certain abundance, density, and distribution criteria (Linders et al. 2020, p. 28).

A population complex is comprised of an interconnected group of populations. To delineate population complexes, we grouped Taylor’s checkerspot butterfly observation records and

occurrences within and up to 2 km (1.2 mi) based on the average movement radii. The dispersal distance for Taylor's checkerspot is unknown. The average dispersal distance for the closely related Edith's checkerspot (*Euphydryas editha*) is variable and depends on many factors (Gilbert and Singer 1973, p. 70). In a mark-recapture study, movements of individual Edith's checkerspot butterflies varied from 0.02 km (0.01 mi) to 0.19 km (0.12 mi) based on the site and year (White and Levin 1981, p. 355). Another checkerspot species, the bay checkerspot (*Euphydryas editha bayensis*), randomly moved up to 3 and 5.6 km (1.9 and 3.5 mi, respectively) in release experiments, but distances were mostly 0.05 km (0.03 mi) or less (Harrison 1989, p. 1241). On one occasion, an individual Taylor's checkerspot butterfly was documented at least 11 km (6.8 mi) from the nearest known population; however, it is not known whether this was a dispersal event or an individual from an unknown population (Grosboll 2021, *in litt.*). Based on this information, we determined that a distance up to 2 km (1.2 mi) would best represent both short-distance movements within a population complex as well as rare, long-distance movements between population complexes. While we chose a distance of at least 2 km (1.2 mi) to delineate population complexes; this distance may change over time as new information becomes available or vary as the Service relies on site-specific information.

Conserving and managing sufficient habitat will be essential to encourage the growth of resilient population complexes by counteracting habitat loss, degradation, and fragmentation. Therefore, long-term management plans and adequate protections are crucial to ensuring the resilience of these population complexes in the long-term.

Delisting Criteria

We expect Taylor's checkerspot butterfly to be recovered and eligible for delisting consideration when the following criteria are met:

Delisting Criterion 1

At least 12 population complexes have been reestablished or identified within the range of Taylor's checkerspot butterfly, with a minimum of 4 population complexes in the North Salish Sea Recovery Region, 3 population complexes in the South Puget Recovery Region, 2 population complexes in the Willamette Valley Recovery Region, and an additional 3 population complexes anywhere within the species' range.

Delisting Criterion 2

Each population complex in Delisting Criterion 1 will be managed to a sufficient level of resiliency for at least 10 years.

Delisting Criterion 3

Sufficient high-quality habitat is protected with long-term management commitments to support the population complexes necessary to achieve Delisting Criteria 1 and 2.

Rationale

To delist Taylor's checkerspot butterfly, the species needs to have at least 12 resilient population complexes distributed throughout its range for sufficient resiliency, redundancy, and representation to ensure the species long-term viability. To capture the range of genetic and ecological diversity across the 12 population complexes, at least 4 will be located in the North Salish Sea Recovery Region, 3 will be located in the South Puget Recovery Region, 2 in the Willamette Valley Recovery Region and 3 additional population complexes will be located within the species' range. The number and distribution of population complexes across the range of Taylor's checkerspot butterfly is intended to maintain and improve the extent of genetic and ecological diversity for short- and long-term representation. Twelve population complexes distributed across the species' range is meant to ensure sufficient redundancy to reduce extinction risk due to catastrophic events. All else being equal, increasing the number of population complexes improves redundancy. The additional three population complexes will be located within recovery regions and specifically determined as more information becomes available on, but not limited to, genetic and ecological diversity, suitable habitat, and climate change.

III. RECOVERY ACTIONS

RECOVERY ACTIONS

This recovery plan identifies recovery actions needed to implement the recovery strategy and attain the recovery criteria. Implementation of a recovery action will depend on its priority, availability of funds and resources, coordination with partners, and complexity and logistical constraints. A broad action may have multiple components developed as needed to best coordinate recovery implementation. Specific project-level implementation of these actions will be accomplished through shorter-term activities (collectively referred to as the Recovery Implementation Strategy [RIS]) in coordination with all partners interested and willing to work on implementing the activities. Activities are intended to be adaptable and guide all partners to coordinate recovery implementation and further identify those responsible for each action described in the recovery plan. Because these activities will be described in the RIS, they can be modified as needed without requiring future revision of this recovery plan, so long as they remain consistent with the recovery actions described here.

As discussed in the Introduction, this recovery plan is a guidance document rather than being regulatory in nature. As such, implementation of recovery actions is voluntary and depends on the cooperation and commitment of partners in this conservation effort. However, all Federal

agencies have an obligation under section 7(a)(1) of the Act to carry out programs for conservation of federally-listed species.

The actions needed to alleviate threats to the species and achieve recovery criteria are organized below into four categories:

Priority 1

1. Maintain and increase suitable habitat and connectivity across the species' range to support population complexes.

Habitat loss is one of the primary threats to Taylor's checkerspot butterfly. To support resiliency of population complexes, suitable habitat needs to be maintained in recovery regions across the species' range. Additionally, increasing the total area of suitable habitat in recovery regions as well as improving connectivity among populations as well as between population complexes is key to improving redundancy and representation of resilient population complexes.

Suitable habitat for Taylor's checkerspot butterfly includes short-statured, open or early seral conditions and plentiful larval and adult food resources. To preserve or create suitable habitat, ongoing habitat restoration, maintenance, and manipulation of vegetation structure is necessary. Having suitable habitat substantially increases the likelihood that Taylor's checkerspot butterfly will occupy and persist at any given site.

Habitat fragmentation is another primary threat to Taylor's checkerspot butterfly, and immigration and emigration are vital to the species' capacity to persist on the landscape. Improving connectivity within and between population complexes will facilitate dispersal among patches and allow for the recolonization of connected but extirpated habitat patches.

2. Reintroduce and reinforce populations within population complexes across the species' range.

Captive propagation, reintroduction, and translocation of Taylor's checkerspot butterfly is required to improve resiliency of population complexes by producing adequate numbers of individuals for reintroducing new population complexes as well as reinforcing existing population complexes. Increasing the number and distribution of population complexes is key to improving the species' redundancy and representation. Therefore, captive propagation, reintroduction, and translocation programs are essential to the recovery of the species.

3. Pursue acquisitions, conservation easements, and management agreements.
Acquiring land, development rights, and conservation easements on areas with existing and potentially suitable habitat, and developing and implementing management plans, will mitigate habitat loss and fragmentation, which are the primary threats to Taylor's checkerspot butterfly. When permanent protection of occupied sites is not possible, long-term management agreements with willing landowners engaged in compatible uses should be pursued.

Priority 2

4. Develop and implement survey and monitoring to determine population metrics and assess threats.
Documenting and understanding population metrics such as occupancy, distribution, abundance, and trends over time is necessary to estimate progress toward recovery. Developing standardized survey and monitoring protocols will improve consistency of range-wide data, providing more accurate insight into the status of the species.
5. Conduct scientific investigations to guide conservation efforts by studying the species' ecology, factors limiting populations, and the response to management actions (e.g., habitat enhancement and manipulation, captive propagation, translocation, and/or reintroduction).

Priority 3

6. Promote and coordinate partnerships, information sharing, and outreach across the species' range.
Partnerships are crucial to any conservation effort and can increase efficiencies, information sharing, and improve decision-making for Taylor's checkerspot butterfly conservation. Public awareness and support of and engagement with species' conservation increases the likelihood of identifying partnership opportunities and can directly reduce threats by ensuring landowners understand available conservation tools.

Table 1. Crosswalk relating threats, recovery criteria, and recovery actions for the Taylor's checkerspot butterfly (*Euphydryas editha taylori*).

Listing Factor	Threat	Downlisting and Delisting Criteria	Recovery Actions
A Present or Threatened Destruction, Modification or Curtailment of its Habitat or Range	Habitat loss through development, conversion to incompatible uses, land-use change, and fragmentation	2, 3	1, 2, 3, 6
	Successional changes through long-term fire suppression	2, 3	1, 3, 4, 5, 6
	Invasive plant species	2, 3	1, 3, 4, 5, 6
	Military training and recreation	3	1, 2, 3, 4, 5, 6,
C Disease or Predation	Predation by parasitoid wasps and spiders	1, 2, 3	1, 2, 4, 5
D Inadequacy of Existing Regulatory Mechanisms	Continued risk of habitat loss and degradation under Federal, State, and local laws	3	1, 3, 4, 6
E Other Natural or Manmade Factors	Vulnerabilities associated with isolated populations, loss of connectivity and gene flow	1, 2, 3	1, 2, 3, 4, 5, 6
	Extreme weather events	1, 2	1, 2
	Climate change	1, 2, 3	1, 2, 3, 4, 5, 6

IV. TIME AND COST ESTIMATES

Achieving the recovery criteria for Taylor's checkerspot butterfly is expected to require a minimum of 30 years from the publication of the final recovery plan.

Presented below is a table of site-specific recovery actions and their estimated cost of implementation, projected to the estimated date of delisting. Estimated costs include only project specific contract, staff, or operations costs in excess of base budgets. They do not include budgeted amounts that support ongoing agency staff responsibilities. This recovery plan does not commit the Service or any partners to carry out a particular recovery action or expend the estimated funds.

Estimated costs described in Table 2 incorporate planning, design, implementation, and research, monitoring, and evaluation associated with specific actions. Adaptive management actions evaluate the implementation of those actions to ensure that management/conservation tools are appropriately and effectively addressing impacts to the species and meeting the objective of this recovery plan. If the tools are not effective, changes in management should be made and additional planning and scientific research may be necessary.

Table 2. Priority and estimated cost of recovery actions.

Recovery Actions	Priority	Estimated Cost
1. Maintain and increase suitable habitat and connectivity across the species' range to support population complexes	1	\$20,259,000
2. Reintroduce and reinforce populations within population complexes across the species' range	1	\$18,860,000
3. Pursue acquisitions, conservation easements, and management agreements	1	\$54,782,000
4. Develop and implement survey and monitoring to determine population metrics and assess threats	2	\$4,982,000
5. Conduct scientific investigations to guide conservation efforts by studying the species' ecology, factors limiting demographics such as population size and distribution, and the response to management actions (e.g. habitat enhancement and manipulation, captive propagation, translocation, and/or reintroduction)	2	\$2,000,000
6. Promote and coordinate partnerships, information sharing, and outreach across the species' range	3	\$2,350,000
Total Estimated Cost		\$103,233,000

Priority 1 actions are those actions that must be implemented to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2 actions are those that must be taken to prevent a significant decline in population size or habitat quality or to mitigate a significant threat.

Priority 3 actions are all other actions necessary to provide for the species' full recovery.

The assignment of priorities does not imply that some recovery actions are of low importance, but instead suggests that lower-priority items may be deferred while higher-priority actions are implemented.

Date of Recovery: If all actions are fully funded and implemented as outlined, including full cooperation of all partners needed to achieve recovery, then we estimate the earliest that the delisting criteria could be met would be 2052. We believe it is possible to permanently protect and restore adequate habitat for the development of the required number of population complexes across the range of the species within 20 years. Once established, the population complexes must be monitored to determine whether they are meeting minimum thresholds for 10 years. Therefore, the minimum time necessary to recover Taylor's checkerspot butterfly is a minimum of 30 years.

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VI. APPENDIX A

GLOSSARY

Anthropogenic: Caused or influenced by humans; herein, environmental change caused or influenced directly or indirectly people.

Bald: Sloping dry sites dominated by herbaceous vegetation, dwarf-shrubs and/or mosses and lichens that are typically surrounded by forest at elevations below the subalpine forest zones (Chappell 2006, p. 5).

Conservation-reliant species: Species that require continuous maintenance and management into the foreseeable future (Scott et al. 2010, pp. 91-92).

Conspecific attraction: The tendency for animals of the same species to settle near one another.

Diapause: A period of arrested development and reduced metabolic rate, during which growth, differentiation, and metamorphosis cease; a period of dormancy not immediately referable to adverse environmental conditions.

Early seral: The first ecological community after a disturbance at a site.

Evolutionary potential: The ability of a population to evolve in response to environmental change.

Fitness: Relative to other individuals, the extent to which an individual is adapted to its environment and its ability to leave offspring.

Fragmentation: The breakup of a large, continuous area of habitat resulting in smaller, isolated areas of habitat that likely cannot support self-sufficient wildlife populations independently.

Habitat: An area that contains both the resources (e.g., food and cover) and environmental conditions (e.g., temperature precipitation, predators, etc.) suitable for an organism to survive and reproduce.

Habitat quality: The range of environmental conditions that provide habitat that provides for individual and population persistence, although survival and reproduction rates may vary from low to high and/or an area may provide habitat for varying lengths of time.

High-quality habitat: Habitat that provides the resources and conditions needed for individuals and populations to realize strong, positive measures of key demographic parameters including population size, density, fecundity, and survival.

Larvae: Butterflies between the egg and chrysalis stage (i.e., caterpillar).

Listing Priority Number (LPN): A number designating the priority of a candidate species that should be federally listed under the Endangered Species Act as threatened or endangered but cannot be listed immediately.

Metapopulation: A group of spatially separated populations of the same species but which are connected via occasional dispersal (Levins 1960, entire).

Microsite: An area within an environment whose combination of features creates a unique set of features and/or conditions distinctive from its surroundings.

Occupancy: The presence of an individual or individuals at a particular site.

Phenology: Periodic events in biological life cycles.

Population: A group of conspecific individuals that is demographically, genetically, or spatially disjunct from other groups of individuals (Wells and Richmond 1995, p. 461).

Population cohesion: The ability of individuals to act as and form a unit.

Population complex (analogous to a metapopulation): An interconnected group of multiple populations. A resilient population complex would be demographically and genetically robust, maintained without reinforcement, and broadly distributed to include large patches of high-quality habitat within a permeable landscape matrix.

Recovery unit: A special unit of the listed entity that is geographically or otherwise identifiable and is essential to the recovery of the entire listed entity (NMFS and USFWS 2018, p. 85).

Redundancy: The ability of a species to withstand catastrophic events by spreading risk among multiple populations or across a large area (Smith et al. 2018, p. 304).

Representation: The ability of a species to adapt to changing environmental conditions over time as characterized by the breadth of genetic and environmental diversity within and among populations (Smith et al. 2018, p. 304).

Resiliency: The ability of a species to withstand stochastic disturbance; resiliency is positively related to population size and growth rate and may be influenced by connectivity among populations (Smith et al. 2018, p. 304).

Self-Sustaining Population: A population that remains stable or increases over time without human intervention.

Site: An area with suitable habitat or where suitable habitat might develop or be restored.

Stochastic: Unpredictable or random event.

Succession: Change in the composition of an ecological community over time.

Suitable habitat: Potential or occupied habitat that contains the specific biotic and abiotic conditions for a particular species. For Taylor's Checkerspot butterfly suitable habitat consistently contains open grasslands habitat dominated by short-statured grasses composed of abundant forbs to serve as larval host plants and nectar sources with an open structure that includes bare ground.

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