

Taylor's Checkerspot Annual Working Group Meeting Minutes

November 7 & 8, 2017 | Oregon Zoo, Portland, OR

Day 1 – Nov. 7, 2017: Partner Updates

In Attendance:

Dana Ross; Adam Stebbins, *Benton County*; Sanders Freed, Elspeth Kim, Bill Kronland, Susan Waters, *Center for Natural Lands Management (CNLM)*; Kelli Bush, Keegan Curry, *Evergreen State College*; Matt Blakely-Smith, *Greenbelt Land Trust*; Tom Kaye, Andy Neill, *Institute for Applied Ecology*; Conrad Ely, Dan Grosboll Emily Phillips, *Joint Base Lewis-McChord (JBLM)*; Isaac Stanlin, *Oregon State University*; Karen Lewis, David Shepardson, Julia Low, Jessie Car, Tia Perry, Ronda Naseth, *Oregon Zoo*; Judy Lantor, Tom McDowell, Ginger Phalen, Zach Radmer, Karen Reagan, Rich Szlemp, *US Fish and Wildlife Service (USFWS)*; Amy Kocourouk, *USFWS/NRCS*; Karen Holtrop, *US Forest Service*; Hannah Anderson, Mary Linders, Gail Olson, Ann Potter, Lisa Randolph, *Washington State Dept. of Fish and Wildlife (WDFW)*; Regina Johnson, Graywolf Nattinger, David Wilderman, *Washington State Dept. of Natural Resources (WDNR)*.

USFWS Updates

Tom McDowell, USFWS – Recovery Planning

We all face a lot of challenges - resource, regulatory, biological, etc. Our continued efforts to work together on the ground will be necessary to achieve recovery. The recovery process is changing. As discussed in prior meetings, 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. There is currently a rough draft recovery outline and a rough draft SSA. Goal is to complete a draft of the recovery plan by September 2020.

Karen Reagan and Zach Radmer, UWFWS – New Roles

With Ted Thomas's retirement, Karen and Zach have assumed new roles regarding Taylor's checkerspot (TC). Karen is the species lead for listing and recovery (Sections 4, 6, 10), while Zach is the species lead for consultation (Sections 7, 10). Rich Szlemp continues to be the species lead in OR. What do these sections do? Section 4 – determination of endangered species and threatened species. Section 6 – cooperation with the states. Section 7 – interagency cooperation. Section 10 – exceptions (such as permitting). Section 4 includes the SSA. Section 6 is the point of contact for recovery funding proposals. Section 7 – informal and formal consultation with federal agencies. Exceptions – scientific permit review and processing, safe harbor agreement development, habitat conservation plan development. Rich works on all of this in OR. In addition to these three individuals, staff from the Partners program (Judy Lantor and Ginger Phalen) and Amy Kocourouk work with TC as well.

It has not yet been decided if a recovery team will be put together. Per mandate, the state natural resource agency and someone from the office of the Governor will be invited to cooperate on the SSA.

Rich Szlemp, USFWS – Oregon Translocation

Small numbers this first try for translocation in Oregon but it was an effort to get some experience and learn early lessons. Larvae were collected and cared for until they laid eggs (they all did). Goal was 1000 eggs and that goal was reached! 1,031 from 10 females.

Adult surveys: north release unit mostly grass, not a lot of nectar. Southern part had a bunch more nectar – found most of the adults here. Plan to do future releases in this area to establish a population. Lessons learned and next steps: this is an ongoing effort that will take continuous releases. Will also look into other release locations. Looking for cooperative landowners that are willing to receive butterflies.

The objective is to establish a self-sustaining population at Fitton Green. In doing so, work with partners to learn how to captive rear and release at other locations. KATU news went to the prison and did a video on the program. Tom Kaye did a lecture at the prison about the TC and captive rearing. Four women currently working to raise larvae.

From meeting materials: I was able to move 50 Taylor’s checkerspot larvae on March 16, all from Beazell Memorial Forest (35 from Middle Meadow, 15 from North), and another 50 on March 19 [25 from Beazell (20 from Middle Meadow and 5 from Summit) and 25 from the powerline area northeast of Fitton Green] to the southern portion of Fitton Green. I placed them at two different locations within Fitton Green South, each location receiving a total of 25 per day for a total of 100. I did spend a little time on Sunday looking for the ones I placed on the previous Thursday, but not surprisingly, I didn't locate any. One general note was that the released larvae were not all of same size at either location. On May 3rd, eight adults were observed by Dana Ross in the release area. On May 8th, I observed a total of five adults.

Oregon Captive Rearing Update

Ronda Naseth, Oregon Zoo – Oregon captive rearing (from meeting materials):

First eggs laid: 21 May 2017	Egg development: all 27 cups developed and hatched.	Estimated egg count: 1,031
Last eggs laid: 25 May 2017		
First 1 st instar reached: 31 May 2017	Average days from lay to hatch: 11	Larvae development: first official count of lab-hatched with known matriline was 833.
First 2 nd instar noted: 6 June 2017	Average days from 1 st to 2 nd instar: 7	
First 3 rd instar noted: 12 June 2017	Average days from 2 nd to 3 rd instar: 5	
First 4 th instar noted: 15 June 2017	Average days from 3 rd to 4 th instar: 5	Larvae delivery: first official count of plant-hatched larvae with unknown matriline was 151.
First 5 th instar noted: 25 June 2017	Average days from 4 th to 5 th instar: 10	
Warm diapause began 25 July 2017	(32 larvae in this stage)	All larvae now in diapause. Total larvae in diapause: 935
Cold diapause began 20 Sep 2017	(903 in this stage)	

Rearing Issues: We performed our first diapause check on 22 October and the larvae looked cozy and healthy. Two runts were observed and only two marginally damp/frassy paper towels were changed out. Movement = 3%. See next page for breakdown of movement by diapause cup. Min/max checks will continue weekly on Wednesdays. Next diapause check is scheduled for 15 November.

Rearing conditions and environmental data: While there was some concern expressed about the diapause shed doors not closing properly, I have asked Facilities not to make any repairs at this time as doing so could be disruptive for the larvae. Additionally, there didn't appear to be any adverse impact on the larvae from these slightly ajar doors.

Two of the terra cotta saucers had some water in them, and one of the terra cotta pots was quite wet. This appeared to correlate with the roof vents on the shed and what the technicians reported as "sideways rain" in the preceding days. Again, no adverse impact on the larvae cups or the larvae themselves was observed, but we did stagger the pots differently so none were positioned directly under any roof vents. We added a lid to the cup containing the min/max to capture environmental data that most closely resembles that of the larvae cups.

Washington Captive Rearing Updates

Keegan Curry, SPP - Mission Creek Captive Rearing

Oregon Zoo and Nate Haan provided some supplementary eggs in 2016. Kept 24 larvae for 12 matrilineal (in all, 329 held for breeding). 93% development of eggs for wild adults. SPP has received USFWS funding to expand rearing at Mission Creek. A second greenhouse will be built that should double capacity. Completion anticipated by May 2018 that will support full colony by Spring 2019.

From meeting materials: The 2016 captive breeding population was comprised of 299 adult butterflies. These were the offspring of 2015 wild females reared at Mission Creek. Mission Creek conducted 298 breeding introductions, resulting in 32 copulations and 8 productive females. A total of 10 wild gravid females were collected in 2016 and transported to Mission Creek for oviposition. Out of the 10 wild females, 7 produced viable eggs that hatched. In May 2016, 131 adults (103 females and 28 males) that were surplus to the captive breeding effort were transferred to WDFW for release.

A total of 3,940 eggs were collected in April and May 2016, resulting in 3,166 pre-diapause larvae. 3,184 larvae entered diapause, including 47 second diapause larvae. On 17 February 2017, 3,174 larvae were removed from diapause (99.8% survival through diapause). In early March 2017, 2,770 post-diapause larvae were transferred to WDFW for release at TA7S and GHP. 329 post-diapause larvae were retained for the 2017 captive breeding colony, 123 returned to diapause and 174 pupae developed. A total of 156 adults emerged and were included in the 2017 breeding colony at Mission Creek. On 24 May 2017, 8 adult males were transferred to WDFW for release, followed on 2 June 2017 by 71 more adults (54 females and 17 males).

From MCCCW 2016-17 Annual Report:

Table 1. Number of individuals and percent survival by life stage for Taylor’s checkerspot butterflies reared at Mission Creek Corrections Center for Women, Belfair, WA, 2016-17.

Life stage	Wild Founders 16FL ¹		Captive-bred 16MC		Wild Founders 15FL ²	
	#	% survival	#	% survival	#	% survival
Eggs	2819	---	1121	---	---	---
Egg to hatch	2615	0.928	551	0.492	---	---
Hatch to diapause	2583	0.988	541	0.982	---	---
Diapause to wake-up	2577	0.998	541	1.000	47	---
Diapause to release	2545	0.988	538	0.994	47	1.000
Postdiapause	329	---	---	---	---	---
Multi-diapause	123	0.374	---	---	---	---
Pupation	174	0.845	---	---	---	---
Eclosion	156	0.897	---	---	---	---

¹QC larvae not included.

²These are 2nd diapause

Karen Lewis, Oregon Zoo – Washington Captive Rearing

The 2016 breeding season was really successful. Unfortunately, only 500 made it to release. >2000 were dead at wake up (ones that seemed fine the week prior) – consistent with issues for the last four seasons. Of those that survived, 101 made it to second diapause. Good copulation in 2017 breeding season but not many eggs laid, and low hatch rate.

Larval mortality investigation: Koch’s postulates. Purpose: is an infectious process responsible for high rates for larval mortality at OZ? Used ninety presumed healthy larvae, half each from OZ and MC. Split into 3 cups of five larvae and each cup was then randomly assigned to one of the 3 conditions. Three conditions: super control, control, and treatment. Super control housed with other healthy larvae. Only animals that died in this trial were 3 animals from the ‘super control’ which makes them feel confident it’s not a pathogen. Signs point to it either being the food source or environmental conditions. Feel like environmental conditions are good, which brings it back to food.

Also using larvae produced at Oregon zoo this year to do a food source trial. Hoping to detect differences in mortality.

<i>Captive Rearing (Washington) - Prediapause larvae release; Postdiapause larvae released; adults released</i>				
<i>Facility</i>	<i>2014</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>
Oregon Zoo	0; 0; 0	0; 490; 110	1003; 1210; 80	0; 1163; 66
Mission Creek	0; 2608; 56	0; 2305; 116	0; 2477; 131	0; 2770; 79
U. of Washington	NA	NA	0; 0; 20	

Mary Linders, WDFW – South Puget Sound Releases/Reintroductions

Releases were carried out in 2017 at GH and T7S. 2017 counts were really low. Lots of zeros. Did see a high rate of return to diapause at captive rearing facilities though, so may not be as bad as it looks. Scatter Creek, Range 50, and Range 76 all had good numbers though. Scatter Creek South made huge gains this year. In addition to southern unit, northern unit had 53 observations, which is a good start. Carrying capacity is not a concern right now. In regards to patch size – the current approach is to look for patches with one host plant per larvae put out. Minimum of 10 plants per square meter. Regarding a delayed flight season – is there a mismatch with the flight season and phenology? More interesting is the drought causing a jumbled up mix of timing of flowering. We have provided enough variety of nectar though that there’s usually something in bloom.

From meeting materials: A total of 3,024 larvae were released at GHP on 10 and 23 Mar 2017, with a total of 909 larvae released at TA7S on 16 and 30 Mar 2017. In addition, a total of 145 adults and one Taylor’s checkerspot pupa were released from the captive rearing facilities to TA7S between 30 May and 2 June 2017. We used distance sampling to estimate daily population density, daily population size, and to illustrate the distribution of adults at two current (GHP and TA7S) and two former (R50, SCS) release sites, and at R76 (source site). The flight season initiation was the second latest recorded since 2005, starting a full month later than in 2016. Peak counts were staggered across a broad range of dates from 10 to 29 May 2017. Peak day encounter rates varied among sites, with about 60 percent more butterflies observed at R50 (0.142 checkerspots/m) compared to SCS (0.090/m). Rates at R76 (0.053/m for transects 1-16; 0.048/m for transects 1-12) were about one third of those at R50 and half of what was observed at SCS. The shift away from R76 being the site with the highest encounter rates began in 2016. Only 1 checkerspot was observed at GHP, which was also true for TA7S (prior to release of adults). The peak raw count at R50 (1,410) was the highest of any site in 2017, with adults distributed across the majority of the 22-ha monitoring area based solely on natural reproduction. Checkerspots have increased their spread annually since 2014 with 51.7 acres occupied in 2017, the highest to date. This population is officially established based on the project definition. Using the same standard, analyzed distance data show that SCS also exceeded the target of 250 adults in a single day abundance estimate in 2016, with a peak single day abundance estimate of 1,463 (range 692-2,458), however a release was conducted in 2016 due to concerns about the potential effects of *El Nino* weather on small populations.

Staff from Joint Base Lewis-McChord continue to monitor PCM and adjacent parts of TA14 using transects with a 100-m spacing; these surveys are also conducted around the perimeter of 91st Division Prairie (the Artillery Impact Area) as well as on TA6; checkerspots were recorded at several locations where monitoring for colonization will continue as resources allow.

Population Status Updates

>> For all survey results in this document – <u>comparisons are only appropriate across lines</u> , not across tables or sites. <<					
Table 3. South Sound (Distance estimation - peak single day count and associated single abundance estimate). <i>Transect spacing is 25 m at all sites except R76, where a 50 m spacing is used.</i>					
Site, Land Owner	Alias	2014	2015	2016	2017

Range 76, JBLM	R76	754; 4020	652; 4028	114; 1311	582
Range 50, JBLM	R50	331; 1209	622; 1730	1246; 3391	1410
Scatter Creek South, WDFW	SCS	60; 116	130; 336	539; 1463	717
Glacial Heritage, Thurston Co.	GHP	48; 91	69; 190	85; 246	1
TA7S, JBLM	TA7S	52; 120	59; 235	1; NA	1
Pacemaker, JBLM	PCM	0; NA	0; NA	NA	NA

Ann Potter, WDFW – Clallam County sites

The flight period was late, especially in relation to the last two years (which have had early flight periods). Numbers were down quite a bit.

From meeting materials (by Anita McMillan and Shelly Ament, WDFW): Taylor’s Checkerspot adults were monitored on two Clallam County sites under state and private ownership, Eden Valley and Dan Kelly Ridge, located west of the Elwha River. The survey effort was led by Anita McMillan and Shelly Ament, WDFW, and biologists from CNLM and DNR contributed to 2017 monitoring at the Dan Kelly Ridge site. Monitoring was conducted by walking established transects and counting butterflies (Pollard and Yates method).

The adult flight period in 2017 was characterized by a notably late start (first adult observed May 4), and an overall short duration of approximately one month. At Eden Valley, three complete surveys (all transect segments surveyed) were made: May 19 (40 adults), May 22 (74 adults), and June 5 (9 adults). An additional survey was initiated on May 9, but was not completed as low butterfly numbers indicated the flight period was just getting underway. At Dan Kelly Ridge, three complete surveys were made to the CNLM ownership area (West End): May 19 (46 adults), May 26 (134 adults), and June 6 (33 adults). Two complete surveys were conducted to the non-CNLM areas: May 9 (8 adults), and May 19/20 (82 adults). In addition, two partial visits (2-3 of 5 transect segments) were conducted May 26 (131 adults) and June 6 (38 adults) to the non-CNLM areas.

Within Clallam County, WDFW also searched for Taylor’s Checkerspot on several sites with potential habitat and/or recent detections. Three visits were made to the Port Angeles Landfill, location of a 2016 Taylor’s Checkerspot detection approximately 5 miles from the nearest known occupied site. Seven visits were made to the Port Angeles Airport, a nearby site with potential habitat, and a single survey was made to a nearby cemetery. Two bald-meadow complexes located west of the Elwha River were also surveyed for the butterfly (Pyramid Mountain and Storm King Mountain), as was a bald northeast of Hurricane Ridge (Round Mountain), and a meadow west of the Dungeness River (Upper McDonald Creek). No Taylor’s Checkerspots were detected during these efforts to locate new sites.

Karen Holtrop, USFS – Clallam County sites

Numbers were way down at all USFS sites (across the board). Like other sites, late short season. These sites are all within 5 miles of each other – little bit of genetic info available suggests they are genetically related. This is likely why the small populations can persist. Looking for a protocol that can reduce the monitoring burden, tough to get full coverage.

From meeting materials:

Adults

- In 2017 we conducted adult surveys at Bear Mountain, Three O'clock Ridge (3OCR), Upper Dungeness (UD), and Gray Wolf. (Some areas only received one survey visit with acceptable weather conditions.)
- The adult counts were *much* lower than previous years at all areas of all sites. (We are hoping this is a natural population fluctuation, and will numbers will bounce back.)
- Flight season: adults were observed between 22 May and 30 June (UD); 25 May and 20 June (3OCR); and 22 May and 6 June (Bear Mtn.). Generally later than 2016 and shorter.
- We again detected checkerspots near Silver Creek, a location where adults had not been detected prior to 2016.

Larvae

- We conducted pre-diapause larval monitoring surveys at UD NE Clearcut and Bear Mtn. Larval densities were good at UD but not at Bear Mtn. Detected 14 pre-diapause / oviposition sites, of which 7 were within habitat restoration veg. cutting areas.
- We also surveyed Silver Creek area and found 6 oviposition spots in a small area.

Clallam County USFS Sites (daily or visit high adult counts)					
	2014	2015	2016	2017	Notes
Bear Mountain, USFS	18	67	31	17	3 – 4 survey visits/year (4 in 2017)
Gray Wolf, USFS	11	35	--	1	Only 1 survey visit/year. Not surveyed in 2016.
Three O'clock Ridge (TOR), total	242	211	127	10	
<i>TOR road</i>	21	39	21	4	Several visits per year (6 in 2017)
<i>TOR clearcut</i>	54	49	42	0	1 – 2 visits per year (1 in 2017)
<i>TOR balds</i>	148	109	52	6	1 – 2 visits per year (1 in 2017)
<i>TOR N.</i>	19	14	12	0	Several visits per year (5 in 2017)
Upper Dungeness (UD) total	784	287	190	46	
<i>UD Road</i>	290	124	65	14	Several visits per year (6 in 2017)
<i>UD clearcut openings</i>	494	163	114	10	1 – 2 visits per year (1 in 2017)
<i>UD Silver Creek</i>		-	11	22	5 survey visits
Clallam County WDFW Sites (peak single day adult counts with dates)					
Eden Valley	153 <i>May 7</i>	321 <i>May 2</i>	281 <i>May 6</i>	74 <i>May 22</i>	
Dan Kelly Ridge	<10	57 <i>Apr 18/19</i>	175 <i>Apr 30/May 1</i>	131 <i>May 26</i>	
Clallam County CNLM Site (peak single day adult counts with dates)					
Dan Kelly Ridge West end	<10	104 <i>Apr 18</i>	176 <i>Apr 18</i>	134 <i>May 26</i>	

Clallam County USFS Sites (larvae counts - densities)				
	2015	2016	2017	Notes
Upper Dungeness NE Clearcut	11 (9.2/ha)	1 (0.8/ha)	13 (10/ha)	2015-2016 survey area was 1.2 ha; 2017 1.3 ha.
Bear Mountain	5 (25/ha)	3 (5/ha)	1 (2/ha)	2015 survey area was 0.2 ha; 2016 0.6 ha; 2017 0.5 ha.
Silver Creek	--	--	6 (30/ha)	Survey area 0.2 ha.

Zach Radmer, USFWS – Clallam County site

Graysmarsh is an additional privately-owned site in Clallam county. Working with USFWS to get a safe harbor. Short season and high count was 500.

Dan Grosboll, JBLM – South Sound JBLM sites

Currently using a distance monitoring protocol. Across rest of sites on installation they are doing 100 m transects to ID any additional sites.

Dana Ross – Benton County sites

Data represents not so much a population estimate but an index of population. This was the lowest year on record at Fitton Green. This reflects most on two satellite meadows, which have been gradually degrading over time. On the positive site, the powerline area has sustained its population and Dana expects to see increased numbers in the future. Beazell has received a lot more management, much better habitat. This year's 'crash' is the 4th highest count in the last 15 years – the base is much higher than it used to be. This is great progress thanks to all the habitat work.

Habitat Management Updates

Sanders Freed, CNLM – Dan Kelly

Focus is on opening balds and seeding in host and nectar plants. Have been going up twice a year to do work since 2013 and survey numbers are going up.

From meeting materials: Tree and shrub removal was conducted in the fall of 2016 within and between balds. Seeding of native species was also conducted within and around the balds. Species seeded include fescue, plantago and plectritis. Another restoration trip is planned for fall 2017 that will include more tree and shrub removal and more seeding, including *Castilleja hispida*.

Ann Potter/Dave Hays, WDFW – Dan Kelly

Primary challenge is the sporadic availability of work crews.

Karen Holtop, USFS - Clallam County Sites

Removing small shrubs and trees and cooperation with Dave Hays. Had WCC crews this year at UD and Bear Mountain. Started getting seed from CNLM – *plectritis* and *colinsia* which seems to be coming up well. Just got *lomatium* and CAHI seed and WCC crew seeded plots last week. Try to do pre-diapause larvae surveys in habitat enhancement areas. At UD – quite a few larvae in habitat restoration areas, which is good news.

From meeting materials: Tree and shrub cutting and piling of about 2 acres each occurred at Upper Dungeness NE Clearcut and Bear Mountain in October 2017. Approximately 0.5 lb. of *Collinsia parviflora* were seeded in the disturbed areas at each site. Last year's seeding of *Plectritis congesta* and *Collinsia parviflora* appeared very successful, with good germination. We are receiving *Castilleja hispida* seed from Center for Natural Lands Mgt. and plan to establish *C. hispida* monitoring seed plots.

Dave Hays, WDFW – Scatter Creek

From meeting materials: In late August 2017 a wildfire in south Thurston County burned through the Scatter Creek Wildlife Area charring 345 acres of the preserve. The fire did extensive damage to structures, destroying the historic 1860's home and barn on the preserve. The fire also incinerated important habitat for over a half dozen butterflies that the state has deemed Species of Greatest Conservation Need, potentially killing scores of caterpillars and pupae. These butterflies include the Taylor's Checkerspot, Valley Silverspot, Great Spangled Fritillary, and Hoary Elfin, as well as the Oregon Branded, Mardon and Sonora skippers. The fire also burned significant stands of oaks and fir on the property.

The Scatter Creek Wildfire burned through a vast swath of the southern portion of the preserve, hitting far more of the landscape than would be targeted with controlled ecological burns. The fire intensity varied across the burn, from extremely hot in and around trees, to fairly cool in portions of the prairie, especially areas that had been burned in the past few years. For Taylor's Checkerspot, the fire impacts are relatively unknown. Checkerspots had been expanding throughout the southern unit of the Wildlife Area, so they may have been present in the approximately 230 acres of grassland that burned. Of the main area with concentrated Checkerspots, approximately ¼ -1/3 of the habitat was burned.

Restoration efforts are underway include seeding burned areas that could be prepared, through herbicide application in October 2017. Additional seed was purchased through the Center for Natural Land Management specifically for checkerspot larval and adult host plants. Future potential efforts may include expanding prairie and oak savannah through the removal of up to half of the burned conifers on the site.

David Wilderman, WDNR – Bald Hill and Mima Mounds

Neither site is currently occupied. Most work was focused on Bald Hill this year - removing conifers, conducting weed control, and seeding with TC food plants. Cleared a new area of mature conifers this year (2 acre area in north bald). New portion of bald getting work. Lots of potential to convert to checkerspot habitat. In addition to invasive plant control, working to maintain areas that have received checkerspot enhancement. Castilleja population up this year after some bad drought years. At Mima – not much checkerspot specific work due to funding issues, just tall oat grass control. Did get a 6-acre burn in that was followed up with seeding and planting.

Sanders Freed, CNLM – South Sound sites

At Glacial Heritage, carried out two burns that were then seeded with checkerspot mix. Will be planting 10K plugs of balsamroot, plantago, and triternatum to increase hosts and nectars. At Tenalquot – also burned a unit that got checkerspot mix, and will also get 10K plugs. At Wolf Haven – a five-acre burn was carried out that received checkerspot mix. No plantago currently put out at Wolf Haven but hope to add that in next few years to increase it's potential for TC introduction. At Cavness ranch – conversion to prairie from a Christmas tree farm is going well. Really good response by CALE. Still far from being a checkerspot site but hope in the future there will be 180 acres with lots of *levisecta*. Two other preserves receiving work are Violet Prairie and Deschutes Prairie which are both ag conversion sites.

From meeting materials: Glacial Heritage Preserve - Spring herbicide spot treatments are conducted for tall oatgrass, while both manual and chemical methods are used to treat Scotch broom within the butterfly enhancement areas. Three units were burnt in 2016 that received butterfly host and nectar species in the seed mix. In addition, 35,000 host and nectar species were planted in one of the burn units. In 2017, two burn units were within enhancement area 2, and one burned most of enhancement unit 1. All will receive seed this fall, and one of the units will receive approximately 15,000 plants. In addition, the buffer zone between *Castilleja* populations was pulled. *Castilleja hispida* is planted and seeded with enhancement unit 2, while *Castilleja levisecta* is seeded in enhancement unit 1.

Tenalquot Preserve- Spring herbicide treatments for tall oatgrass, and manual removal of Scotch broom are conducted annually. Two units were burnt in 2016, one for butterfly enhancement and the other for general prairie restoration. Both units were treated with glyphosate post fire, followed by seeding. Approximately 35,000 butterfly host and nectar species were planted in the butterfly enhancement burn unit. Spot treatments for HYRA and LEVU were conducted in the butterfly enhancement units. A 3-acre burn was conducted in the fall of 2017, with follow up spot treatments for HYRA and LEVU, which will be seeded and plugged this fall. *Castilleja hispida* seeding and planting will resume at this site in 2017.

Wolf Haven- Spring grass control with herbicides and manual removal of Scotch broom and knapweed are conducted annually. A 5-acre unit was burnt in 2016 followed by seeding and plugging. Approximately 10,000 nectar species were planted here. *Castilleja levisecta* has established well at this site. *Plantago* is not seeded or planted here, although it is fairly common already. Another 5- acre burn was conducted in the fall of 2017, with follow up spot and boom treatments for HYRA and LEVU, which will be seeded and plugged this fall.

Cavness Ranch- Approximately 50 acres of retired Christmas tree farm has been converted to prairie, with a large population of *Castilleja levisecta*. A burn was not conducted in 2017, but the prairie area will be over-seeded this fall with more CALE hosts. Little weed control is needed because of the long history of herbicide applications.

Violet Preserve- At Violet Preserve, a total of 12 acres has been converted to prairie with both forbs and grasses. Another eight acres has been seeded with fescue, and another 10 acres has begun herbicide treatments. The area seeded with fescue will receive forbs in the fall of 2017, which will result in 20 acres of new prairie. *Castilleja hispida* has established well on the site from seed.

Deschutes Preserve- At Deschutes Preserve, agricultural conversion is beginning, with a total of 14 acres being treated. Seven acres has been treated and seeded with fescue, which will have forbs added in 2018. Another seven acres is undergoing the first year of herbicide treatments. Over the next several years- 36 acres are scheduled for conversion. Which species of *Castilleja* to introduce to the site is still under debate.

Dan Grosboll, JBLM – Range 76

They have begun to do direct seeding, especially in areas with higher fire intensity and where gophers have created some bare soil. This year there's going to be a project to dig up unexploded ordinances across the site – seeds will go into these turned over soil areas.

Bill Kronland, CNLM – TA7S

This is an occupied site. Not a lot of work going on at this point, the focus is on maintenance. Two unoccupied sites – TA15 (formerly occupied) and Johnson prairie (not clear if occupied formerly but high quality). Getting more work here. Preparing 10-acre release-ready patches. Another interesting result of this information-based restoration is that this year as burns were being implemented Kathryn Hill looked at soil moisture and temperature, etc. pre-burn, running an anecdotal equation in her head. This allowed her to work with JBLM fire manager to determine if a burn should go forward – or if they should burn a black line instead and burn later when soil moisture was higher and it was a much more patchy burn that could provide a better outcome. Similar approach was used at Johnson prairie, but not as far along that path and have more flexibility in determining where these patches are. Being very purposeful in picking patches considering future actions needed based on location, characteristics, and regulatory limitations on each patch.

From meeting materials (by Dan Grosboll and Bill Kronland): Habitat enhancement work for Taylor's checkerspot butterfly has progressed in three areas on JBLM over the past year: maintaining and improving habitat for the extant population on Range 76, treating exotic vegetation for the translocated population on Training Area 7S, and preparing release-ready habitat on Training Area 15 and Johnson Prairie.

*R76 restoration and enhancement-*Range 76 is an unusual environment for habitat restoration and enhancement because it is littered with potentially deadly dud artillery shells and has other significant constraints. This year followed earlier experimental direct seeding of annual checkerspot hosts with application across 175 acres of direct hand seeding checkerspot nectar and host resources into microsites where seed/soil contact would be possible such as gopher mounds and areas of higher fire intensity. Larger seeded areas with a substantial exotic grass component will be sprayed with grass specific herbicide as well as ongoing treatment of habitat modifying weeds.

We are preparing 41 acres of release-ready habitat across 7 locations on Training Area 15. Locations range in size from 3.3 to 5 acres, with the goal of enhancing 113 acres of buffer habitat among the release-ready areas. Release patches are also being strategically spread among burn units while seeding prescriptions are following diverse cover targets to maximize our ability to plan prescribed burns and use firing patterns to create refugia on the landscape. Intensive enhancements began on Training Area 15 in fall 2014, and translocations may begin in spring 2018.

Intensive enhancements began on Johnson Prairie in earnest in fall 2016, following similar strategies being used on Training Area 15. Currently, we are preparing 24.8 acres of release-

ready habitat across 2 areas, with 42 acres of high-quality buffer. Our goal is to have these areas ready for potential translocation by 2020.

Andy Neill, IAE – Benton County sites

IAE works on the three occupied sites – powerline area (near Fitton Green), Beazell, and two small meadows that are privately owned. Work is small scale – 1-5 acre sites. Invasive grasses and encroaching shrubs and trees biggest issue. At Beazell, the last year and a half has had a lot of tree removal, utilizing an AmeriCorps crew. Will get more food and nectar plants in the ground. Have added *Castilleja levisecta* and *erriopholum* to the site. Saw adult TCs on each of the patches that were enhanced last year. At the powerline area, good progress made – including working with the Partners Program. Powerline is maintained by BPA every few years – making good progress on collaborating with BPA to guide work and utilize BPA resources/machinery. Funding for restoration is very limited at the two small meadows on private land.

In the works this fall – Benton county will burn a few sites, followed by herbicide treatment and plant and seeding TC resources there to establish options for future sites. Most plant resources are grown through the WV seed cooperative, but they are having issues with locating site-appropriate seed of some of the important nectar food plants to ensure a diversity of flowering food plants throughout the flight period.

From meeting materials: In 2017, restoration of Taylor's checkerspot butterfly (TCB) habitat at Cardwell Hill area and Beazell Memorial Forest, both in Benton County, Oregon, has focused on removal of invasive grasses, reduction of shrub and tree encroachment around core TCB habitat, and augmentation and expansion of TCB habitat by introducing seed and plants of TCB food and nectar plants.

Cardwell Hill Area (Private): In fall 2016, IAE planted 2,600 plants and added over 36 pounds of native seed in disturbed areas after a fall mow and herbicide treatment. Plants and seed added to these areas were primarily TCB nectar and food plants that included locally, hand collected seed of English plantain. Invasive grasses, such as false brome and tall oatgrass, were targeted with a spring 2017 broadcast of grass specific herbicide and spot spray of glyphosate. In fall 2017, the Bonneville Power Administration (BPA) coordinated with USFWS, IAE, and the landowner to establish restoration actions to be completed by BPA and identify TCB occupied areas that are to have minimal disturbance. The primary effort of the BPA crew was to clear trees and tall shrubs from the area under the BPA powerline as part of scheduled maintenance. The BPA crew mowed shrubs, trees, and tall grass and applied herbicide to shrubs that were mowed in fall 2016. The expressed willingness of the BPA to work to improve TCB habitat at this site is a welcome addition to restoration planning for the future.

Beazell Memorial Forest (Benton Co.): In 2016, seven small (0.01-0.02 acre) habitat areas outside of core TCB habitat were sprayed, raked to remove thatch, and planted with blubs, bareroot plants, plugs, and seed. These habitat areas have become patches of high density TCB nectar and food plants, including locally collected English plantain seed. In addition to the habitat areas at Beazell Memorial Forest, seeding and planting of TCB nectar and food plants was completed in areas that were cleared of trees by Benton County employees, contractors, IAE volunteers, and an AmeriCorps 12 person crew. In spring 2017, TCs were observed nectaring in

each of the habitat areas and other seeded and planted areas established in fall 2016. In summer 2017 four more habitat areas were sprayed with glyphosate and will be prepared for fall 2017 planting and seeding of TCB nectar and food plants. Scotch broom and false brome were targeted with spot spray treatments by IAE and Benton County employees in spring and summer 2017. Future restoration plans include mowing and spraying of non-native grasses followed by augmentation of the plant community with TCB food and nectar plants. Golden paintbrush (*Castilleja levisecta*) seed was added to the habitat areas in 2016 and will be added to the habitat areas in 2017.

Other Benton County Sites: In addition to Beazell and Cardwell Hill, Fort Hoskins Historic Park (Benton Co.), a potential TCB reintroduction site, received herbicide treatments to control non-natives and bracken fern and a 5 acre meadow was burned. Seeding and planting of TCB nectar and food plants will occur in these areas in fall 2017. Fitton Green Natural Area (Benton Co.), a site that received TCB larva translocated by USFWS in spring 2017, will be enhanced with TCB nectar and food plants in fall 2017 to improve TCB habitat.

Table 6. Benton County Survey Results (high count/population estimate)

Region/Site, Entity	2014	2015	2016	2017	Notes
Fitton Green, Benton Co. & private land	581	1162	420/675	167/252	
Beazell, Benton Co.	610	1254	1379/2730	383/765	
Bald Hill Farm, Greenbelt Land Trust	0	1	3		Single male observed in 2015, 3 in 2016.

Figure 1. 2017 survey estimates of Taylor’s checkerspot abundance at FGNA by Day of Flight.

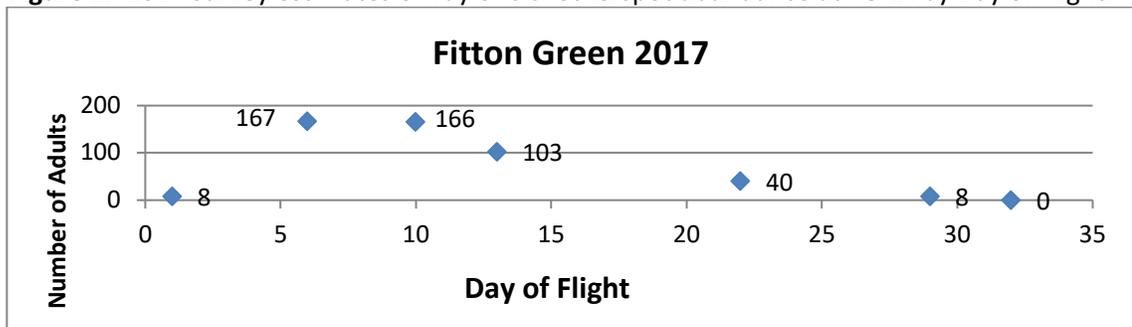


Figure 2. Annual population estimates for Taylor’s checkerspot at FGNA (2003-2017).

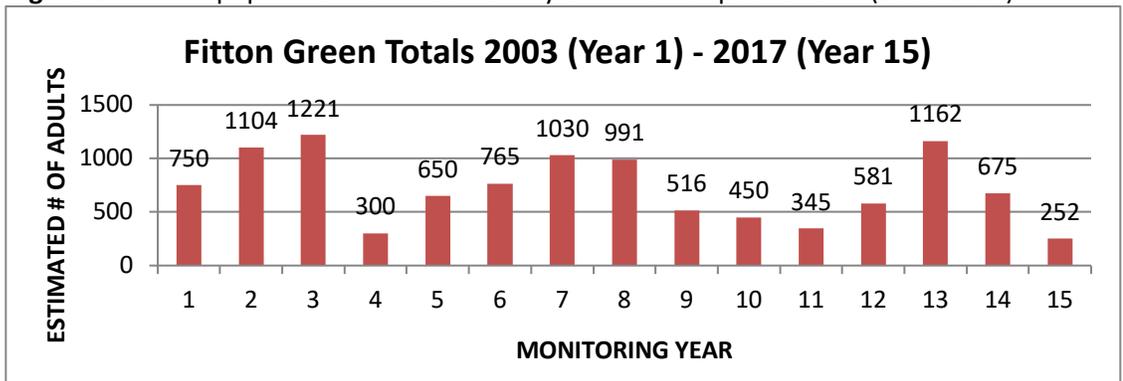


Figure 3. 2017 survey estimates of Taylor’s checkerspot abundance at BMF.

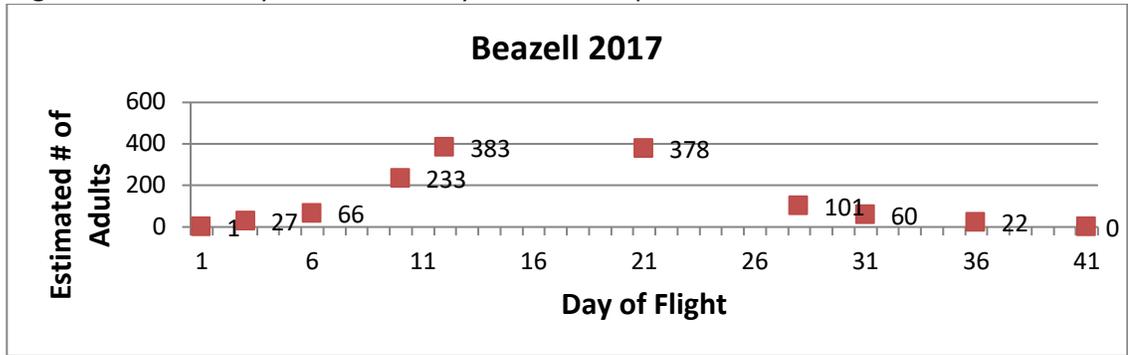
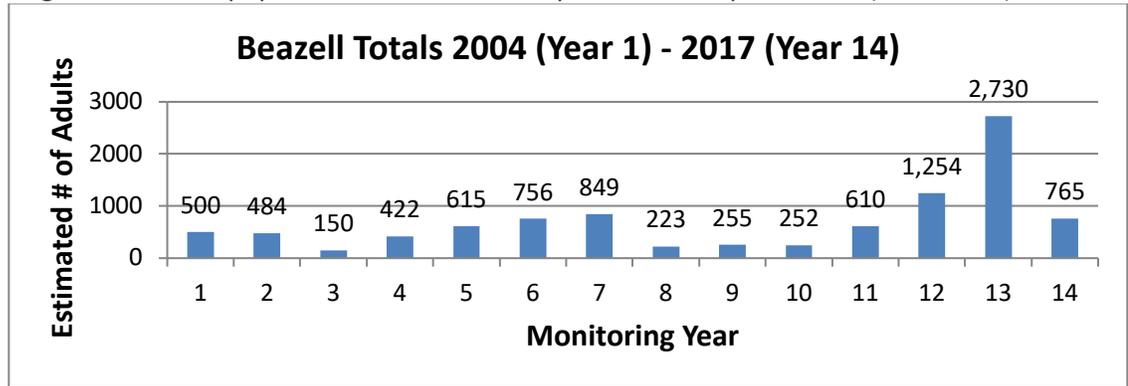


Figure 4. Annual population estimates for Taylor’s checkerspot at BMF (2003-2017).



Research Updates

Susan Waters, CNLM – Predation Study

Focusing on egg and larvae portion of the lifecycle, wanted to answer the question ‘what kills checkerspot eggs and prediapause larvae?’ Wanted to focus on invertebrate predators.

From meeting materials: This exploratory project 1) assessed the effect of invertebrate predators on TCB egg and prediapause larval survival rates and 2) collected video footage of egg and larval predation events to attempt to identify predators to rough taxonomic groups. In 2017 we placed captive-reared TCB egg masses on *Plantago lanceolata* in paired circular 1m-radius plots at three south Puget Sound prairie preserves (Glacial Heritage, Tenalquot, and West Rocky). In one half of the plots, we surrounded egg masses (and later, larval nests) with a sticky ring placed on the ground to reduce non-aerial invertebrate predation. We revisited plots every 3-4 days to count the number of TCB individuals of all instars. We also collected a range of habitat variables in each plot to assess as covariates of survival rate. In a subset of the control plots, we collected time-lapse video footage focused on egg masses or larval nests.

We analyzed data from egg to 2nd instar only, because after 2nd instar we removed the predator-reduction treatment (we removed sticky rings to prevent them causing mortality to more mobile, dispersing 3rd instar larvae). Initial analysis shows that: 1) mortality was high at all sites and in all treatments; 2) predator reduction treatments tended to increase survival rates, but the trend was not strong; 3) West Rocky mortality rate was higher than other sites. Given video

footage of predation events and field experiences witnessing “trespassers” amid depredated egg masses, we suggest that mites, thatch ants, and a very small as-yet-unidentified invertebrate are likely candidates for the main early life stage predators of TCB. We also believe that our predator-reduction treatments often did not successfully exclude these animals, suggesting that predation effects are likely much stronger than we were able to detect.

Susan Waters, CNLM – Oviposition Study

In 2016, looked at plots at scatter creek. Did not detect any relationship with nectar or basking area. Not yet reported is temperature info. Used iButtons to track temp full season. Most interesting trends were: 1. Mean daytime temp – the warmer the temp the less likely females were to oviposit. Also, the more variable, the less likely the female were oviposit.

Tom Kaye, IAE and Isaac Sandlin, OSU – Hybridization Study

This project is Isaac’s master thesis. Methodology – was sent seeds of WA pops of CAHI as he was having trouble growing them out. CALE is diploid across the board. CAHI ploidy depends on population. We used flow cytometry to estimate ploidy between populations of CAHI. Found Scatter creek and TA15 to be diploid, Johnson, Wolf Haven, and Bald hill tetraploid. Yellow island was hexaploidy. Crossed CALE with the three types of CAHI and itself. Got highest fruitset with hexaploidy (92%). But seed set was most important. But CALE with diploid CAHI had 55% seed set – CALExCALE was 60%, very similar. F1 generation did indeed make hybrids. So – time to germinate – CALE CAHI diploid was nearly as high as CALExCALE. Tetraploid and hexaploidy low to zero. F2 crosstypes – all had high fruitsets, but seed set was highest with CALE x hybrid (66), but CAHI and hybrid were 50% and hybridxhybrid (61%). Of hundreds of CALE x hybrid 4n 1% - low but not zero. Will do germination rates of these this fall.

Tom adds that some implications of this is that sites where there’s pressure to do dual recovery – if we’re putting diploid hispidia out, we’re creating conflict – need to use a higher ploidy level (genetically).

Nate Haan, University of Washington – TC Host Plant Suitability Study (written only, not at meeting)

From meeting materials: The goal of this project was to evaluate host plant suitability for pre-diapause TCB larvae. We released and tracked TCB egg clusters in plots at Glacial Heritage, West Rocky and Tenalquot in 2015 and 2016. Each plot contained one of the three host species (total 126 plot observations across the two years). We compared larval survival, mass, and development rate on the three host species, and tested whether they were affected by plant senescence and several other variables. We assessed predictors of survival separately from hatching to second instar, from second to third instar, and from third to fourth instar, in order to pinpoint mortality sources. Here are some of the key findings:

- Larval survival
 - Overall, survival from hatching to fourth instar was highest on *P. lanceolata* (20%), intermediate on *C. hispidia* (17%), and lowest on *C. levisecta* (6%). These differences were driven mostly by a disparity in survival during second instar.
 - At least one larva survived to fourth instar in 81% of plots with *Plantago*, 78% of those with *C. hispidia*, and 54% on *C. levisecta*, suggesting none of the hosts causes a significant genetic bottleneck.

- Both *Castilleja* species senesced during larval feeding, while *Plantago* did not. Larvae feeding on *C. levisecta* were less likely to survive to second and third instar if they fed on a senescing plant. Larvae feeding on *C. hispida* were less affected by plant senescence, although survival to second instar was lower if eggs were laid later in the flight period.
- None of the several environmental variables we measured (slope/aspect, vegetation structure, soil moisture, nutrients, etc.) had any direct bearing on larval survival.
- Larval mass and development rate
 - Neither mass nor development rate (days to fourth instar) depended on the host plant being eaten.
 - Neither mass nor development rate was affected by the environmental variables we measured.
- Iridoid glycosides
 - All three host species produce iridoid glycosides: *P. lanceolata* contains the compounds aucubin and catalpol; the two *Castilleja* species contain these compounds plus two additional ones, macfadienoside and (probably) methyl shanzhiside. Their concentrations were extremely variable from year to year and plot to plot (from less than 1% dry weight to over 15%), and in some cases, increased as the season progressed.
 - Larvae sequester all four of these compounds. They often contain comparable amounts of iridoid glycosides to those found in other *Euphydryas* butterflies. However, they sequestered lower levels from *C. levisecta* than from the other two hosts. The amounts they sequestered could be low enough that they are not repellent to predators.