U.S Fish and Wildlife Service

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

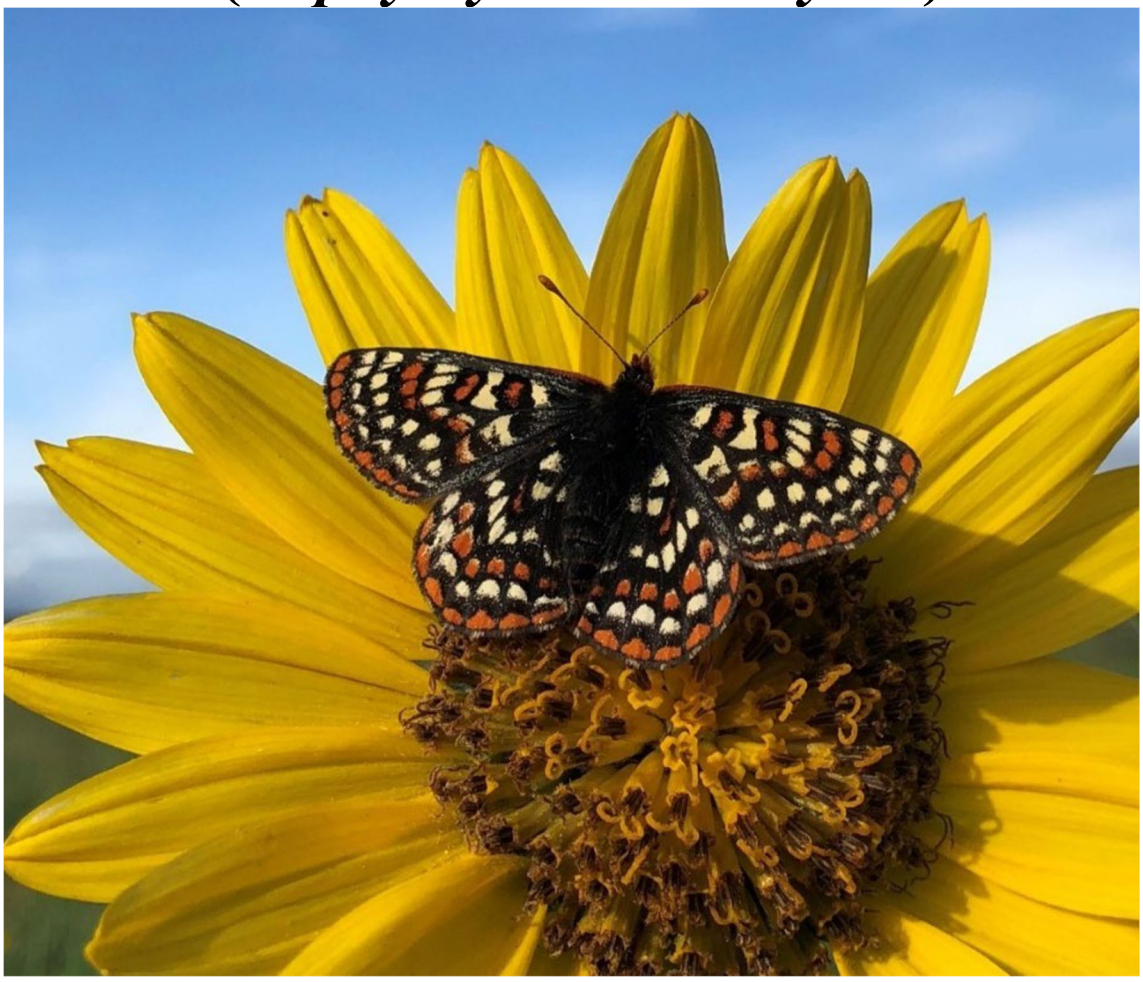

Photo: Dan Grosboll/USFWS/2013

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

U.S. Fish and Wildlife Service
Portland, Oregon

Approved:

Acting
Nanette Seto

Digitally signed by NANETTE SETO
Date: 2024.08.28 10:11:50 -07'00'

Regional Director
Pacific Region 1

## PURPOSE AND 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.

## RECOMMENDED CITATION AND ELECTRONIC AVAILABILITY

U.S. Fish and Wildlife Service. 2024. Recovery Plan for Taylor's Checkerspot Butterfly (*Euphydryas editha taylori*). U.S. Fish and Wildlife Service, Region 1, Portland, Oregon. ix + 36 pages.

An electronic copy of this recovery plan is available at:
https://www.fws.gov/pacific/ecoservices/endangered/recovery/plans.html

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

We thank our partners who play an active role in the conservation and recovery of Taylor's checkerspot butterfly, particularly those at the British Columbia Ministry of the Environment and Climate Change Strategy, Joint Base Lewis-McChord (JBLM) of the United States Department of Defense, the U.S. Forest Service, Bonneville Power Administration, Washington Department of Fish and Wildlife (WDFW), Washington Department of Natural Resources (WDNR), Washington Department of Corrections, Oregon Department of Corrections, The Evergreen State College, Sustainability in Prisons Project, Benton County, Thurston County, The Nature Conservancy, Wolf Haven, the Oregon Zoo, Woodland Park Zoo, the Center for Natural Lands Management, Xerces Society, Ecostudies Institute, the Institute for Applied Ecology, and private landowners. Numerous partners have provided information through surveys and research, which has informed management and conservation efforts. In particular, we would like to thank our partners at WDFW for their decades of dedicated conservation work on Taylor's checkerspot butterfly, specifically Mary Linders (retired), Derek Stinson (retired), Ann Potter (retired), Gail Olson (retired), Dave Hays (retired), Hannah Anderson, and Wendy Connally, but also many others, too numerous to list here. At JBLM, we highlight the work of Dave Clouse, Emily Richardson (now with WDNR), Rod Gilbert, Todd Zuchowski, John Richardson, and Dan Grosboll (now with the Service). Additionally, former Service staff conducted important early conservation work for Taylor's checkerspot butterfly. We sincerely thank Theodore Thomas (retired WFWO) for his long-term dedication to the species and Judy Lantor (retired WFWO) for her work with partners on habitat development, maintenance, and restoration.

## RECOVERY PLANNING PROCESS

The Service is now using a three-part framework for recovery planning (see https://www.fws.gov/endangered/esa-library/pdf/RPI.pdf). 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 2024a).

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 was prepared in coordination with our conservation partners and may be updated as needed based on new information, allowing it to be adapted to changing circumstances with greater flexibility and efficiency (USFWS 2024b).

# EXECUTIVE SUMMARY

## Species Status

Taylor's checkerspot butterfly (*Euphydryas editha taylori*) was identified as a candidate for listing under the 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, like the combination of habitat loss, degradation, and fragmentation, which reduced the overall number of populations and resulted in the remaining populations being small and isolated. Inadvertent pesticide application was also considered a potential threat (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). The final listing and critical habitat rules were published on October 3, 2013 (USFWS 2013a; USFWS 2013b).

## Recovery Vision

Our recovery vision for Taylor's checkerspot butterfly is one where multiple population complexes with genetic and ecological diversity are distributed across the species range in protected suitable habitat that can support all life stages and facilitate connectivity, and threats are reduced or eliminated. Good resiliency, representation and redundancy will ensure that the species is viable into the future.

## 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 vegetation succession 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 includes having multiple population complexes in each of the three recovery regions where threats to the species and its habitat have been addressed and there is commitment from partners for long-term habitat management. The recovery strategy seeks to improve: (1) resiliency by restoring and managing habitat sufficient to support large, self-sustaining population complexes that are capable of withstanding stochastic events; (2) redundancy by increasing the number of population complexes within and across recovery regions to withstand catastrophic events that may impact one or more population complexes; and (3) representation by maintaining and conserving genetic and ecological diversity to ensure the evolutionary potential of the species.

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 demonstrate a moderate to high 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 twelve 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, two population complexes in the Willamette Valley Recovery Region, and an additional three population complexes anywhere within the species' range.

Delisting Criterion 2

> Each population complex in Delisting Criterion 1 will demonstrate a moderate to high 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.

**Date of Recovery:** Recovery criteria could be met by 2054, based on the conservative assumption that all recovery actions are fully funded and implemented as currently outlined, assuming effective coordination and cooperation by all partners and stakeholders.

**Recovery Actions and their Estimated Cost (in Fiscal Year 2024 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 resilient 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 across the species' range | 1 | $54,782,000 |
| 4. Develop and implement survey and monitoring to measure appropriate population metrics and assess threats across the species' range | 2 | $5,232,000 |
| 5. Conduct scientific investigations to guide conservation efforts by studying the species' ecology, demography, distribution, factors limiting populations, and the response to management actions (e.g., habitat enhancement and manipulation, captive propagation, translocation, and/or reintroduction) across the species' range | 2 | $2,000,000 |
| 6. Promote and coordinate partnerships, information sharing, and outreach across the species' range | 3 | $2,350,000 |
| | | TOTAL: $103,483,000 |

The estimated cost to implement all actions considered necessary to achieve recovery for Taylor's checkerspot butterfly is $103,483,000 over 30 years with the majority of costs being incurred in the first 20 years. This recovery plan does not commit the Service or any partners to carry out a particular recovery action or expend the estimated funds, nor does it ensure allocation of funds to implement these actions.

# Contents

PURPOSE AND DISCLAIMER ..... i
ACKNOWLEDGMENTS ..... ii
RECOVERY PLANNING PROCESS ..... iii
EXECUTIVE SUMMARY ..... iv
LIST OF FIGURES ..... viii
LIST OF TABLES ..... viii
I. INTRODUCTION ..... 1
BACKGROUND ..... 1
Basic Species Information ..... 1
Historical and Current Distribution and Abundance ..... 3
Threats ..... 4
II. RECOVERY ..... 6
RECOVERY VISION AND STRATEGY ..... 6
Recovery Vision ..... 6
Recovery Regions ..... 6
Recovery Strategy ..... 8
RECOVERY CRITERIA ..... 12
Recovery Objectives for Taylor's Checkerspot Butterfly: ..... 13
Downlisting Criteria ..... 13
Rationale ..... 13
Delisting Criteria ..... 15
Rationale ..... 15
III. RECOVERY ACTIONS ..... 16
Priority 1 ..... 17
Priority 2 ..... 17
Priority 3 ..... 18
IV. TIME AND COST ESTIMATES ..... 20
V. REFERENCES ..... 23
LITERATURE CITED ..... 23
VI. APPENDICES ..... 26
APPENDIX A: GLOSSARY ..... 26
LITERATURE CITED IN THE GLOSSARY ..... 28
APPENDIX B: SUMMARY OF THE COMMENTS RECEIVED ON THE DRAFT RECOVERY PLAN FOR THE TAYLOR'S CHECKERSPOT BUTTERFLY ..... 29

## LIST OF FIGURES

Figure 1. Recovery regions and critical habitat for Taylor's checkerspot butterfly (*Euphydryas editha taylori*).....8

## LIST OF TABLES

Table 1. Crosswalk relating threats, recovery criteria, and recovery actions..... 19

Table 2. Priority and estimated cost of recovery actions..... 21

# 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 species biological report (SBR) (USFWS 2024a, 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 2024a). 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 Taylor's checkerspot butterfly faced imminent and

significant threats, primarily habitat loss, degradation, and fragmentation, leading to small, isolated populations, and the potential threat of inadvertent pesticide use (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).

Taylor's checkerspot butterfly is a medium-sized black, orange, and white subspecies of Edith's checkerspot (*Euphrydryas editha*). The species is early flying, typically from April-June, and is nonmigratory, completing its life cycle in a single year. At low elevations, the species inhabits grassland habitat found in prairies, meadows, coastal bluffs, and coastal beach deposits in low, seaside elevations. At higher elevations, Taylor's checkerspot butterfly is found in montane meadows, old forest clearings, and rocky balds in forested areas. These habitat areas are unevenly distributed throughout the species' historical range.

The species depends on ephemeral, early seral habitats, and requires protection of sufficiently large habitat patches such that periodic management treatments (i.e., fire) can be implemented to ensure that appropriate short-statured habitat is annually available. 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, increasing their body temperature and increasing their growth rate. Adults need sites for basking, mating, feeding, sheltering, and reproduction.

From the 13 extant populations across the species' range in Washington and Oregon, five 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 prairies (Severns et al. 2013, p. 19).

The genetic analysis did not include specimens from British Columbia; however, based on the distance and barriers 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.

***Historical and Current Distribution and Abundance***

The precise historical range and abundance of Taylor's checkerspot butterfly 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). It likely occupied both extensive open prairies and smaller peripheral balds and Garry oak (*Quercus garryana*) meadows throughout its historic range, prior to European colonization. The range has been restricted by habitat loss, and currently Taylor's checkerspot butterfly is found from southern Vancouver Island and adjacent islands in British Columbia, south along the Strait of Juan de Fuca into the Puget Trough in Washington, and in the Willamette Valley in Oregon within the South Puget Sound, Willamette Valley, and the North Salish Sea recovery regions (see USFWS 2024a; Figure 1). Nearly all the remaining sites suitable for the species 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 butterflies use recent clearcuts with certain soils and rock outcrops, and coastal meadow habitats. In Washington, most populations inhabit large areas of native prairies and balds in the lowlands surrounding the southern tip of the South Puget Sound. A single population near Sequim, Washington 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 800 to 4,000 feet (ft) (244 to 1,219 meters [m]) elevation. In Oregon's Willamette Valley, Taylor's checkerspot butterflies occupy upland prairie within a powerline corridor and one complex of meadow patches within oak and conifer forest (Kaye et al. 2011, p. 19).

Sites associated with Taylor's checkerspot butterfly primarily occur on shallow or well-drained soils with native plant communities formed by anthropogenic burning practices, wildfire, flooding, freezing, and burrowing animals. Soil conditions at these sites were initially created by repeated glaciation and outwash events. The species persists in areas where periodic management maintains the open habitat or early seral conditions upon which Taylor's checkerspot butterfly depends, and continued, active management is crucial to the species' conservation.

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 potentially may 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 recovery metric. Instead, we use population complexes as the population metric to define recovery where a population complex is defined as an interconnected group of populations (analogous to a metapopulation). To identify the number and distribution of population complexes needed, we grouped observation records and occurrences within 1.2 miles (mi) (2.0 kilometers [km])of one another using the best available dispersal data (see page 14 below).

Some currently occupied sites may belong to the same population complex, as genetic exchange is likely occurring between sites based on genetic similarity (Severns et al. 2013), their proximity, and lack of dispersal barriers (Holtrop, U.S. Forest Service, *in litt*. 2021). No matter how the species' presence on the landscape is quantified (i.e., occupied sites, populations, or population complexes), at the time of listing, the species' range and abundance had declined substantially from loss of habitat and the subsequent extirpation of occupied locations.

### *Threats*

Taylor's checkerspot butterfly is primarily threatened by habitat loss, degradation, and fragmentation, which has resulted in most of the remaining populations being small and isolated (USFWS 2013a). Habitat loss and fragmentation is primarily due to agricultural and urban development, although succession of early seral prairie habitat into forest has also played a role. Historically, the grasslands, prairies and meadows of the south Puget Sound region of Washington and western Oregon were actively maintained by the native peoples of the region with fire (Boyd 1986, entire; Christy and Alverson 2011, p. 93). Fire suppression initiated by Europeans resulted in encroachment of woody species into prairie habitat (Dunn and Ewing 1997, p. v; Tveten and Fonda 1999, p. 146). In addition, commercial, military, and recreational use of occupied sites as well as invasive plants and animals result in direct and indirect mortality to the species and degrade habitat. Today, fire suppression, forest succession, land conversion for agriculture and development, and invasion by non-native plants have altered the structure, composition, and function of remaining habitat. Additionally, in the absence of periodic management, the early seral habitat upon which Taylor's checkerspot butterfly depends will become unsuitable, meaning active management in perpetuity is crucial to species conservation.

Because the species exists within a matrix of rural agricultural lands and low-density development, herbicide and insecticide use may have direct effects on the species and its host plants (Service 2013a). At the time of listing, the pesticide *Bacillus thuringiensis* var. *kurstaki* (Btk) was used to treat for spongy moth infestations and was suspected to have caused the extirpation of Taylor's checkerspot butterfly at sites in the South Puget Sound region (Service

2013). Although herbicides and pesticides remain a threat to the species, there is no information to suggest that impacts are currently occurring at levels that affect occupied sites. Other threats, like predatory spiders and wasps or deer and other animals that browse vegetation, exist but effects are not known to occur at the site or population level.

Finally, climate change is likely to directly affect Taylor's checkerspot because extreme weather events (e.g., excessive, and ill-timed heat, freeze, and flooding) cause direct mortality to butterflies. Additionally, climate change will 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. The unit of analysis for determining the recovery status is at the population complex.

### *Recovery Vision*

Our recovery vision for Taylor's checkerspot butterfly is one where multiple population complexes with genetic and ecological diversity are distributed across the species range in protected suitable habitat that can support all life stages and facilitate connectivity, and threats are reduced or eliminated. Good resiliency, representation and redundancy will ensure that the species is viable into the future.

### *Recovery Regions*

To set targets for the number of population complexes necessary to recover Taylor's checkerspot butterfly, we used 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 would provide the opportunity for future reintroductions (Figure 1). Recovery region boundaries were largely based on the Environmental Protection Agency Level IV Ecoregions (EPA 2013). Where genetic information was available, it was incorporated into the recovery region delineation. These recovery regions are not designated recovery units and should not be treated as such.

*North Salish Sea Recovery Region*

The North Salish Sea Recovery Region spans areas in both 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 (U.S.) 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. British Columbia's recovery strategy for the species 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 support population complexes, although there are currently no

specific recovery targets identified (COSEWIC 2016, pp. 3-9).

Historically, Taylor's checkerspot butterfly was distributed across a greater area of the northern portion of the Olympic Peninsula but it has recently been extirpated from multiple locations (Linders, WDFW, *in litt*. 2021). Despite these losses, occupied areas in the U.S. portion of the North Salish Sea Recovery Region have the highest genetic and ecological diversity of any recovery region, currently with three occupied areas that support genetically and ecologically distinct groups (Severns et al. 2013, entire).

*South Puget Recovery Region*

The South Puget Recovery Region is located entirely within Washington south of Puget Sound (Figure 1) and historically was considered the stronghold for the species. Occupied areas here inhabit areas of native prairies in the lowlands surrounding the southern tip of the South Puget Sound and there is a single genetic group within this region (Severns et al. 2013, entire). 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 likely still supports the largest naturally occurring Taylor's checkerspot butterfly population complex and includes the largest area of presumably suitable and potentially suitable habitat of any of the recovery regions.

*Willamette Valley Recovery Region*

The Willamette Valley Recovery Region is located entirely in western Oregon (Figure 1) from the Columbia River south to the town of Cottage Grove, Oregon. The habitat in this region consists of native prairies and balds, which were historically common throughout the valley. This recovery region currently hosts two occupied sites which consist of a single genetic grouping (Severns et al. 2013, entire).




**Figure 1.** Map of recovery regions and critical habitat for Taylor's checkerspot butterfly (*Euphydryas editha taylori*).

### *Recovery Strategy*

The recovery strategy provides a concise overview of the envisioned recovered state for Taylor's checkerspot butterfly, describes the Service's chosen approach to achieve it, and includes the rationale for why the approach was chosen. Specifically, the recovery strategy articulates how the plan's statutory elements (e.g., recovery criteria, recovery actions, and

estimates of time and cost) will work together to achieve recovery.

The recovery strategy for Taylor's checkerspot butterfly includes having multiple population complexes in each of the three recovery regions where threats to the species and its habitats have been addressed and there is commitment from partners for long-term habitat management. The recovery strategy relies on the following to reduce the risk of extinction and ensure species' viability:

1. Improve resiliency such that populations can withstand the risk of extirpation from stochastic events (i.e., demographic, environmental, and genetic) by protecting, restoring, and managing habitat sufficient to support self-sustaining population complexes. Dispersal among constituent populations should be facilitated by management that connects and 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 risk of extirpation from catastrophic environmental 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 population complexes and, where appropriate, among complexes within a recovery region. Population complexes across the species' range will include a range of genetic and ecological diversity.

The main threat to Taylor's checkerspot butterfly is habitat loss, degradation, and fragmentation, as the species needs high-quality habitat to support population growth and cohesion. To recover this conservation-reliant species, downlisting and delisting targets require that sufficient, high-quality habitat is protected and appropriately managed long-term. High-quality habitat provides the necessary food plant resources; short-statured, open, or early seral conditions; and open ground for basking as well as the diverse microsites needed for successful development of eggs into adults (USFWS 2024a). Active management of prairie and grassland habitat is needed to control non-native plants and prevent succession of suitable habitat into forest habitats, and create the conditions necessary to support all life stages.

To preserve or create suitable habitat, ongoing habitat restoration, maintenance, and manipulation of vegetation structure is necessary. The native habitats (prairies, balds, and beach deposits) used by Taylor's checkerspot butterflies vary across the species range and require different management techniques (e.g., prescribed fire, herbicide application and mowing) to maintain them. Specific techniques may be preferred in certain areas depending on

location, topography, access, available resources, etc. Prescribed fire creates preferred vegetation structure, increases seed-soil contact for restoration planting, removes thatch, removes mosses and lichens, and controls woody vegetation. Mowing can be an alternative where fire is not feasible. Herbicide application is commonly used to manage these habitat types and control invasive plants. Restoration will also focus on establishing vegetation that provides sufficient resources to support all life stages of Taylor's checkerspot butterflies. While habitats differ across the species range, restoration of sites will include activities such as site preparation, direct seeding, or planting plugs. In addition to maintaining and restoring habitat to support populations, management will also be needed to maintain and create dispersal corridors to ensure connectivity among occupied sites. Dispersal is vital to the species' capacity to persist on the landscape and improving connectivity within and between populations will facilitate dispersal among patches and allow for the recolonization of suitable but unoccupied habitat patches. Because some restoration and management activities can harm or result in mortality of individual Taylor's checkerspot butterflies, the scale and timing of these activities must be carefully considered at occupied sites.

To ensure high quality habitat is protected throughout the species' range and there is adequate connectivity to maintain and facilitate dispersal, potential sites will be identified and prioritized for potential land acquisitions or conservation easements with willing landowners. Management plans will be developed for sites acquired for conservation or protected with easements to ensure land will be managed for the long-term benefit of the species. The protection and management of connected native landscapes will also benefit multiple species and support a larger distribution of functioning ecosystems.

Because the remaining Taylor's checkerspot populations are small and isolated, in addition to habitat management, improving the resiliency of existing complexes and establishing new complexes will be accomplished through reinforcements and reintroductions using captive bred or reared individuals and/or wild individuals. Several partners have worked collaboratively to support an ongoing captive rearing program for the Taylor's checkerspot butterfly with reinforcement and reintroductions focused on managed habitats in the South Puget Sound prairie and Willamette Valley and include areas that historically supported Taylor's checkerspot butterfly. To continue to facilitate recovery in all recovery regions, partners should work to select and prioritize reintroduction and reinforcement sites with suitable habitat. Additionally, incorporating genetic management considerations, like which genetic source to use as a donor population, when reintroducing the species to unoccupied sites or reinforcing existing populations will help maintain genetic diversity.

Within each recovery region a minimum number of population complexes are needed to downlist or delist the butterfly (see Recovery Criteria), and different strategies will be implemented in each region.

*North Salish Sea Recovery Region*

Taylor's checkerspot butterflies within the North Salish Sea Recovery Region exhibit the highest genetic and ecological diversity of the species' three recovery regions. Additionally, this region is the northern extent of the species' range, which may become more important as the climate warms. To maximize the potential for this region to contribute to the overall recovery of Taylor's checkerspot butterfly, elevation, ecotype, and genetic parameters must be incorporated into planning to reinforce existing populations, and the establishment of future populations through reintroductions.

The primary management strategy within this region is to improve the resiliency of existing populations, to develop population complexes, and to restore and enhance habitat across each of the ecotypes. Existing populations may be reinforced, and new, additional populations may be established throughout the diverse habitats to conserve and improve representation.

*South Puget Recovery Region*

The South Puget Recovery Region supports the largest documented Taylor's checkerspot butterfly population complex as well as the largest area of suitable and potentially suitable habitat of the three recovery regions, providing the greatest opportunity for the establishment of new population complexes. Individuals in this region originated from the same remnant population and the range of elevations and ecotypes is limited, thus opportunities to improve representation within this recovery region are limited in the short-term. The primary management strategy in this region will be to improve the species' resiliency and redundancy through improving habitat quality at occupied sites and formerly (or likely formerly) occupied sites, and to reintroduce Taylor's checkerspot to multiple areas to establish populations and support development of population complexes. These population complexes may need to be reinforced over time.

*Willamette Valley Recovery Region*

This recovery region has two occupied sites consisting of a single genetic grouping (Severns et al. 2013, entire), thus establishing additional populations using translocation of individuals from occupied sites or individuals from the captive rearing program will be essential for this region to meet recovery criteria. Maintaining and enhancing existing occupied sites to facilitate development of population complexes will improve resiliency and redundancy. Additional populations complexes may be established in areas of suitable habitat in the Willamette Valley to help meet delisting criteria.

## 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 objectives 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 reduce or 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***

The following downlisting criteria, when met collectively, would indicate that Taylor's checkerspot butterfly may be reclassified as a threatened species:

*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 demonstrate a moderate to high 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.

***Rationale***

To downlist Taylor's checkerspot butterfly, there needs to be 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 by enhancing and creating population complexes. A resilient population complex is demographically and genetically robust, maintained without reinforcement, and broadly distributed to include large patches of high- quality habitat within a permeable landscape matrix. The size and distribution of habitat patches needed to support a resilient population complex may vary (see USFWS 2024a for additional information) and therefore are not specified here. Nonetheless, population complexes distributed across the species' range will contribute to the species' viability because the physical and biological attributes of each complex are dissimilar and the likelihood of all being equally affected by a stochastic event is low. Having at least nine resilient population

complexes distributed throughout the species' range will improve the species' redundancy as well as the species' representation (see above).

Individual Taylor's checkerspot butterflies generally live 1 year 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 a minimum of 5 years (or five generations) as a sufficient time period to determine whether a population complex is resilient and self-sustaining. Demographic and habitat parameters (e.g., larval host plants, nectar plants, habitat connectivity as well as size and structure) associated with measures of resiliency will be determined as additional data are collected and our knowledge of the species improves. This timeframe is comparable 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]). Additionally, this timeframe aligns with WDFW guidelines, which considers a translocated population "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).

To delineate population complexes, we grouped Taylor's checkerspot butterfly observation records and occurrences within and up to 1.2 mi (2.0 km) based on the average movement radii of the species. While the dispersal distance for Taylor's checkerspot butterfly is unknown, the dispersal distance of the closely related bay checkerspot (*Euphydryas editha bayensis*) is variable and depends on many factors (Gilbert and Singer 1973, p. 70). In a mark-recapture study, movements of individual bay checkerspot butterflies varied from 0.01 mi (0.02 km) to 0.12 mi (0.19 km) based on the site and year (White and Levin 1981, p. 355). In another study, the bay checkerspot butterfly unexpectedly moved up to 1.9 and 3.5 mi (3.0 and 5.6 km, respectively) in release experiments, but distances were mostly 0.03 mi (0.05 km) or less (Harrison 1989, p.1241). On one occasion, an individual Taylor's checkerspot butterfly was documented at least 6.8 mi (11 km) from the nearest known population; however, it is not known whether this was a dispersal event or an individual from an unknown population (Grosboll, U.S. Fish and Wildlife Service, *in litt*. 2021). Based on this information, we determined that a distance up to 1.2 mi (2.0 km) would best represent both short-distance movements within a population complex as well as rare, long-distance movements between population complexes. However, we may change this distance as new information becomes available and there is more fine-scale or site-specific information.

Conserving and managing sufficient high-quality habitat will be essential to encourage the growth of resilient population complexes. Future recovery activities will establish and implement standardized habitat suitability monitoring and aid in determining additional habitat management needs.

***Delisting Criteria***

The following delisting criteria, when met collectively, may indicate that Taylor's checkerspot butterfly no longer meets the Act's definitions of either a threatened species or endangered species, and may be removed from the Federal Lists of Endangered and Threatened Wildlife and Plants:

*Delisting Criterion 1*

At least twelve 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, two population complexes in the Willamette Valley Recovery Region, and an additional three population complexes anywhere within the species' range.

*Delisting Criterion 2*

Each population complex in Delisting Criterion 1 will demonstrate a moderate to high 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 twelve resilient population complexes distributed throughout its range to capture the range of genetic and ecological diversity and ensure sufficient resiliency, redundancy, and representation which will result in the species' long-term viability. Twelve population complexes distributed across the species' range should ensure sufficient redundancy to reduce extinction risk due to catastrophic events. The three population complexes beyond those required for each recovery region will be located within the recovery regions and locations will be identified as more information becomes available related to genetic and ecological diversity, suitable habitat, and climate change.

# III. 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 the conservation of federally listed species.

Recovery actions are the statutorily required, site-specific management actions needed to achieve recovery criteria, as described in section 4(f)(1)(B)(i) of the Act. The Service assigns recovery action priority numbers (1-3) to rank recovery actions. The assignment of priorities does not imply that some recovery actions are of low importance, but instead implies that lower priority items may be deferred while higher priority items are being implemented. Recovery action priority numbers are based on the following:

Priority 1: An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.

Priority 2: An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.

Priority 3: All other actions necessary to provide for full recovery of the species.

The actions needed to alleviate threats of habitat loss and small, isolated populations to Taylor's checkerspot butterfly and achieve recovery criteria are:

**Priority 1**

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

   Suitable habitat is essential for the persistence of Taylor's checkerspot butterfly at any given site within the recovery regions, and connectivity among habitat is essential for dispersal.

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

   Reintroductions and reinforcement will use individuals (eggs, larvae, adults) from sites with adequate abundance or from the captive rearing programs (larvae typically) to augment or create new populations. Reintroductions will require individuals being moved to an area of suitable habitat where the species has not been found recently. Reinforcement will require wild or captive-reared individuals being moved to occupied areas to augment the number and/or genetic diversity of the existing population. To manage risks to individuals and populations, numerous parameters of the donor populations and recipient sites will be considered when planning translocations, including habitat condition, diseases, parasites, abundance, etc.

3. Pursue acquisitions, conservation easements, and management agreements across the species' range.

   Land with suitable habitat must be protected and managed to benefit the species. 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 primary threats to Taylor's checkerspot butterfly, and increase the species' climate resilience. 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 measure appropriate population metrics and assess threats across the species' range.

Documenting and understanding variation in population metrics such as occupancy, distribution, abundance, and trends over time is necessary to document progress toward recovery. Standardized survey and monitoring protocols are important for understanding population resiliency and improving consistency of range-wide data.

5. Conduct scientific investigations on the species' ecology, demography, distribution, factors limiting populations, and the response to management actions (e.g., habitat enhancement and manipulation, captive propagation, translocation, and/or reintroduction) across the species' range to guide conservation efforts.

   Information and data collected about the species will inform conservation efforts and be essential to adaptively manage this species and their habitats.

**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. Public awareness and support of and engagement with species' conservation can increase partnership opportunities and landowners' awareness of d 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**<br>**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**<br>**Disease or Predation** | Predation by parasitoid wasps and spiders | 1, 2, 3 | 1, 2, 4, 5 |
| **D**<br>**Inadequacy of Existing Regulatory Mechanisms** | Continued risk of habitat loss and degradation under Federal, State, and local laws | 3 | 1, 3, 4, 6 |
| **E**<br>**Natural or Man-made Factors** | Vulnerabilities associated with isolated populations, loss | 1, 2, 3 | 1, 2, 3, 4, 5, 6 |
| | Extreme weather events | 1, 2, 3 | 1, 2, 3 |
| | Climate change | 1, 2, 3 | 1, 2, 3, 4, 5, 6 |

# IV. TIME AND COST ESTIMATES

Recovering species can be time-consuming and expensive, as it often entails undoing centuries of impacts that have led to their current imperiled state. When species are listed under the Act they are often restricted to a fraction of their historical range, in habitats where major ecological processes have been disrupted. Demographic characteristics and genetic structure of populations may be degraded. Stressors such as invasive species, diseases, climate change, and habitat loss and degradation can interact synergistically with severe consequences for species. While the Act mandates that recovery plans include an estimate of the cost to recover species, this does not signify that these funds will be allocated. A wide range of partners often contribute to the cost of recovery, including Federal agencies, States, and non-governmental organizations. Funds actually dedicated to species recovery are typically a fraction of the estimated cost. Because recovery periods may cover multiple decades, annual costs are much lower than overall cost estimates. While our focus here is on recovery of Taylor's checkerspot butterfly, implementation of recovery actions will also often benefit other listed and nonlisted species dependent on grassland ecosystems, as well as human welfare.

Achieving the recovery criteria for the Taylor's checkerspot butterfly is expected to require approximately 30 years, and the RIS that will accompany this recovery plan identifies that the majority of costs will occur within the first 20 years. While this is a shorter time horizon than some recovery plans, given the myriad of uncertainties associated with recovering listed species, estimating recovery costs is still difficult. In general, these uncertainties include: (1) emergence of new threats, (2) response of species to management, (3) innovations in methods / technologies to address threats, and (4) potential economies of scale.

Presented below are site-specific recovery actions and their estimated cost of implementation, projected to the estimated date of delisting (Table 2). This recovery plan does not commit the Service or any partners to carry out a particular recovery action or expend the estimated funds, nor does it ensure allocation of funds to implement these actions. 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.

Cost estimates are preliminary, do not necessarily reflect economies of scale (i.e., single actions that benefit multiple species), and may change substantially as efforts to recover the species continue. Taylor's checkerspot butterfly and other prairie dependent species may benefit synergistically from conservations efforts being implemented, and opportunities for cost efficiencies will be pursued. Project-level details of recovery action implementation will be developed with partners and stakeholders in the RIS that will accompany this recovery plan. Pursuant to Section 7(a)(1) of the Act, the Secretary of the Interior "shall review other programs administered by him and utilize such programs in furtherance of the purposes of this Act. All

other Federal agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act." Under this provision, Federal agencies often enter into partnerships and Memoranda of Understanding with the Service for implementing and funding conservation agreements, management plans, and recovery plans developed for listed species. Implementation of specific recovery actions pursuant to Section 7(a)(1) is subject to availability of funds and is at the discretion of partners.

Estimated costs described in Table 2 incorporate planning, design, implementation, and research, monitoring, and evaluation associated with specific actions. Employing adaptive management principles will ensure that management actions and tools are mitigating threats to the species and meeting the objectives of this recovery plan. If the actions and tools are not effective, changes in management should be made and additional planning and research may be necessary.

**Table 2.** Recovery Actions, their estimated cost (in Fiscal Year 2024 dollars), and the priority of each recovery action for Taylor's Checkerspot Butterfly.

| Recovery Actions | Priority | Estimated Cost |
|---|---|---|
| 1. Maintain and increase suitable habitat and connectivity across the species' range to support resilient 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 across the species' range | 1 | $54,782,000 |
| 4. Develop and implement survey and monitoring to measure appropriate population metrics and assess threats across the species' range | 2 | $5,232,000 |
| 5. Conduct scientific investigations to guide conservation efforts by studying the species' ecology, demography, factors limiting populations, and the response to management actions (e.g., habitat enhancement and manipulation, captive propagation, translocation, and/or reintroduction) across the species' range | 2 | $2,000,000 |
| 6. Promote and coordinate partnerships, information sharing, and outreach across the species' range | 3 | $2,350,000 |
| | | TOTAL: $103,483,000 |

The estimated cost to implement all actions considered necessary to achieve recovery for Taylor's checkerspot butterfly is $103,483,000 over 30 years, with the majority of costs being incurred in the first 20 years. Recovery actions identified in this plan, like habitat conservation and restoration, will provide benefits to other species.

**Date of Recovery**: If all actions are fully funded and implemented as outlined, including full cooperation of all partners needed to achieve recovery, we estimate the earliest that the delisting criteria could be met would be 2054. 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 30 years.

# V. REFERENCES

## LITERATURE CITED


Boyd, R.T. 1986. Strategies of Indian burning in the Willamette Valley. Canadian Journal of Anthropology 5:65-86.

Christy, J.A. and E.R. Alverson. 2011. Historical vegetation of the Willamette Valley, Oregon, circa 1850. Northwest Science 85(2):93-107.

Dunn, P., and K. Ewing. 1997. South Puget Sound prairie landscapes. The Nature Conservancy of Washington, Seattle. 289 pp.

EPA (Environmental Protection Agency). 2013. Level III and IV Ecoregions of the Continental United States. https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental- united-states.

Gilbert, L.E. and M.C. Singer. 1973. Dispersal and Gene Flow in a Butterfly Species. The American Naturalist 107:58-72.

Grosboll, M. 2021. In Litt. Email to T. Callaway. Recovery Coordinator, USFWS, Wenatchee, Washington. Re: TCB in Johnson Prairie. October 27, 2021.

Harrison, S. 1989. Long-Distance Dispersal and Colonization in the Bay Checkerspot Butterfly,*Euphydryas Editha Bayensis*. Ecology 70:1236-1243.

Holtrop, K. 2021. In litt. Email to K. Reagan, Endangered Species Biologist, USFWS, Lacey, Washington. Re: Potential for genetic exchange on the Olympic National Forest.

Kaye, T.N., A.G. Stanley, and D. Ross. 2011. Dispersal behavior and habitat selection of Taylor's checkerspot butterfly. Progress report. Institute for Applied Ecology, Corvallis, Oregon and U.S. Fish and Wildlife Service, Lacey, Washington. 27 pp.

Linders, M. 2011. Captive rearing and translocation of Taylor's checkerspot in south Puget Sound: 2010-2011. ACUB Project Progress Report. Washington Department of Fish and Wildlife, Olympia, Washington. 22 pp.

Linders, M.J., K. Lewis, and K. Curry. 2020. Taylor's checkerspot (*Euphydryas editha taylori*) Captive Rearing and Translocation: South Puget Sound, Washington, 2018–2019. 2019 Annual Report to: US Fish and Wildlife Service (Cooperative Agreement #F16AC00588, F19AC00408) and Joint Base Lewis-McChord (Contract# W911S8-12-H-0001,W911S8-18-2-0008, W911S81820017, W911S81920011). 43 pp. + appendices.

Linders, M. 2021. In litt. Email to K. Reagan, Endangered Species Biologist, and D. Grosboll, Fish and Wildlife Biologist, USFWS, Lacey, Washington. Re: Extirpated Taylor's checkerspot butterfly sites in Clallam County, Washington.

NMFS (National Marine Fisheries Service). 2018. Interim Endangered and Threatened Species Recovery Planning Guidance, Version 1.4. Silver Spring, Maryland. 122 pp.

Potter, A.E. 2016. Periodic status review for Taylor's Checkerspot in Washington. Washington Department of Fish and Wildlife, Olympia, Washington. 16 + iii pp.

Severns, P.M., A. Bower, and A. Potter. 2013. Genetic assessment of Olympic National Forest populations of Taylor's checkerspot, *Euphydryas editha taylori* Macy (Lepidoptera: Nymphalidae). Final report to the ACUB Technical Review Committee, October 2013. 23 pp.

Shaffer, M.L. and B.A. Stein. 2000. Safeguarding our precious heritage. Pages 301-321 in: Stein, B.A., L.S. Kutner, J.S. Adams, editors. Precious heritage: the status of biodiversity in the United States. Oxford University Press, New York, New York.

Singer, M.C., and P.R. Ehrlich. 1979. Population dynamics of the Checkerspot Butterfly *Euphydryas editha*. Fortschritte der Zoologie 25:53-60.

Smith, D.R., N.L. Allan, C.P. McGowan, J.A. Szymanski, S.R. Oetker, and H.M. Bell. 2018. Development of a Species Status Assessment Process for Decisions under the US Endangered Species Act. Journal of Fish and Wildlife Management 9:302-320.

Stinson, D.W. 2005. Washington State Status Report for the Mazama Pocket Gopher, Streaked Horned Lark, and Taylor's Checkerspot. Washington Department of Fish and Wildlife, Olympia, Washington. 129+ xii pp.

Tveten, R.K. and R.W. Fonda. 1999. Fire effects on prairies and oak woodlands on Fort Lewis, Washington. Northwest Science 73(3):145-158.

USFWS (U.S. Fish and Wildlife Service). 2001. Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Species That Are Candidates or Proposed for Listing as Endangered or Threatened, Annual Notice of Findings on Recycled Petitions, and Annual Description of Progress on Listing Actions. Federal Register 66:54807-54832. 26 pp.

USFWS. 2004. Endangered and Threatened Wildlife and Plants; Review of Species That Are Candidates or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions; Proposed rule. Federal Register 68:24875-24904. 30 pp.

USFWS. 2010. Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington. U.S. Fish and Wildlife Service, Portland, Oregon. 255 pp.

USFWS. 2012a. Endangered and Threatened Wildlife and Plants: Listing Taylor's checkerspot butterfly and streaked horned lark and designation of critical habitat; Proposed rule. Federal Register 77(197):61937-62058. 122 pp.

USFWS. 2012b. Endangered and Threatened Wildlife and Plants: Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions; Proposed rule. Federal Register 77:69993-70060. 68 pp.

USFWS. 2013a. Endangered and Threatened Wildlife and Plants: Determination of endangered status for the Taylor's checkerspot butterfly and threatened status for the streaked horned lark; Final rule. Federal Register 78(192):61451-61503. 53 pp.

USFWS. 2013b. Endangered and Threatened Wildlife and Plants: designation of critical habitat for Taylor's checkerspot butterfly and streaked horned lark. Federal Register 78(192):61506-61578. 85 pp.

USFWS. 2015. Recovery plan for the Behren's silverspot butterfly (*Speyeria zerene behrensii*). U.S. Fish and Wildlife Service, Sacramento, California. 82 pp.

USFWS. 2019a. Draft Recovery Plan for the Streaked Horned Lark (*Eremophila alpestris strigata*). U.S. Fish and Wildlife Service, Portland, Oregon. 224 pp.

USFWS. 2019b. Recovery plan amendment for the Palos Verdes Blue Butterfly (*Glaucopsyche lygdamus palosverdesensis*). U.S. Fish and Wildlife Service, Carlsbad, California. 9 pp.

USFWS. 2019c. Recovery plan amendment for the Quino checkerspot butterfly (*Euphydryas editha quino*). U.S. Fish and Wildlife Service, Carlsbad, California. 22 pp.

USFWS. 2019d. Recovery plan amendment for the El Segundo Blue butterfly (*Euphilotes battoides allyni*). U.S. Fish and Wildlife Service, Carlsbad, California. 17 pp.

USFWS. 2024a. Taylor's Checkerspot Butterfly (*Euphydryas editha taylori*) Species Biological Report. U.S. Fish and Wildlife Service, Lacey, Washington. 100 pp.

USFWS. 2024b. Taylor's Checkerspot Butterfly (*Euphydryas editha taylori*) Recovery Implementation Strategy. U.S. Fish and Wildlife Service, Lacey, Washington. 17 pp.

White, R.R. and M.P. Levin. 1981. Temporal Variation in Vagility: Implications for Evolutionary Studies. The American Naturalist 105(2):348-357.

Wolf, S., B. Hartl, C. Carroll, M.C. Neel, and D.N. Greenwald. 2015. Beyond PVA: Why Recovery under the Endangered Species Act is more than Population Viability. Bioscience 65:200-207.

# VI. APPENDICES

## 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 ongoing maintenance and management into the foreseeable future to persist (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 continuous area of habitat resulting in smaller, isolated habitat patches that likely cannot support self-sufficient populations independently.

**Genetic groupings**: Groups of genetically similar populations that exhibit substantial genetic differentiation from other populations or occurrences.

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

**Habitat quality:** The range of environmental conditions 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.

**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 with stand catastrophic events by spreading risk among multiple populations or across a large area (Smith et al. 2018, p. 304).

**Reinforce / reinforcement:** The intentional movement and release of an organism into an existing population of conspecifics (IUNC/SSC 2013).

**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).

**Resilient population complex:** a population complex that is demographically and genetically robust, maintained without reinforcement, and broadly distributed to include large patches of high- quality habitat within a permeable landscape matrix.

**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. In previous agency reports and planning documents this term was used to delineate locations where Taylor's checkerspot butterfly had been documented historically.

**Stochastic:** Unpredictable or random event.

**Succession:** The process by which the structure and/or composition of an ecological community changes 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.

## LITERATURE CITED IN THE GLOSSARY


Chappell, C.B. Plant associations of Balds and Bluffs of Western Washington. Natural Heritage Report 2006-02. 40 pp. + apps.

IUCN/SSC (2013). Guidelines for Reintroductions and Other Conservation Translocations. Version 1.0. Gland, Switzerland: IUCN Species Survival Commission, viiii + 57 pp.

Levins, R. 1969. Some Demographic and Genetic Consequences of Environmental Heterogeneity for Biological Control. Bulletin of the Entomological Society of America 15: 237-240. doi:10.1093/besa/15.3.237

NMFS and USFWS (National Marine Fisheries Service and U.S. Fish and Wildlife Service). 2018. Interim Endangered and Threatened Species Recovery Planning Guidance. 123 pp.

Scott, J.M., D.D. Goble, A.M. Haines, J.A. Wiens, and M.C. Neel. 2010. Conservation-Reliant Species and the Future of Conservation. Conservation Letters 3:91-97.

Smith, D.R., N.L. Allan, C.P. McGowan, J.A. Szymanski, S.R. Oetker, and H.M. Bell. 2018. Development of a Species Status Assessment Process for Decisions under the US Endangered Species Act. Journal of Fish and Wildlife Management 9:302-320.

Wells, J.V. and M.E. Richmond. 1995. Populations, Metapopulations, and Species Populations: What Are They and Who Should Care? Wildlife Society Bulletin 23:458-462.

## APPENDIX B: SUMMARY OF THE COMMENTS RECEIVED ON THE DRAFT RECOVERY PLAN FOR THE TAYLOR'S CHECKERSPOT BUTTERFLY

### Background

We posted a Document Availability Notice on November 15, 2022, to announce the availability of the Draft Recovery Plan for the Taylor's Checkerspot Butterfly for a 60-day public review and comment period, and to solicit comments by the scientific community, State and Federal agencies, Tribal governments, and other interested parties on the general information base, assumptions, and conclusions presented in the draft plan. The public comment period was open until January 17, 2023. During the public comment period, we received 100 comments in total, including responses from the U.S. Forest Service, the Oregon Zoo, a state agency, individuals who work with the Taylor's checkerspot butterfly, and the general public.

Comments received ranged from minor editorial suggestions to specific recommendations on plan content. We considered all substantive comments. We thank the reviewers for these comments and to the extent appropriate, we have included applicable information or incorporated changes into the recovery plan. Below, we provide a summary of comments received on the draft plan; however, some of the comments that we incorporated as changes into the recovery plan did not warrant an explicit response and, thus, are not presented here.

There were four topics of comments that were most germane to the purposes of this recovery plan: 1) the time a resilient population complex is required to be monitored and considered resilient prior to downlisting or delisting; 2) the distance between population complexes considered separate; 3) the number of resilient population complexes in each region and across the range of the species considered sufficient for representation and redundancy; and 4) the estimates for cost and time to achieve recovery.

1. Time a resilient population complex is required to be monitored and considered resilient prior to downlisting or delisting: Several commentors stated that population complexes should be monitored and determined to be resilient for a longer time period before considering downlisting or delisting. In this plan, we recommend that population complexes be determined to be resilient for at least 5 years before considering downlisting, and for at least 10 years before considering delisting. It is important to remember that this downlisting criterion calls for demonstrating that all 9 population complexes are resilient for 5 years before initiating analysis of the status of the species to determine if downlisting is warranted. Although the resiliency criteria have not yet been determined, we anticipate they will involve determining butterfly abundance, population complex trends, and habitat quality. Similarly, we expect that by the time all population complexes are documented as resilient for 10 years, we will have more than 10 years of data informing the status of the species and delisting decisions. As described in the

Recovery Criteria section, this timeframe is comparable to recovery plans for 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]). Additionally, this timeframe aligns with WDFW guidelines, which considers a translocated population "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)

2. Distance between population complexes in order to consider them separate population complexes: Several comments noted the terms "dispersal" and "movement" are used somewhat interchangeably and there is a lack of clarity about the dispersal ability of Taylor's checkerspot butterfly. There has been little research explicitly measuring dispersal or movement by Taylor's checkerspot butterflies, and available data reflects multiple confounding factors. Males and females move differently and move in response to different stimuli. Vegetation structure, temperature, cloud cover, wind, the age of individuals in the population, the availability of nectar sources, genetics of individuals in the population, and other factors complicate each study and increase variation between studies and anecdotal observations. At this time, more research is needed to determine the distance separating population complexes (as well as other factors), however, the information included in the plan reflects what is currently known about the species and reflects best available data and management activities may change as more information is gained in the future.

3. Number of resilient population complexes in each region and across the entire range of the species that are considered sufficient for representation and redundancy: Several commenters considered the number of resilient population complexes representing each ecological and genetic grouping required within each recovery region to be too low. Because representation and redundancy criteria are applied across the entire range of Taylor's checkerspot butterfly (there are no distinct population segments for insects), we have included downlisting/delisting criteria that require multiple populations in each region to increase representation across the range. In order to maintain or increase overall representation, the required resilient population complexes should be spread across the three recovery regions so that multiple ecological and genetic groupings are included. We believe that the number of population complexes defined, and their distribution across the landscape within different ecological settings, will provide for adequate representation, resiliency, and redundancy to ensure the viability of the species into the future. By ensuring that population complexes are distributed throughout the range of the species, we believe Taylor's checkerspot butterfly will have populations spread across a large enough area that stochastic or catastrophic events are extremely unlikely to impact all population complexes in the same manner. Requiring multiple populations in each Recovery Region will enable representation of the diversity of

ecological habitats. Finally, the number of population complexes in each Recovery Region is proportionate to the number of genetic groups found in each region, facilitating representation of the genetic diversity found within this species.

4. Estimates for cost and time to achieve recovery: There were two comments that the costs of recovery have likely been underestimated. We made time and cost estimates based on the conservative assumption that all recovery actions will be fully funded and successfully implemented as currently outlined, including cooperative efforts by all partners needed to achieve recovery. Estimates were informed by costs of projects including, but not limited to, land stewardship and acquisition, captive rearing, and restoration actions that the Service funded and/or participated in with external partners. These cost projections are estimates, and we acknowledge that recovery effort costs may vary from the totals outlined in the recovery plan and the recovery implementation strategy.