Taylor’s Checkerspot Annual Working Group Meeting
November 16 & 17, 2015 | Oregon Zoo – Portland, OR

**Day 1 – November 16**

**In attendance**


**Recovery Planning Process and Updates**

*Brad Thompson, USFWS*

In order to successfully create a recovery plan for each of the multiple species listed, a new approach will be taken. A recovery plan allows the USFWS to clearly communicate identified goals and objectives to achieve down-listing and/or de-listing. Only four items are legally required to be in the recovery plan: recovery goals; site-specific actions; budget; implementation schedule. The goal is for this document to be 30-50 pages, including a recovery outline (which will paint the picture of what USFWS is working towards). This document, the formal recovery plan, will have two corresponding documents - Species Status Assessment (SSA) and Recovery Implementation Strategy (RIS). These documents won’t be part of the official recovery plan and can be updated regularly to reflect the current status of the population (SSA) and detailed site specific recommendations for recovery (RIS). The RIS can include other species such as streaked horned lark and Mazama pocket gopher, and/or may be created region by region. This allows for recovery of multiple species without combining them in the official recovery strategy. At this time there is no formal recovery team for the Taylor’s checkerspot.

**Population Status and Restoration Actions**

*British Columbia*

*Jenny Heron, BC Ministry of the Environment*
Taylor’s checkerspot currently occur on Denman Island and they hope to translocate them to Helliwell Provincial Park on Hornby Island, where there was a historical population. In preparation for this, habitat enhancement was carried out at Helliwell Provincial Park in March 2015. This included conifer removal on .35 hectares, management of invasive thistle that is growing in very quickly. Substantial public outreach was also conducted. In the meantime, a plan has been recently completed to guide management of the Taylor’s checkerspot butterfly reserve on Denman Island. Using larvae reared in the volunteer captive rearing program, 350 larvae were released in March and April 2015 to augment the Denman Island population. It is projected that up to 1,000 larvae will be released to the same site in 2016, paired with increase monitoring. The hope is to release captive reared larvae on Hornby Island in 2017 or 2018.

Thirty-five adult checkerspots were observed in 2015, though it is likely that the population is higher as not all potential areas were monitored. Monitoring will start back up in February 2016.

Clallam County, Washington State

Shelly Ament, Ann Potter, and David Hays, Washington Department of Fish and Wildlife

There are seven known populations of Taylor’s checkerspot in Clallam County; daily high counts of adults are included in the table below. All Clallam County sites had early flight periods. Distance sampling was conducted at the privately owned sites and 25 m transects were conducted on the steep sites (Eden Valley, Dan Kelly). WDFW was able to conduct more searches than ever in 2015, and when possible, additional monitoring was conducted at potential sites. No additional populations were found in 2015.

<table>
<thead>
<tr>
<th>Entity</th>
<th>Site Name</th>
<th>2015 HC</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>USFS</td>
<td>Bear Mountain</td>
<td>67</td>
<td>Highest ‘high count’ ever</td>
</tr>
<tr>
<td>USFS</td>
<td>3 O’clock Ridge</td>
<td>211</td>
<td>Down from 2014 but comparable to norm</td>
</tr>
<tr>
<td>USFS</td>
<td>Upper Dungeness</td>
<td>287</td>
<td>Down from 2014 but comparable to norm</td>
</tr>
<tr>
<td>WDFW</td>
<td>Privately owned</td>
<td>754</td>
<td>Highest ‘high count’ ever.</td>
</tr>
<tr>
<td>WDFW</td>
<td>Eden Valley</td>
<td>321</td>
<td>Up from 2014</td>
</tr>
<tr>
<td>WDFW</td>
<td>Dan Kelly</td>
<td>27</td>
<td>Down from 2014</td>
</tr>
<tr>
<td>CNLM</td>
<td>Dan Kelly west end</td>
<td>104</td>
<td>Down from 2014</td>
</tr>
</tbody>
</table>

Overall, 10 acres of tree and shrub removal has been done at Dan Kelly Ridge. Five acres of work was conducted at the west end of the property, which is primarily owned by the Center for Natural Lands Management. WDNR has done 1-3 acres/year. Eden Valley is also receiving restoration treatment at 1-3 acres/year. Improvements have been made to reduce direct impacts from vehicles (clear turn around areas, etc). Ticks with Lyme disease were identified on restoration sites which lead to some crews withdrawing from work due to safety. This and
weather were the key challenges in the 2015 monitoring and restoration season. WDFW hopes to get a weather station installed at one of the sites.

South Sound, Washington

Mary Linders, WDFW

At Range 76, which has been the source site for reintroductions since 2006, a regular population curve is beginning to show. Although analysis has not yet been done for 2015, population levels are expected to be closer to the 2010 mark. Reintroduction sites and numbers of years of releases are: Scatter Creek South - 7 consecutive years; Glacial Heritage - 4 consecutive years; Range 50 – 2 consecutive years; TA7S - 2 consecutive years; and Pacemaker - 1 year. Success for a site is defined as an annual abundance estimate of at least 250 adults for 5 years straight, widely distributed across a monitoring area at least 50 acres in size, and that they occupy the site solely through natural reproduction each year for five consecutive years. The goal is to establish at least 3 new populations (meeting the above criteria) at three Puget lowland sites by 2022.

Peak count at Scatter Creek South was 130, which is projected to be above the 250 mark for single day adult abundance this year for the first time. Range 50 has had single day estimates over 250 for four of the last five years, with estimates in 2016 also expected to be over 250, meaning Range 50 would be the first site to reach five consecutive years with counts over 250. Glacial Heritage and TA7S showed mediocre results in 2014 and preliminary 2015 data. Overall, 2015 raw data shows similar or higher numbers at all sites except for Range 76. Bottom line is that a lot of good habitat is needed to get reintroduction sites over the 250 mark, but that patience pays off. Success at Range 50 indicates that current methods are viable under favorable conditions (e.g. weather, habitat), and that habitat improvements are finally taking hold and giving back (e.g., Scatter Creek). Individual releases can and do fail due to unfavorable weather and/or poor habitat and thus large and repeated releases are necessary. Cooperation and collaboration are vital to success, and variation is the norm, so we should embrace it.

David Hays, WDFW

Prescribed fire was conducted across 200 acres of Taylor’s habitat in 2015. Now that CNLM has an in-house burn boss (Mason McKinley) there is and will be expanded capacity to conduct prescribed fire in the South Sound. The inability to acquire burn permits due to the drought as well as the fescue shortage due to the drought were two challenges led to a reduced size and scope of burns, with 50% less acreage burned than usual.

Bill Kronland, CNLM

JBLM has a different permitting process and this enable more burns to be conducted. The goal of the prescribed burning is to maintain and expand habitat on-base. Fifteen pounds of forbs were hand seeded on each burn site. Dan Grosboll is conducting a study to modify the fuel regime to
improve early season burns. Following application of glyphosate, it is possible to do a 2.5 acre spring burn followed by 30-40 lbs of seed (with no grasses in the mix). This could create a forb rich landscape that will carry patchwork fire.

At TA15 there are two sites that are being prepped for enhancement. Restoration that CNLM conducts at JBLM uses an informative approach, including using plug survivorship studies and assessments of sites to inform follow up actions.

**Benton County, Oregon**

*Rich Szlemp, USFWS on behalf of Dana Ross*

There are two populations in Benton County – Fitton Green and Beazell Memorial Forest. There were approximately 1,200 adults at each of the sites, with was the second highest count ever at Fitton Green and the highest count ever at Beazell. A single male was observed about 1 mile southeast of the occupied area in Fitton Green.

*Adam Stebbins, Benton County Natural Areas*

Benton County has an HCP that include three priority areas for Taylor’s in Benton County - Fitton Green, Beazell Memorial Forest, and Fort Hoskins (the last of which is not occupied but has a lot of potential). Benton County utilizes volunteers to do a lot of the restoration at county sites, and more work than ever was carried out at Beazell this year. Lots of conifers removed and the county worked with IAE to create corridor connectivity between the north and south meadow. A 20 acre controlled burn was carried out at Fitton Green South meadow (where there have been occasional TCB sightings but is not currently occupied). The focus of restoration is on maintaining habitat quality to the edge of the BPA corridor near the north end of Fitton Green, which is occupied. At Fort Hoskins, the expansion of 6 acres of prairie habitat was achieved through conifer removal. This is currently an unoccupied site, though they are seeding forbs and grass throughout area to create connectivity to existing meadows. The estimate of potential habitat when current restoration efforts are completed is 20 acres at Ft. Hoskins and 40 acres at Beazell that are now connected.

**Captive Rearing**

*Karen Lewis and Julia Low, Oregon Zoo*

Over the last few years unexplained mortality events have taken 15%-100% of colony. In 2014, all animals that overwintered at zoo were sacrificed. The colony was restarted with wild founders. In 2014 the program produced 4,200 eggs and 3,800 of those resulted in 3\textsuperscript{rd} instar larvae and 3,770 went into diapause. 460 of the larvae died over a two-week period in early February, and 537 molted in diapause, which has never happened with this program. Suspect most deaths are attributed to larvae who tried to molt or unsuccessfully molted. Almost 2,700 larvae died a few were culled. Winter 2014-2015 was the warmest winter on record in Portland, a
possible contributor. Risk to wild populations was determined low due to no identified pathology so 498 surviving larvae were released at Glacial Heritage in Spring 2015 and the remainder were reared to the adult stage for inclusion in the captive breeding program.

This year the program had 50 ovipositing females (20 wild and 30 captive-bred) on plants, producing 5,340 eggs at zoo and resulting in 3,000 larvae. The earlier collected wild females were more productive than those collected later. OZ ended up with 2,558 larvae entering diapause. We are conducting more frequent checks on diapausing larvae this year. Temperatures have been about 10 degrees warmer this fall than usual and there have been higher than normal mortality rates already – most that died seemed like runts and also many had frass on them. Still have 2,500 larvae in diapause.

There was a pre-diapause larval mortality event in June 2015 and testing showed a very low level of a fungicide (chlorothalonil) present in plants that were fed to larvae that died. This is the first time any explanation for any mortality event has been identified and we hope to have studies done on the dead caterpillars to see if they have that same fungicide in them.

*Kelli Bush and Seth Dorman, Sustainability in Prisons Project*
Sustainability in Prisons Project/Mission Creek survival rates have been good – they haven’t seen the problems there that the zoo is having. Hoping to compare environmental data to see where there might be differences that could shed light on the situation.

**Afternoon Updates and Discussions**

**North Sound Coordination – Peter Dunwiddie, CNLM**
Coordination among north sound partners (Clallam County, Whidbey, and San Juan Islands) has begun with funding support from USFWS. The goal was to identify what work was underway to produce plants, what resources are needed, and identifying best strategy for producing seeds to meet all needs. CNLM’s South Puget Sound nursery is growing north sound exclusive seed, nursery production is beginning on Whidbey Island at the Pacific Rim Institute, and San Juan County Land Bank has begun nursery with several species. With the grant, CNLM will coordinate plant and seed production and provide expertise.

**TCB Host Suitability – Nate Haan, UW**
The goals of Nate’s research are to measure variability in senescence phenology among the three main TCB host species, to determine relative suitability of these three species as TCB host plants, and to identify how environmental factors influence these characteristics.

Timing of senescence of host plants can be a major factor for survival (if plant senesces too soon, starvation can occur). Focus on Phase II of project – release larvae on the plots from Phase Ib and monitor survival/performance (2015-2016). This will be repeated next year as well. The
study includes 45 plots of harsh paintbrush (*Castilleja hispida*), golden paintbrush (*Castilleja levisecta*), and plantain (*plantago lanceolata*). Each study plot contains 5 or more individuals of the given host species, with enclosures set over patch of plants to allow some control over what the larvae are eating. These enclosures showed some environmental effect but none that seem critical. At each plot the study measured variables regarding the host plants, abiotic environment, and caterpillars. Preliminary results show that plantago stays green the longest, and that although CAHI and CALE do senesce fairly rapidly they appear to do so mostly after larvae enter diapause. The vast majority of TCB mortality occurred for eggs and first-instar larvae; larvae that made it to 2nd and 3rd instar were very likely to survive to 4th instar. Host plant identity did not appear to affect larval mortality. Similarly, environmental differences among the plots were not strong predictors of plant senescence or TCB mortality. In summary, in 2015 larval mortality was driven by factors other than host plant identity and senescence rates.

**Taylor’s Checkerspot and Golden Paintbrush Discussion**

*Field and Lab Observations – Nate Haan, UW*

During a pilot study in 2013, post-diapause larvae on CALE survived similarly to those on PLLA, with around half of the individuals remaining and feeding on the original plant to which they were released until pupation. TCB larvae also stayed put more than those on plantago (observationally less likely to wander off). From host plant experiments (described above) – prediapause larvae are doing fine on CALE. In greenhouse study with *E. e. colonia* – larvae survived well on CALE, but depended on CALE host plant. *Colonia* were able to sequester iridoid glycoside compounds. This spring, Nate found CALE that had been oviposited on by wild individuals.

**Additional Observations**

Dennis Aubrey found in his thesis that TCB preferred CALE and CAHI over PLLA for oviposition. In 2013, observations at Beazell Memorial Forest (Benton County site) found clear evidence of CALE growing in January and February and in February found caterpillars feeding on CALE and PLLA (in the wild).

**Hybrid Issue (CALE x CAHI)**

Genetically, lab analysis could identify markers that distinguished the two types of Castilleja. Peter Dunwiddie provided samples that from the eye looked like hybrids. Preliminary study looked at flower color. Turned out that plants that looked intermediate that were genetically intermediate – some almost all levisecta, some almost all hispida. Likely explanation is that they weren’t just F1 hybrids, but also next generation hybrids – which suggests they can persist. Take home message – you can’t tell just based on flower color what you’re looking at.

Tom Kaye and a colleague ran a study in the lab that created hybrids and found hybrids can look many different ways. Many actually look a lot like one or the other, with some that look like a
mix. The outstanding question is if they can produce fertile plants. Tom’s graduate student is crossing for hybrids than crossing again, to see if F2 are fertile as well as F1. If so, could be a problem if CALE gets genetically swamped by CAHI, in terms of CALE recovery. Big point: if we’ve got tetrapoid hispida to work with, it would be sterile and we could use that sterile source for planting.

**Group Discussion**

There is good evidence that TCB will use CALE. We won’t know the population effect until CALE and TCB co-occur on a larger scale – we need to let the butterfly show us what it wants and needs by having TCB on sites with CALE. It seems clear from these observations and findings that a diversification of host plants would be beneficial and provide a buffer. Sites in the Willamette Valley with PLLA and CALE present would be key opportunities for reintroduction. Other potential sites for co-recovery of CALE and TCB include Cavness and Mima Mounds in South Sound, and possibly sites in North Sound (this list based on sites where CALE occurs that is within TCB historical range – just brainstorming).

In terms of what else we need to know, the group suggested fitness performance on host species (some information about this from Nate Haan’s work), and South Sound availability of CASP in the winter (been observed in WA & OR).

**Habitat Suitability Discussion**

*Selecting Criteria for Rapid Habitat Assessment in South Sound – Mary Linders, WDFW*

To begin, a definition of habitat: “A habitat is clearly discernible where movements of adults and larvae achieve integration and cohesion…” Dennis et. al 2003. When habitat components are diffuse, it becomes harder to define. The steps for assessing habitat suitability are as follows: ID stage specific habitat needs; collaborate with stakeholders early on; define habitat needs in quantifiable terms; ID data collections sites; collect data; use data from extant sites and other sources to define acceptable terms; assess potential reintroduction sites; make a decision: suitable or not; if not, treat and re-assess. Information about steps 1-3 expanded below.

1. Identifying stage-specific habitat needs:
   - Adult stage
     - Oviposition sites for females. *Host species identify, suitable density, range of microsites.*
     - Nectar: *Key nectar species vs. occasional sources?*
     - Roost sites: *Trees? Shrubs? Tall Forbs?*
     - Basking, perch sites: *Open ground? Nectar plants? Other tall forbs?*
   - Larval stage
Suitable host plants in appropriate densities. Species identity? Availability to all larval instars pre- and post-diapause? Sufficient host density relative to larval mobility (reduce starvation and exposure)?

Suitable microsites for basking, especially post-diapause (mid-winter). Warm/cool slopes, moist/dry sites? Open ground for basking sites? Variety of microsites (exposed but protected from wind)?

- Pupal stage
  - Pupation sites. Microclimates within a day’s walk of post-diapause feeding sites microsite - not too wet, dry, etc (like Goldilocks). Exposed to sun. Minimal predation risk?

2. Collaborate with stakeholders:
   - Biological and management expertise. Resource agencies, taxa experts, and researchers.
   - Restoration expertise and site knowledge. Land owners, land managers.
   - Permitting. Resource agencies.
   - Funding and reporting. Resource agencies. Foundations, etc.

3. Define habitat needs in quantifiable terms:
   - A word model: “Semi-native prairie with multiple patches of dense and diverse host and nectar plants within a low, open vegetation structure across a variety of microsites.
   - Supported and informed by: a large body of literature on Edith’s checkerspot and other butterflies; local Taylor’s checkerspot research; and local observation and expert opinion.
   - The general word model (in step 3) worked fine for a while, but now we need measurable variables. To do this, the group outlined various habitat variables including checkerspot resources for oviposition, host and nectar resources, etc. and created abundance categories. The measurable variables also include structural characteristics, invasive exotics, and other variables of interest such as native grass.

8. Getting this data to result in a yes/no decision.
   - Used condition at extant site (at 50 acre scale) to assess and create thresholds.
   - Checked thresholds against reintroduction site where we’re seeing success as well as other data sources from literature sources, to create 5 acre scale threshold.
   - Checked that again. Used this data to identify the specific needs for the word model (‘dense and diverse host’ etc).
   - Then map RHA results to show structural, larval, and adult resources at a site. Results tell you not just if habitat qualifies or not, but if not, what’s missing.

Group Discussion
When discussing suitable habitat, what about outside factors? How do we assess predator
pressure and adjacent pesticide/herbicide use (especially at Glacial Heritage). Dan Grosboll did sweep nets and observed that diversity increased the farther you got from the adjacent property.

Jenny Heron noted that in British Columbia, they used to do plot surveys of habitat around occurrences of Taylor’s checkerspot. Unfortunately, much of the habitat is so unsuitable it’s not worth the resources needed to conduct surveys to quantify the level of unsuitability.

On a related note, there is a big increase of Asian and European gypsy moths this year which will mean a big increase in Btk (Lepidoptera-specific) pesticide use.

Day 2 – November 17


Life Cycle Vulnerabilities

Presentation – Susan Waters, CNLM

Susan created a diagram (see handout, Appendix A) in an effort to identify vulnerabilities at each stage of the Taylor’s checkerspot life cycle. She then looked at factors that impact each of those vulnerabilities, identified ongoing work, and highlighted items identified in the action plan. Diapause and pupation seem to be two stages that are: very important, poorly understood, and also hard to study – so Susan did not consider them low hanging fruit, so removed that stage from this work process. Post-diapause also doesn’t seem to be a major factor, so remove that as well. Remaining life stages break into 3 categories: 1 - Plant community; 2 - Animal interactions; 3 - Abiotic challenges (microclimate and climate change).

The group then broke into small groups of 3-4 people to select the top 3 factors they feel we need to be addressing. The resulting list is as follows:

- Host & nectar availability (x2)
- Predation (x2) (what impact are we having? Could use fire to impact mites by reducing litter.)
- Weather/microsite variety/temperature
- Fire (prescribed, changed regime, change in habitat)
- Chemicals/spray (BTK)
• Habitat condition (structure, invasives, density)
• Connectivity
• Vehicular mortality (ties into microsite variety – why are roads attractive, how can we build this into our sites?)
• Oviposition microsite characteristics – do we need to know more?

This list was referred back to as we updated the action plan, to ensure that these top priorities are addressed in our list of next best actions for Taylor’s recovery. Please refer to the 2015-2016 Action Plan to see the full list, including new tasks [marked with an asterisks (*)].
APPENDIX A - Handout

Vulnerabilities: potential negative impacts on survival or fecundity

- Lack of cover
- Lack of warmth spots
- Lack of landmarks
- Thermal impacts on habitat use
- Limited nectar availability
- Low host plant density
- Body size (fecundity)
- Lack of host plant density
- Low host plant palatability
- Early host plant senescence
- Fire-related damage
- Parasitoids, fungi, disease
- Wet weather?
- Low larval host plant density
- Predation
- Starvation
- Water stress
- Predation
- Heat stress
- Dispersal
- Genetic diversity
- Climate impacts: range shifts
- Long-term population level
- Bars to aggregation
- Predation

Risk factors:
- Lack of cover
- Low larval host plant density
- Predation
- Starvation
What aspects of Taylor’s checkerspot life history are we most concerned with in our management actions and research needs?

**Factors that could increase mortality**

**Egg stage**
- Invertebrate predation
- High temperature

**Prediapause larval stage**
- Invertebrate predation
- Early host plant senescence

**Diapause**
- Parasitoid attack?
- Fungal attack?
- Fire?

**Postdiapause larval stage**
- Bird predation? (affected by IGs?)
- Inadequate host plant density

**Pupal stage**
- Rodent predation?

**Factors that could reduce fecundity**

**Prediapause larval stage**
- Low host plant quality

**Postdiapause larval stage**
- Low host plant quality
- Low host plant density

**Adult stage**
- Not mating
- Lack of nectar resources
- Low host plant density

**Other factors you notice that are not included:**

**In *E. editha bayensis*, fecundity is usually not limiting to population growth. We don’t know whether it is limiting in *E. editha taylori*.**
## 2015-2016 Taylor’s Checkerspot Butterfly Action Plan (DRAFT)

The purpose of this action plan is to identify the next-best conservation actions that can be conducted over the next 3-5 years to support TCB recovery. An asterisk (*) indicates a newly added task.

### 1. Protect Occupied and Other Key Sites

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<thead>
<tr>
<th>Cat</th>
<th>Ref</th>
<th>Task</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>a</td>
<td>Work w/EPA to develop and implement management agreements at Scatter Creek and Cardwell Hill</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>Pursue acquisition or conservation easement with willing sellers. (e.g. South Puget Sound, Bald Hill (WA), Denny Island Private Land and Cardwell Hill properties (OR))</td>
<td>Ongoing (South Sound, BC); Opportunistic in OR, Bald Hill</td>
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<td></td>
<td>c</td>
<td>Finalize voluntary management plans on private land (e.g. Denny Island, Bald Hill (WA)) under the guidance of WDFW &amp; DNR Forest Practices Board.</td>
<td>Completed in Clallam County; Ongoing in BC</td>
</tr>
<tr>
<td>1.2</td>
<td>a</td>
<td>Minimize direct impacts to occupied sites.</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>Minimize training impacts &amp; reduce adverse impacts from wildfires, especially at R74/75, R51</td>
<td>In progress (WDFW,ONF, DNR)</td>
</tr>
<tr>
<td></td>
<td>c</td>
<td>Reduce vehicular impacts (including travel management planning at ONF)*</td>
<td>Ongoing (JBLM)</td>
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<td></td>
<td>d</td>
<td>Coordinate with BITK spray implementing parties to reduce impacts to Taylor’s checkerspot.*</td>
<td>In progress (ONF, WDFW); Ongoing (JBLM)</td>
</tr>
<tr>
<td>1.3</td>
<td>a</td>
<td>Identify existing management and restoration plans for each site and identify overlaps, conflicts, and gaps.*</td>
<td>In progress (BC), Planned (WA)</td>
</tr>
</tbody>
</table>
|     | b  | Conduct threat assessment at site level to prioritize threats (using tools such as IUCN).* | *
|     | c  | Identify necessary criteria for management plans to achieve desired outcomes for Taylor’s checkerspot.* | *

### 2. Enhance and Increase Effective Habitat

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<th>Cat</th>
<th>Ref</th>
<th>Task</th>
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<tbody>
<tr>
<td>2.1</td>
<td>a</td>
<td>Enhance habitat by controlling/removing invasive species and structural modifiers, and enhancing larval food and nectar plants as appropriate.</td>
<td>1</td>
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<td></td>
<td>b</td>
<td>Improve production of larval and nectar plant materials throughout the range, esp. in Clallam Co., BC, and Benton Co.</td>
<td>In Progress</td>
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<td></td>
<td>c</td>
<td>Reduce and resolve conflict at sites where both Castilleja species occur and coordinate future reintroduction of either species.*</td>
<td>13</td>
</tr>
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</table>
|     | d  | Collect information on plantago pathogen in order to identify and calculate the level of risk to Est. (relate to larger picture of host plant population change). | *
| 2.2 | a  | Improve connectivity between occupied areas and/or suitable habitat. | 9 |
| 2.3 | a  | Define habitat restoration targets through research. | 11 |
|     | b  | Evaluate quality of various host species in relation to butterfly performance in all life stages (e.g. phenology, chemical content, abundance, environmental, etc.). | In Progress for pre-diapause larvae (UW) |
|     | c  | Define butterfly habitat selection through research (e.g. oviposition & adult habitat, nectar and larval food plant density, phenology, soil type structure, and spatial arrangement) | In progress. Ovipos. Complete in Clallam Co., AIA, OR. |
|     | c  | Understand oviposition site selection and larval mortality in response to plant community characteristics and thermal context.* | 8 |
|     | d  | Determine the characteristics of occupied habitat, with respect to nectar plants, host plants, and vegetation structure. Build upon previous work. | Ongoing (UW, WDFW); course review completed (IAE? |

### 3. Utilize existing knowledge to create white paper that documents both known habitat characteristics and known habitat management practices and identifies information gaps

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<th>Task</th>
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<td>3.4</td>
<td>a</td>
<td>Ongoing (opportunist)</td>
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<tr>
<td>2.6</td>
<td>6. Increase understanding of impact of external factors.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2.6.a</td>
<td>a. Evaluate impact of predators.</td>
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<td></td>
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<tr>
<td>2.6.b</td>
<td>b. Evaluate the impact of vehicle off-road traffic on plant population.</td>
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<tr>
<td>2.6.c</td>
<td>c. Evaluate the impact of fungicide and other pesticides.</td>
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<tr>
<td>2.6.d</td>
<td>d. Improve our understanding of the influence of weather and climate change on population dynamics and reintroductions.</td>
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<td>2.7</td>
<td>7. Refine criteria and establish standardized habitat assessments (by region) to evaluate habitat suitability.</td>
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<tr>
<td>2.7.a</td>
<td>a. Assess status of occupied and key sites.</td>
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### 3. Captive Rearing & Reintroduction

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<tr>
<td>3.1</td>
<td>1. Continue to implement captive rearing and reintroduction programs, including monitoring source and release sites in South Sound.</td>
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<tr>
<td>3.1.a</td>
<td>a. Evaluate genetic transfer between source and reintroduction sites following establishment.</td>
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<tr>
<td>3.2</td>
<td>2. Where appropriate, initiate efforts to increase the number of populations through captive rearing and reintroduction (by region).</td>
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<tr>
<td>3.2.a</td>
<td>a. Identify and prioritize potential future release sites in coordination with recovery planning efforts and entities (e.g. in OR).</td>
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<td>3.2.b</td>
<td>b. Develop new facilities or additional capacity for captive rearing, as needed (e.g. Benton County, Dungeness Island).</td>
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<td>3.3</td>
<td>3. Document decision making and state of knowledge for population increase efforts.</td>
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### 4. Survey / Monitor

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<tr>
<td>4.1</td>
<td>1. Develop suitable survey and monitoring protocols: to determine occupancy, trends, distribution, and abundance.</td>
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<td>4.1.a</td>
<td>a. Develop methodologies for calculating an estimate of population size.</td>
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<tr>
<td>4.2</td>
<td>2. Annually monitor all known populations.</td>
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<td>4.3</td>
<td>3. Prioritize and survey suitable habitat to identify additional populations and/or expansion.</td>
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### 5. Coordination & Education

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<tr>
<td>5.1</td>
<td>1. Determine and implement best approach for increasing numbers of populations within each region (e.g. habitat enhancement, habitat manipulation, translocation, captive rearing and reintroduction).</td>
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<td>5.2</td>
<td>2. Develop a Recovery Plan.</td>
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<td>5.3</td>
<td>3. Review data from genetic and meta-population studies to direct population management.</td>
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<td>5.3.a</td>
<td>a. Determine the appropriate taxonomy for populations identified as E. taylorii using genetic analyses.</td>
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<td>5.3.b</td>
<td>b. Determine the degree of genetic structuring within and between populations of E. taylorii.</td>
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<td>5.4</td>
<td>4. Address challenges resulting from ESA listing on ability to monitor populations and conduct recovery actions and cooperatively develop solutions (e.g. monitoring &amp; project survey requirements; recovery planning; conservation measures).</td>
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<td>5.4.a</td>
<td>a. Develop partnerships with additional Federal Agencies that contribute to recovery of TCB, reduce burdens and complications associated with managing for listed species where appropriate, and carry out the ESA Section 7(a)(1) responsibilities of those Federal Agencies (e.g., develop programmatic biological opinions for Federal programs that affect TCB).</td>
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<tr>
<td>5.4.b</td>
<td>b. Develop partnerships and voluntary agreements with State and private entities that contribute to recovery of TCB, reduce burdens and complications associated with managing for listed species, and provide assurances for landowners (e.g., pursues ESA Section 10(a)(1)(A) and 10(a)(1)(B) agreements and permits for researchers, land managers, and willing landowners).</td>
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<td>5.5</td>
<td>5. Share information between entities; establish partnerships; and maintain a working group.</td>
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<td>5.5.a</td>
<td>a. Utilize synergistic restoration efforts (e.g. funding, communications, messaging, political/public support) with complementary species-at-risk to support a larger distribution of healthy functioning ecosystem (e.g. SWG project, CALE).</td>
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<td>5.6</td>
<td>6. Identify opportunities to conduct public outreach and education, including opportunities to share information about listing and conservation to landowners that may have occupied or potential habitat.</td>
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A single page PDF version of the final plan can be found at cascadiapriarieoak.org.