



# Department of Defense Legacy Resource Management Program

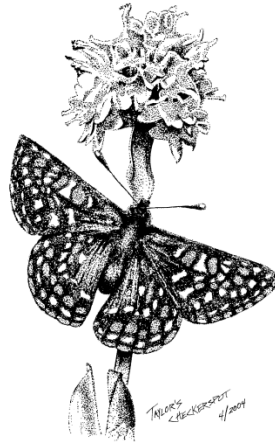
Legacy 09-213

## **Strategy for the Cooperative Recovery of Rare Species Affecting Training Ranges:**

### **Taylor's Checkerspot Butterfly: 2009 and 2010 Working Group Meeting Minutes**

The Nature Conservancy of Washington

March 2011



## Taylor's Checkerspot Working Group Meeting

*23 September 2010*

*Sawyer Hall, USFWS, Lacey, WA*

**Supported by:** The US Department of Defense Legacy Program  
The US Fish and Wildlife Service



**Organized by:** The Nature Conservancy of Washington



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## Meeting Agenda

**9:00 Welcome and Introductions**

**9:15 Range-Wide Distribution**

**9:20 Research Conducted in 2010**

9:20 – 9:35 Movement and Barriers - *Tory Bennett*

9:35 – 9:50 Edge Behavior & Habitat Characteristics - *Tom Kaye*

9:50 – 10:05 Habitat and Conditions Associated with Oviposition - *Paul Severns*

**10:05 Planned Research**

10:05 – 10:25 SERDP Project - *Cheryl Schultz*

10:25 – 10:45 Discussion: Outstanding Research Questions

**10:45 Break**

**11:00 Captive Rearing and Reintroduction**

11:00 – 11:10 Captive Rearing at the Oregon Zoo – *Elayne Barclay*

11:10 – 11:20 Captive Rearing at Mission Creek Prison - *Kelli Bush*

11:20 – 11:40 Habitat Enhancements in Preparation for Reintroduction – *Cheryl Fimbel*

11:40 – 12:00 Translocations – *Mary Linders*

**12:00 Lunch (on your own)**

**1:00 Occupied Site Updates – Surveys & Habitat Management**

1:00 – 1:15 Denman Island - *Jenny Heron*

1:15 – 1:25 Olympic National Forest - *Karen Holtrop*

1:25 – 1:45 Clallam County – *Ann Potter, Dave Hays*

1:45 – 2:05 Bald Hill – *Ann Potter, David Wilderman*

2:05 – 2:20 Joint Base Lewis McChord – *Mary Linders, Rod Gilbert*

2:20 – 2:35 Oregon – *Al Kitzman*

**2:35 Break**

**2:45 Guided Discussion Topics**

Recovery Goal Setting & Action Planning

Range-wide population monitoring – is it necessary? How would it be done?

Reintroductions – thinking forward to other regions, Oregon, North Sound & San Juans, BC?

**4:00 Adjourn**

**5:00 – 7:00 Afterparty at Waterstreet Café - 610 Water Street SW, Olympia, 360-709-9090**

*Appetizers and N/A beverages provided*

Directions from FWS:

Exit FWS on Desmond Drive, Left onto Martin Way, Left onto **I-5 South**

**Exit 105**, Port of Olympia. Merge onto **Plum Street SE**.

Left on **Legion Ave**, follow to T with Water Street.

Left on **Water Street**. Restaurant is on left, directly across from Capital Lake Park.

## The Working Group

The Taylor's Checkerspot working group is comprised of a diverse assemblage of people from various public and private entities spanning the entire range of the sub-species, which crosses both state and national borders. The working group is not an official organization but rather an informal group whose participants have an interest in conservation and recovery of the Taylor's Checkerspot butterfly. Annual meetings provide the opportunity for all folks working on the sub-species to come together and share information about occupied sites, research, habitat management, and other pertinent topics. Participant affiliation and contact information is listed below, organized by last name. The participant list is maintained by The Nature Conservancy. Contact Hannah Anderson for updates.

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Page, Nick	Raincoast Applied Ecology	nick@raincoastappliedecology.ca	



## Range-Wide Distribution



## **Research Conducted in 2010**

### **Movement and Barriers – Tory Bennett**

In order to effectively implement management strategies that fulfill recovery objectives, we need to understand why the Taylor's checkerspot butterfly is isolated. A few studies have revealed that different species, sub-species and groups of individuals (sex, age) can perceive the same habitat differently. While one individual may choose to cross a particular habitat feature (such as a road, woodland edge and area of tall grass), another individual may not. Even a specific characteristic, such as the substrate used on a road (e.g. gravel or tarmac, or the height of the vegetation), can influence whether an individual chooses to cross that feature. Identifying the habitat features and specific characteristics that wildlife individuals perceive as barriers or filters to movement may be the key to devising appropriate habitat management. I have been exploring this through a suite of field surveys conducted (including mark-release, edge effect surveys and fine scale movement surveys) on the Taylor's checkerspot and other species in Benton County, Oregon and the Olympic National Forest in Washington.

### **Edge Behavior and Habitat Characteristics – Tom Kaye**

Institute for Applied Ecology conducted mark-recapture work at Oregon sites and made behavioral observations at sites in Oregon and Washington in 2010. They also collected information to provide course descriptions of Taylor's habitat across the range.

### **Habitat and Conditions Associated with Oviposition – Paul Severns**

#### **Project Sites**

Graysmarsh (private farm), Eden Valley (Washington DNR), Dan Kelly Ridge (Washington DNR), Range 76 (Joint Base Lewis McChord).

#### **Project Goals and Objectives**

- 1) Identify habitat conditions, both biotic and abiotic, that are associated with Taylor's checkerspot oviposition at Graysmarsh, Range 76, Eden Valley, and Dan Kelly Ridge.
- 2) Collect, preserve, and deposit pre-diapause Taylor's checkerspot larvae at the Washington Department of Fish and Wildlife genetics lab as specimens for future genetics studies.

#### **Progress Summary**

- 1) Pre-diapause host plants
  - a) Pre-diapause host plants at Graysmarsh: only *P. lanceolata* (searched on *Orthocarpus pullis* and *Collinsia parviflora* – but *C. parviflora* senesced).
  - b) Pre-diapause at Fort Lewis: primarily *P. lanceolata*, but also used about 20% of the *Castilleja hispida* (n= 38 plants) on Range 76.
  - c) Pre-diapause at Eden Valley: almost exclusively on *Castilleja hispida* one observation on *Plantago lanceolata* (road-associated). *Plectritis congesta* largely senesced, no oviposition found.
  - d) Pre-diapause at Dan Kelly: primarily *Castilleja hispida* and restricted to the balds, some *Plantago lanceolata* but road-associated,(no oviposition on *Plectritis* or *Collinsia*- largely senesced).
- 2) Habitats associated with *P. lanceolata* at Graysmarsh and Range 76 were predominately roadsides (two track roads). Oviposition outside of road areas but much less frequently encountered.



- 3) Most of the reproduction at Eden Valley was in the balds and all eight searched balds yielded egg masses. There might be an association with shrub removal, Castilleja release, and oviposition by butterflies (observed both at Dan Kelly and Eden Valley). However, the late flight season may have influenced oviposition behavior and host plant quality. By the end of the study at Eden Valley (when most larvae were 2<sup>nd</sup> instar) Castilleja with full southern or western exposure surrounded by grasses were turning yellow and several webs that housed numerous larvae ten days prior appeared abandoned. Do not know if the larvae died or moved.
- 4) Formal analysis on habitat characteristics are pending.

## **Future Research**

**Endangered butterflies as a model system for managing source-sink dynamics on Department of Defense lands – Cheryl Schultz**

## Discussion: Outstanding Research Questions

In late July 2010, researchers from throughout the range met to review research conducted in 2010, discuss priority research questions, and coordinate/collaborate on research in 2011. The following list presents questions and needs generated at that discussion. Research questions and needs are **NOT** listed in priority order. More complete notes are available on request.

### Research Needs

- Follow up with larval survival at oviposition sites documented in 2010
- Conduct additional year of oviposition habitat selection
- Determine Genetic variability of captive population and reintroduced population in relationship to source population.

### Research Questions

#### Habitat Use and Selection

- Are females by some mechanism selecting plants that already have eggs?
- What is the intraspecific variability of the hostplants themselves?
- Is there differential use of *Plantago* between those that grow road and those that grow within the matrix of prairie?
- Can CAHI function as a food plant for both pre and post diapauses larvae?
- Can CALE function as a larval host?
- How is occupation related to habitat characteristics? i.e. track temperature, moisture, plant and butterfly phenology

#### Behavior

- Larval dispersal?

#### Genetics

- Is Taylor's really one sub-species or multiple sub-spp, or one spp?
- What is the genetic variability within isolated populations? Is it enough to maintain population robustness?

#### Predators

- What is the role of predators (both invertebrate and vertebrate) to Taylor's survival?
- What is the role of fire in managing predator load?

#### Disturbance

- What are the impacts and interactions of disturbance onto occupied sites? E.g. military training, dog trials, horses, restoration and research impacts. What is the optimal level of disturbance?

## Captive Rearing and Reintroduction

### 2010 Taylor's checkerspot Captive Rearing Summary – Elayne Barclay

Mary Linders, Elayne Barclay et al., Erin Sullivan

#### Oregon and Woodland Park Zoos

In 2009, a total of 10,653 eggs were laid by 34 females crossed with 25 males; all were captive-reared and –mated; 6 females laid only infertile eggs. The average number of clusters per female was 14.2 ( $\pm$  8.9 SD); the average number of eggs per female was 313.3 ( $\pm$  187.3 SD; range 0 - 684). The average number of eggs per fertile female was 365.5 ( $\pm$  159.4 SD; range 72-684). This abundance of eggs resulted from a sudden and sustained increase in sunny weather at the end of the mating season, which markedly increased copulation, oviposition and hatch rates. At 2<sup>nd</sup> instar, 8,459 larvae were counted. Survival from 2<sup>nd</sup> instar to diapause was 94.2 percent (7,966 survived of 8,459 hatched larvae); 3 larvae pupated and eclosed as adults without entering diapause. Space and staffing levels at the Oregon Zoo were insufficient to support this many larvae, so 5,443 prediapause larvae were released in the field by the Washington Department of Fish and Wildlife (see below). Of prediapause larvae remaining at the Zoo, 2,494 of 2,523 (98.9 percent) emerged from diapause; 2,013 postdiapause larvae from the 2009 cohort (1,511 from the Oregon Zoo, 502 from Woodland Park Zoo) were released at field sites by WDFW. Four hundred eighty-one larvae remained at the Oregon Zoo. In addition, 78 of 102 larvae (76.5 percent) from the 2008 cohort emerged from 2<sup>nd</sup> diapause; 70 were retained at the Oregon Zoo, with the remainder going to Woodland Park as part of their training in rearing postdiapause larvae (survival of WPZ postdiapause larvae was 98.6 percent; 503 of 510 larvae). Larvae retained in captivity were used in rearing trials, captive breeding, and/or for field-release as adults. A total of 551 (2008 and 2009 cohort) postdiapause larvae were retained in captivity, 445 of which pupated (80.8 percent) to produce 433 adults (97.3 percent). Thirty-eight of 481 larvae (7.9 percent) from the 2009 cohort entered 2<sup>nd</sup> diapause and 12 of 70 (17.1 percent) larvae from the 2008 cohort (2<sup>nd</sup> diapause larvae) entered 3<sup>rd</sup> diapause; rates of return to diapause were low compared to previous years. A total of 262 adults (84 males and 178 females), including 15 from 2<sup>nd</sup> diapause larvae, were transferred to WDFW for release; 9 females copulated prior to transfer.

In February 2010 we worked with the American Zoological Association's Population Management Center at the Lincoln Park Zoo, Chicago, IL to devise a mating strategy. Using a "daisy-chain" strategy we mated males with females from another line; 157 mating introductions were conducted, of which 37 resulted in copulation. We successfully bred 5 of the 7 recommended F1 (hatched in 2008 from wild source) crosses and all of the 9 recommended F2 (hatched in 2009 from captive-reared/-mated parents) crosses.

#### Postdiapause rearing trial

As in 2009, we observed differences in development time, growth rate, and activity level between indoor and outdoor treatments. Indoor larvae began eating immediately, continuing at an increasing rate; feeding rates of outdoor larvae fluctuated with ambient temperature. Larvae reared outdoors were about one month behind those reared indoors. The first indoor pupa was found on 16 March, 14 days after trial initiation; the last pupa was found 25 March. The first outdoor pupa was found on 19 April, 48 days after the start of the trial; the last was found on 16 May. No obvious differences in rate of pupation (93.0 % indoor vs. 88.0 % outdoor) vs. return to diapause were observed between rearing treatments. Results in 2010 differed from 2009 in two ways: 1) twice as many 2009 outdoor larvae entered 2<sup>nd</sup> diapause compared to those indoors; and 2) larvae reared outdoors in 2010 were more similar in size (weight and wing measure) to wild adults. One lineage produced the most individuals entering 2<sup>nd</sup> diapause in both 2010 treatments. In 2009, nearly all larvae from one founding female went into 2<sup>nd</sup> diapause regardless of treatment; in 2010 those same 2<sup>nd</sup> diapause larvae (all reared indoors) also had the highest percentage of larvae reenter diapause (35% entered 3<sup>rd</sup> diapause).

## Developing a Captive Rearing Facility for at Mission Creek Correctional Center for Women – Kelli Bush

Mary Linders, WDFW/JBLM; Nalini Nadkarni and Kelli Bush, The Evergreen State College

The Oregon Zoo is operating at capacity and is the only facility rearing Taylor's checkerspot. A second rearing facility is being established to increase rearing capacity and reduce the risk of disease, fire or other factors that may endanger captive stock. A cost effective and mutually beneficial means of addressing captive propagation needs is to develop a new rearing program at Mission Creek Correctional Center for Women (MCCCW).

Partners for this proposal include: Washington Department of Fish and Wildlife (WDFW), The Evergreen State College Sustainable Prisons Project (TESC SPP), the Washington Department of Corrections (DOC), US Fish and Wildlife Service, The Nature Conservancy (TNC) and the Oregon Zoo. Funding for the project provided by the Department of Defense Army Compatible Use Buffer (ACUB) program. Through partnership (cost share) the project achieves significant cost savings. The DOC will provide offender crews and staff supervision to build the greenhouse, raise butterflies, grow nectar plants, and conduct any required maintenance for the rearing facility. TESC SPP will mentor a graduate student researcher, cover student travel expenses, and provide staff time to help manage the project. WDFW will provide scientific expertise and funding for the graduate student researcher's salary.

### **Project Objectives are:**

- construction and testing of a suitable facility to house and run a captive rearing program;
- development, training, and testing of a work force to implement captive rearing methods;
- development of host and nectar plants; and
- transfer of rearing techniques from a surrogate species to Taylor's checkerspot.

Mission Creek Corrections Center for Women (MCCCW) is a minimum-custody facility south of Bremerton, Washington. With the supervision of a Department of Corrections (DOC) staff person and consultation provided by project partners, female offenders will build the proposed captive rearing facility and raise butterflies. MCCCW is well-suited to meet the personnel needs for this project because offenders may be stationed for up to four years, which is ample time to build skills and train new personnel before graduating from the program. A graduate student researcher from The Evergreen State College, Sustainable Prisons Project ([www.sustainableprisons.org](http://www.sustainableprisons.org)) will work collaboratively with project partners to train offenders, manage the project and compile reports. Training will be achieved by reciprocal visits between the student intern and staff from the Oregon Zoo.

*Surrogate Species:* *Vanessa cardui* (painted lady) butterflies will be used as a surrogate species to allow offenders the opportunity to develop butterfly rearing skills, while also practicing the protocol they will ultimately apply to Taylor's checkerspots. The relatively short life cycle of painted ladies (~3 weeks) will allow offenders to repeat the rearing protocol multiple times within a minimal time frame.

*Plant Propagation:* Host plant material (*Plantago lanceolata*) for both painted lady and Taylor's checkerspot will be grown at Stafford Creek Corrections Center (SCCC); they will also provide consultation during construction of the captive rearing facility (greenhouse).

*Captive Rearing Taylors Checkerspot:* Once offenders demonstrate proficiency in rearing the surrogate species, they will begin rearing Taylor's checkerspot on a trial basis. We anticipate that this could occur in time for the postdiapause phase in Feb 2011. Rearing will follow established methods developed at the Oregon Zoo (Barclay et al. 2009) If additional time is needed to train offenders, rearing Taylor's checkerspot would be postponed until the egg or prediapause phase.

## Habitat Enhancement at Unoccupied Sites on Puget Lowland Prairies in Western Washington – Cheryl Fimbel

Cheryl Fimbel<sup>1</sup>, Hannah Anderson<sup>1</sup>, Rod Gilbert<sup>2</sup>, Jeff Foster<sup>2</sup>, Dave Hays<sup>3</sup>, Ann Potter<sup>3</sup>, Mary Linders<sup>2,3</sup>, David Wilderman<sup>4</sup>, Birdie Davenport<sup>4</sup>, Grace Diehl<sup>1</sup>

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<sup>2</sup>Public Works, Box 339500 MS17, Joint Base Lewis-McChord, Washington 98433

<sup>3</sup>Washington Department of Fish and Wildlife, 600 Capitol Way N. Olympia, Washington 98501

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To support species' recovery of Taylor's checkerspot on Puget lowland prairies, captive propagation was initiated in 2003. At the same time, conservation partners in the South Puget Sound region implemented numerous parallel efforts to restore native prairie habitat at current and formerly occupied sites. It became evident that coordination of these efforts would yield greater success. In 2007, The Joint Base Lewis-McChord Army Compatible Use Buffer (ACUB) initiative, in partnership with the Nature Conservancy, supported the convening of a cooperative, interdisciplinary and interagency butterfly habitat enhancement team to facilitate coordination of restoration efforts across land ownerships. The team is comprised of 10 members, including regional butterfly experts, restoration ecologists, and land managers from the Department of Defense, two state agencies, two non-governmental organizations, and a county agency. Primary funders include the ACUB program, the US Fish and Wildlife Service, and the Dept. of Defense-JBLM.

The team's goal is to strategically develop, implement, and evaluate an approach based on best management practices to prepare formerly occupied habitat as receiving sites for reintroductions of these rare butterflies. The team identified 13 management units suitable for enhancing habitat for Taylor's checkerspot, totaling nearly 300 acres of semi-native short-stature bunchgrass and forb vegetation across 11 mostly upland prairies sites in Thurston and Pierce counties (Figure 1). Important habitat considerations for Taylor's checkerspot butterflies include:

1. Dense concentrations and interspersed of nectar and larval host plant resources.
2. Multiple species assemblages of nectar and larval host plants in close proximity to ensure availability of food resources despite variations in the progression of plant phenology among years.
3. Mixture of low and tall herbaceous vegetation. Tall plants (in moderation) provide shelter for all stages of butterflies and areas of low plants are necessary to allow access to the base of plants for oviposition and thermal basking by larvae.
4. Resource enhancement patches distributed among different soil moisture and temperature gradients. This provides a variety of habitat conditions and plant phenology stages to promote or sustain resources and conditions for larval development and adult feeding.

For the past three years, team participants have met several times a year to make site visits, and develop or refine a suite of standardized activities and protocols, (see Activities insert) to be implemented across butterfly management units to enhance the target characteristics identified above (Figure 2). Our butterfly plantings rely heavily on native propagules supplied by our associated native plant nursery. The project also benefits from a large team of dedicated volunteers that participate in all stages of plant production, outplanting, and weed control. The implementation of standardized activities across multiple sites has created a unique opportunity for learning across a large landscape.

### Lessons Learned to Date

1. Enhancement of butterfly resource patches requires repeat plantings to replace seedlings lost to mortality; and multiple applications of a variety of well-timed weed control treatments to reduce competition for plantings. Survival of restoration plantings averaged 75% – 90% the first spring after planting, but declined considerably to 25% – 54% of the original seedlings surviving through the second spring (year 2).
2. Butterfly habitat restoration requires high levels of inputs, including financing, planting stock, and labor resources. Strategically allocating intensive enhancement efforts to create high quality prairie in small scale butterfly resource patches, and lower levels of input to maintain semi-native habitat in the surrounding matrix, expedites progress toward project goals.
3. Establishing forbs at scale will likely require use of both plantings and direct seeding. This necessitates the development of large quantities of genetically appropriate seed for use in the Puget lowland region.
4. This collaborative approach benefits from the varied expertise and inputs of numerous partners and agencies, and creates a synergistic approach to a complex problem.
5. This approach serves as a model for integrating research and monitoring into habitat restoration and adaptive management to support butterfly reintroduction efforts across a fragmented system of multiple prairie sites under different ownerships.

### Activities

- Evaluating and identifying 13 butterfly management units at 11 prairie sites (Figure 1) using a cooperative and standardized approach based on a suite of critical habitat characteristics for each butterfly;
- Developing quantitative restoration targets based on important habitat characteristics for each species and current conditions of each management unit;
- Mapping nectar and host plants to guide location of enhancement efforts;
- Controlling weeds using combinations of prescribed fire, chemical and mechanical treatments, emphasizing frequent follow-up in treated areas;
- Propagating and planting 129,000 native forb seedlings and 30,000 grass seedlings of nectar and larval host species, and direct seeding > 20 lbs of seeds;
- Monitoring outplantings using standardized protocols to evaluate treatment success across multiple prairies.

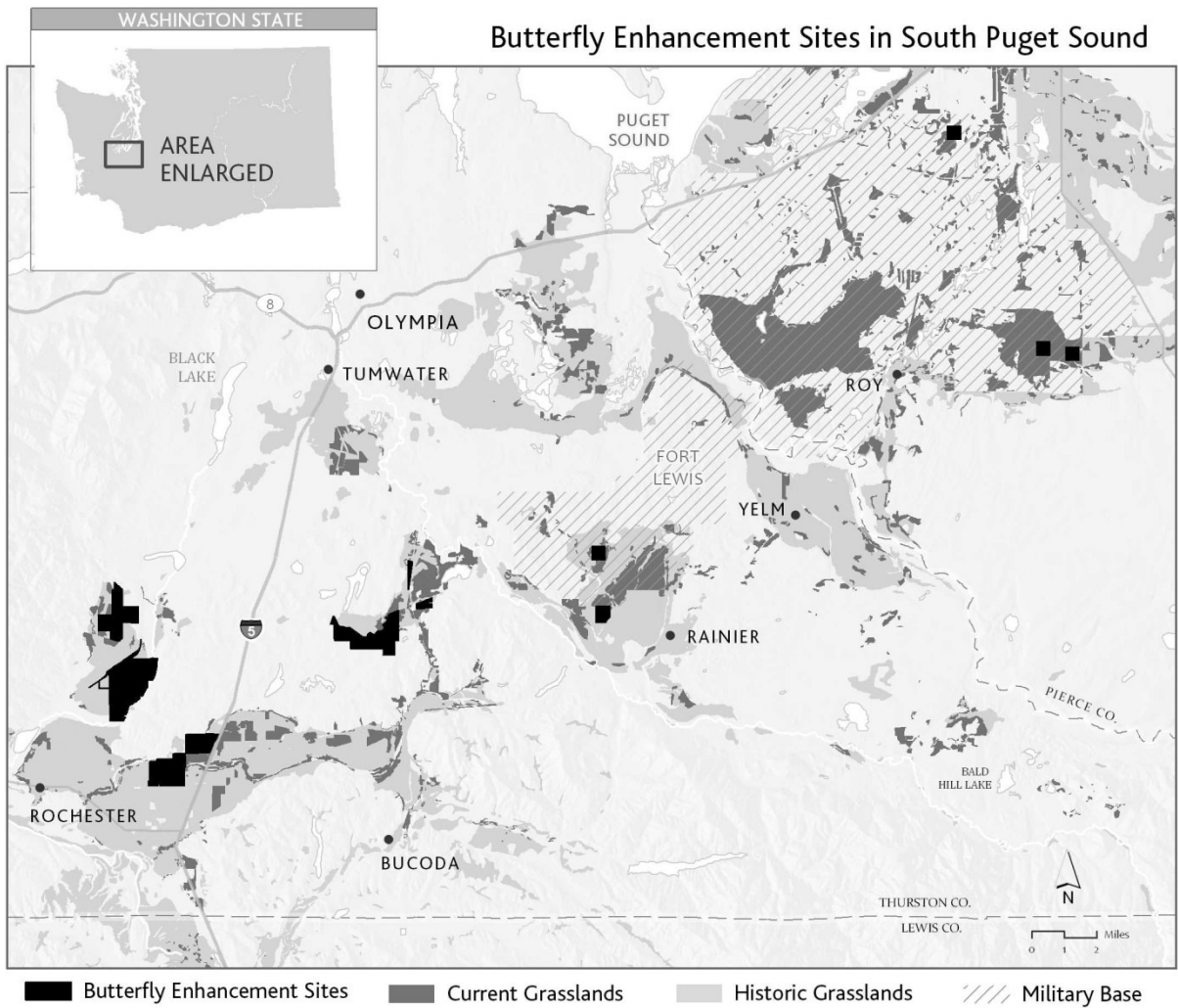
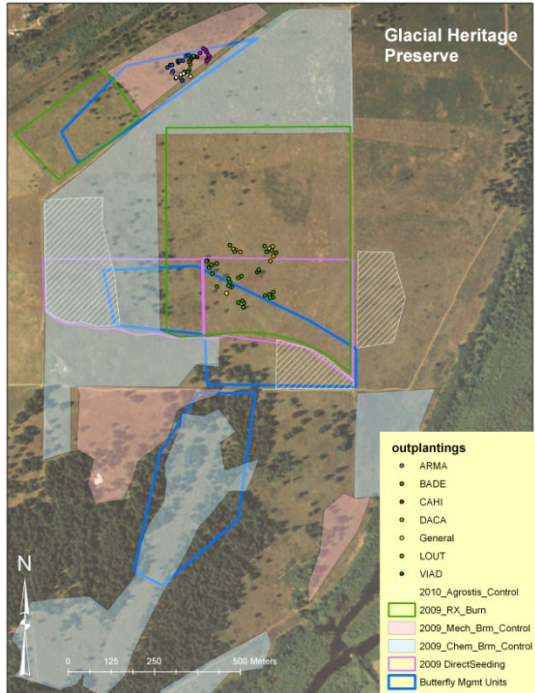
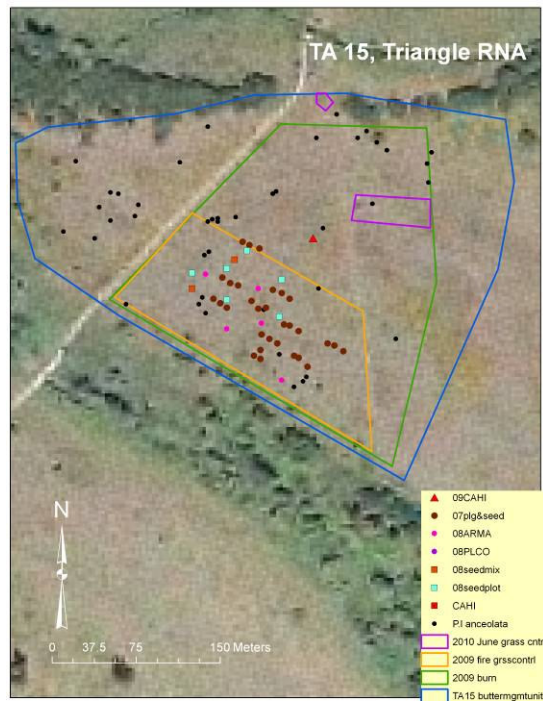


Figure 1. Prairie sites receiving habitat enhancements for Taylor’s checkerspot butterflies (except *Mima* Mounds in far west) in the Puget lowlands of South Puget Sound, 2010.

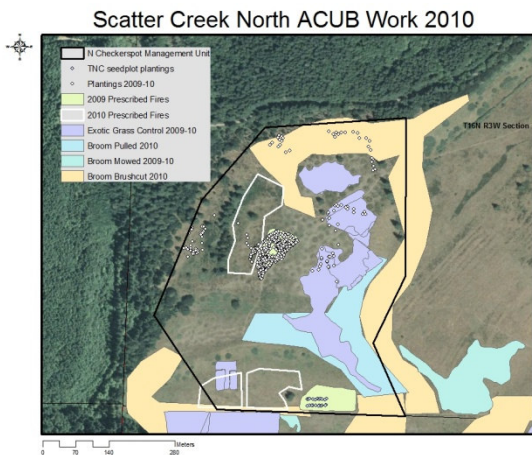
A. Glacial Heritage Preserve



B. Triangle RNA, JBLM



C. Scatter Creek North Wildlife Management Area



D. Scatter Creek South Wildlife Management Area

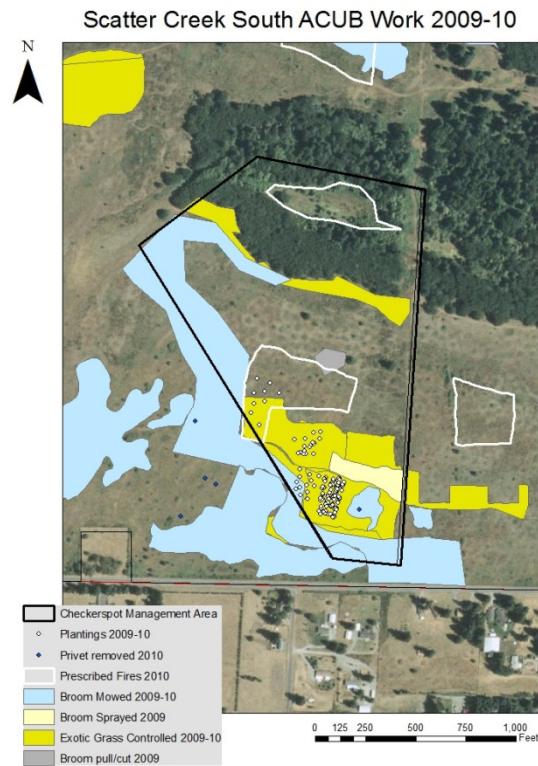


Figure 2. Puget lowland prairie sites showing restoration actions and outplantings for enhancing Taylor's checkerspot habitat, 2008 – 2010, Thurston and Pierce Counties, WA.



## **2010 Taylor's checkerspot Translocation Summary – Mary Linders**

### **Scatter Creek Wildlife Area – South Unit; Joint Base Lewis-McChord, Range 50 – AIA**

#### **2010 Postdiapause larval release**

A total of 2,036 postdiapause Taylor's checkerspot larvae reared at the Oregon and Woodland Park Zoos were released on 3-6 March 2010 between two reintroduction sites in South Puget Sound (891 at Scatter Creek South (WDFW) and 1145 at Range 50 on Joint Base Lewis-McChord). All larvae were released in groups of 2-5 on *Plantago lanceolata*. The weather on all release days was sunny to partly cloudy with temperatures in the low to mid-50s and little or no wind. Larvae appeared large and in excellent health; wild larvae observed during the same period were at the same stage of growth as those released from the Zoos.

#### **Flight season monitoring**

Four sites (Range 50 - AIA, Pacemaker, Scatter Creek North and South units) were monitored for Taylor's checkerspots during the 2010 flight season. Distance sampling training was conducted to insure consistency in decision-making and survey technique by all staff involved. Sites were monitored casually to identify the start of the flight season. Similarly, end of the season monitoring was conducted to determine occupancy and population levels. The first adult in South Puget Sound was observed at Scatter Creek South (WDFW) at 1300 on 18 April 2010. Four full distance surveys were conducted at Scatter Creek North; Scatter Creek South and Range 50 each received five full and one partial survey; and six full surveys occurred at Pacemaker. No adults were observed at Scatter Creek North and Pacemaker (2009 release sites). Known flight season length was 40 days at Scatter Creek South, and 34 days at Range 50 -AIA; no monitoring occurred at Range 50 the week preceding the first count on 23 April 10 due to access and weather restrictions. The peak single day count at Scatter Creek South was 46 and at Range 50 – AIA was 67.

#### **Testing release of adult Taylor's checkerspots**

The first release of adult Taylor's checkerspots occurred in 2010. These were reared from captive-mated offspring at the Oregon Zoo. A total of 259 adults were released, primarily at Scatter Creek South (202); on 11 June 2010 some very late season adults (57) were released at Range 50 after the end of the flight season once all objectives for captive egg collection had been met. Release techniques included use of net cages as well as free release. Both methods resulted in a mixed response, where some animals remained in the immediate vicinity and others dispersed. All adults released were marked in order to distinguish those from adults that eclosed on site from larval releases or on-site reproduction. Several of the marked females were observed at Scatter Creek 9 days after release and were known to be at least 12 or more days old.

#### **Taylor's checkerspot prediapause larval surveys**

Extensive surveys for prediapause checkerspot larvae were conducted in and around release plots at Scatter Creek South and Range 50 –AIA. The purpose of these surveys was to document oviposition and track progress to diapause. Searches at Scatter Creek produced a total of about 8 clusters of eggs and larvae. Two egg clusters disappeared prior to hatching; larval clusters were monitored but did not appear to fair well. Searches at Range 50 turned up 38 larval clusters some with 2 or more clusters on a single host plant, including oviposition on the native host, *Castilleja hispida*.

## Occupied Site Updates – Surveys & Habitat Management

### Denman Island, British Columbia – Jenny Heron

### Olympic National Forest – Karen Holtrop

Taylor's checkerspot surveys were done on Olympic National Forest 2009-2010, funded by ISSSSP. Populations were found at three sites, all in managed areas with a history of regeneration timber harvest, on rocky steep dry slopes with "steps", SW- SE aspect. Roadsides and balds were also used by the butterflies.

**Bear Mtn** Opening in a managed stand (clearcut 1969) on steep slope, rocky bald at top. Elev 2500-2700'

	Date	Num
2009	May 15	41
2010	May 7	1
	May 12	61
	June 5	42
	June 12	5

Flight period 5 weeks

**3 O'Clock Ridge** Openings in managed stands (clearcut 1965) along road, & balds. Elev 2300-3000'

	Date	Num
2009	May 16-17	25
	May 25	69
	June 12	33
2010	May 6	3
	May 11	48
	June 13	10

Flight period 5+ weeks

Upper Dungeness Openings in managed stands (clearcut 1964-1967) along a road. Elev 2800-3300'

	Date	Num	
2009	31 May	35	(Surveyed only half of site due to weather)
	14 June	48	(Surveyed other half site)
2010	Ma y 6	2	
	Ma y 13	93	
	June 14	34	
	June 22	157	(road transect)

Flight period 6 + weeks period

**Other Sightings** (believed to be dispersing individuals)

Dirty Face Ridge : male at 4800' elev (2009); 4400' (2010), 2+ mi from Upper Dung populations

Gold Creek balds: adult observed 1.8 mile from Bear Mtn population (2009)

Mid Dungeness balds: adults observed ~1 mile from 3 O'Clock Ridge popul., on other side of river (2009)

Adults observed on roads approx 0.50-0.75 mile from populations

**Some Other Observations:**

Oviposition, eggs found on *Plantago*

Roosting in Kinnikinnick

Nectaring observed on 15 plant species including strawberry, *Lomatium utriculatum*, *Plectritis*, cryptantha, manzanita, phlox, sedum, dandelion, Oregon grape, oxeye daisy

Post-diapause larvae observed Mar 1 & 19, 2010.

Pre-diapause larvae found July 9, 2010 in *Castilleja*

## Clallam County – Ann Potter, Dave Hays

### Adult surveys and monitoring

Clallam County Taylor's checkerspots, today estimated to consist of 6-7 populations, collectively make up the majority of extant sites and populations for this endangered butterfly. Outside of the Olympic National Forest (ONF), there are 7 known locales for Taylor's checkerspot in Clallam County. During the last decade only 6 have been found occupied, and in recent years the number of regularly occupied sites has decreased to 3-4. The 3 non-ONF sites where checkerspots regularly occur are Dan Kelly Ridge and Eden Valley, grassy bald complexes about 1 mile apart and 10 miles west of Port Angeles; and 30 miles to the east, Graysmarsh Wildlife Refuge, an estuarine, stabilized coastal dune site near the town of Sequim. Clallam County sites are believed to represent separate populations, although it is possible that Dan Kelly and Eden Valley may have some exchange even as they are separated by a mile of dense forest and a ridgeline.

Washington Department of Fish and Wildlife (WDFW) monitors the Taylor's checkerspot populations at Dan Kelly Ridge and Eden Valley, and has since discovering them in 2003. Butterfly numbers in 2009 and 2010 appeared to be slightly higher than prior years at both sites, with high, single-day counts/estimates of over 100 individuals at each site.

Taylor's checkerspots at Graysmarsh are monitored by WDFW and Graysmarsh Wildlife Refuge. Abundance estimates are made from transect data, and although the 2010 data have not yet been analyzed, we can say with a high level of certainty that more butterflies were present at Graysmarsh this year than any previous year we've monitored (2006-2009). During one visit (April 14), 583 butterflies were detected during the transect surveys – which do not completely cover the site.

WDFW continues to search for Taylor's checkerspot on the 4 previously documented Clallam County sites where they have not recently been detected and on other potential sites. Taylor's checkerspots have not been detected in the last 3-6 years at 3 sites found occupied earlier in the decade. Several new areas of potential habitat have been searched in the last two years, however no new checkerspot populations have been found.

Clallam County population monitoring and searches are primarily done by local and Olympia-based WDFW biologists. In recent years, with the work load for other species during the checkerspot flight period increasing, and of course the cool, rainy 2010 spring, we have found it increasingly difficult to conduct the number of surveys needed to adequately monitor these populations.

## Bald Hill – Ann Potter, David Wilderman

### **Adult surveys and monitoring**

Taylor's checkerspot was historically documented on over 20 south Puget Sound sites and until recent years the Bald Hill area supported 1 of 2 populations extant in this region. Between 2002 and 2006, the Washington Department of Fish and Wildlife surveyed over 80 balds in the Bald Hill landscape for Taylor's checkerspot. Seven (8.7%) balds were found occupied by greater than 2 checkerspots during multiple years: at most of these sites 10 or more butterflies were encountered during multiple years. WDFW with support from the Fort Lewis ACUB intensively surveyed these 7 and 5 adjacent balds in 2007 and 2008. The surveys were conducted using established line transects – that in some cases did not provide coverage of the entire site – with the intent of estimating population's size, density, and detectability, and evaluating distance sampling survey methods for Taylor's checkerspot in this landscape. In 2007, 2 Taylor's checkerspots were observed at 1 site during a single visit. They have not been found in the Bald Hill landscape since. Realizing that if Taylor's checkerspots persisted in the landscape they were likely in very low numbers, in 2009 we changed our survey methods from monitoring abundance to searching for any remaining butterflies. In 2009 and 2010, again with support from the Fort Lewis ACUB, we searched more sites than 2007/2008, including balds where 1 or 2 butterflies had been spotted in the past. We did not find checkerspots in the 2009 or 2010 seasons. It is becoming increasingly unlikely – though not impossible – that Taylor's checkerspot persists in the Bald Hill landscape. Small numbers of adults may have been present at surveyed balds and not detected or may persist in nearby balds that were not surveyed. WDFW and Fort Lewis ACUB plan to continue intensive Taylor's checkerspot searches here for 1 more year and WDFW plans to conduct occasional follow-up surveys after 2011.

### **Habitat Management**

In order to enhance and increase suitable habitat for Taylor's checkerspot on the Bald Hill Natural Area Preserve, we have been conducting various treatments in the “south balds” of the preserve beginning in 2007. The south balds are a series of small grassland openings that were larger and more connected historically, and are being increasingly fragmented and degraded by Douglas-fir, shrub, and exotic species invasion. To date, we have removed small conifers from approximately 2 acres, removed large conifers from 6 acres, controlled shrubs on 2.8 acres, and treated orchard grass on just over 1 acre of grassland bald habitat. To revegetate these treatment areas and augment adult and larval foodplants, we have planted approximately 4000 plugs and initiated seed increase for key plant species.

## Joint Base Lewis-McChord Range 76 – Artillery Impact Area (AIA) - Mary Linders and Rod Gilbert

### Postdiapause larval surveys

Based on Paul Severns' findings that postdiapause Taylor's checkerspot larvae in Oregon were active in January, we conducted early searches for postdiapause larvae on Range 76 of the JBLM - AIA to determine whether emergence may be occurring earlier than previously thought. In about 1.5 hrs of searching on 27 Jan 2010, 24 larvae were observed basking and foraging. Most larvae were singles with some in pairs; they were found at several different locations across the site. *Plantago lanceolata*, the larval host plant, was in excellent condition relative to previous years and was in as good or better condition than all other sites visited. This was encouraging given the very poor flight season in 2009. Weather conditions appear to be a huge factor affecting the persistence of this species and are believed to have contributed to the downward trend since 2006, although this is likely not the only factor, and may not be the most significant one. Since mid-May 2009, weather conditions have been far more favorable than in recent years, setting the stage for a positive flight season response.

### Taylor's checkerspot flight season monitoring

Distance sampling was used to monitor Taylor's checkerspot at Range 76 during the 2010 flight season for the fourth consecutive year. Transects were spaced 50 m apart and covered an area of 42 ha. The site was monitored for flight season initiation and termination, with follow-up surveys conducted during all appropriate conditions in between to determine occupancy, distribution and population levels. The first adult was observed at Range 76 on 19 April and last the last adults were observed on 27 May 2010, for a minimum known flight season length of 39 days (Table 1). Flight season length in previous years has rarely exceeded 21 days. It is unclear whether the long flight season in 2010 reflects longer life spans associated with cooler weather conditions, a larger population size, or if both. Weather conditions coupled with reduced off-road vehicle travel are believed to be the key factors affecting the positive response in number of checkerspots observed on Range 76 in 2010 compared to previous years.

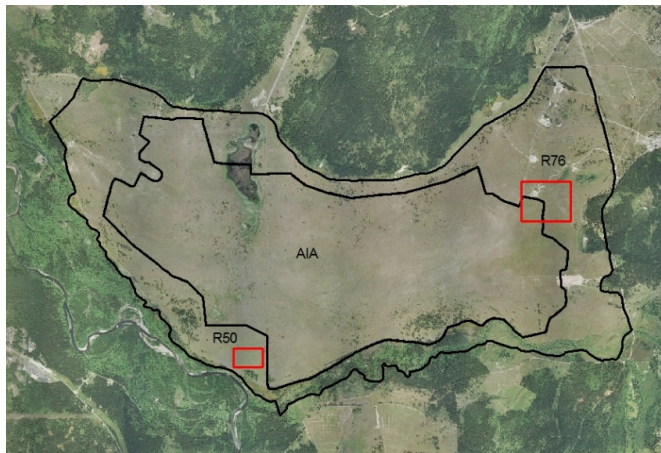
Table 1. Raw counts of adult Taylor's checkerspots observed during distance sampling surveys on Range 76 – AIA, Joint Base Lewis-McChord, Washington, in Spring 2010.

Site/Date	Raw count	Survey effort
19-Apr-10	1st adult Eet	1 observed
29-Apr-10	101	Full
6-May-10	171	Partial - 8 lines
7-May-10	207	Full
8-May-10	352	Full
12-May-10	255	Full
13-May-10	307	Full
14-May-10	296	Full
17-May-10	170	Full
25-May-10	5	Partial – 4 lines
27-May-10	Last adult Eet	6 observed
≥39 days	>1871 observed	7 full, 2 partial surveys

## Habitat Management

**Range 50 - Artillery Impact Area:** Range 50 is located in the SW corner of the Artillery Impact Area (AIA) (Fig. 1); access is difficult due to live fire in adjacent ranges and usually during a 2-4 hr “check-fire” period. The Taylor’s checkerspot release site and surrounding area contain the highest cover and diversity of native forbs in South Puget Sound. R50 has no noxious weed issues and very few introduced grasses. This year we spot sprayed the only tall oat grass plant found within or near the occupied area. It does occur along the road in the SW corner of the Range but has not invaded the core checkerspot resource area. Strategies to reduce the risk of fire were discussed, but no plan is yet in place.

**Range 76 - Artillery Impact Area:** Range 76 is located in the NE corner of the AIA (Fig. 1). Vegetation ranges from very high quality with profuse Puget balsamroot and diverse native forb cover to moderate/poor quality where tall oat grass invades from the south. Sulfur cinquefoil, knapweeds and introduced grasses (*Poa bulbosa*) were spot sprayed; no serious infestations occur in the occupied area.



Tall oat grass is very problematic in the two southernmost transects of the survey area (Fig. 1) and south, where it dominates a few hundred acres. No mechanical spraying is permitted in the AIA due to ordinance hazard; we spot sprayed tall oat grass where we could access it in 2010. Aerial spraying south of the survey area is being considered for 2011. Access to R76 is easier than R50, but dud hazard in part of the occupied area requires EOD support, making weed control problematic or impossible.

**Fig. 1.** The Artillery Impact Area on Joint Base Lewis-McChord covers about 7000 acres; inner duded area (black) and occupied Taylor’s Checkerspot survey areas (red) shown.

**Seed/plug production for habitat restoration:** The following seed and plugs are available from Stafford Creek Corrections Center and Webster’s Nursery for fall 2010 enhancement plantings (as of 9/9/10):

**Plugs:** *Armeria maritima* (ARMA) 11,230, *Castilleja hispida* (CAHI) 18,892, *Eriophyllum lanatum* (ERLA; CAHI host) 9,800, *Lomatium triternatum* (LOUT) 11,368

**Seed:** *Castilleja hispida* (CAHI), *Plectritis congesta* (PLCO) 2,626g, *Collinsia parviflora* (COPA) 2,835g, *Collinsia grandiflora* (COGR), *Plantago lanceolata* (PLLA) ~30 flats

**Other news:** *Plantago patagonica* (very rare native annual) was found on Johnson Prairie in the Rainier Training Area on JBLM. The site was burned in fall 2010 and will be sprayed with Fusilade; intense surveys to locate additional plants will occur next year.

- Checkerspot larvae at the Oregon Zoo fed on introduced *Valerianella locusta*, found at Training Area 15, which may have served as a larval host when that site was occupied. *Rhinathus minor* (annual figwort species) will be tested this winter or spring.
- Fusilade doesn’t kill mature annual rattail grass (*Vulpia*) (*Festuca bromoides*); we are testing Envoy Plus as a new herbicide for controlling it.

## Oregon – Al Kitzman

## Notes





Strategic Action	Task	Location	Priority	Implementing Party	2010			2011			2012			
					Funding request	Funding secured	Funding needed	Funding request	Funding secured	Funding needed	Funding request	Funding secured	Funding needed	
2	Improve / Enhance / Expand Habitat	Develop management / restoration plans at occupied and unoccupied sites.		Bald Hill	WDNR, USFS, WDFW, Weyco		ACUB at NAP	need \$						
				Scatter Creek	WDFW		ACUB							
				AIA + 13th Div	Fort Lewis									
				Oly Nat'l Forest										
				Benton County				?						
				Clallam County	WDNR, USFS, WDFW			?						
				Denman Island				?						
3	Increase Population Sizes and Number of Populations	Continue refining captive rearing, captive mating, and release methodology	*	WDFW, Oregon Zoo		ACUB				85000			85000	
		Develop new or additional facilities for captive rearing	*	USFS, FWS, Xerces, IAE, WDFW, Benton County, Oregon Zoo, TESC, TNC			need \$			13000			13000	
		Identify potential future release sites -- is the habitat suitable for future dispersal from existing populations or translocation of larvae		All occupied, historic and potential sites	WDFW, DOD, FWS, TNC		done in SS, need in OR, Clallam Cty, CANADA							
		Address potential to augment existing populations -- what are drawbacks?			working group									
4	Survey / Monitor	Continue to survey suitable habitat at historic locations. eg. western AIA, Victoria Island, North Olympic Peninsula	*	All Occupied and historic Sites	WDFW, USFS, WDNR, Fort Lewis, USFS			need \$						
		Survey sites adjacent to and neighboring occupied sites	*	Benton County										
			*	Oly Nat'l Forest										
		Annually monitor all known populations, including translocated populations, and potential habitat that may be selected for translocation	*	Bald Hill	WDFW, WDNR		ACUB + DFW							
			*	Scatter Creek	WDFW		ACUB							
			*	AIA & 13th Div	Fort Lewis, WDFW		Fort Lewis							
			*	Benton County			?							
			*	Clallam County	WDFW, USFS		WDFW + FWS + USFS							
*	Denman Island	BC Ministry of Env, Raincoast Applied Ecology			?									
5	Research	Define butterfly habitat selection through research, i.e. oviposition & adult habitat, nectar and larval food plant density, phenology, and spatial arrangement	*											
		Survey habitat vegetation												
		Identify what defines proximate habitat, i.e. what is dispersal distance and barriers to dispersal												
		Conduct genetic and meta-population studies to determine population isolation/diversity												
6	Outreach	Develop outreach material (habitat mngmt guide, TCS brochure)for private landowners with an eye toward habitat enhancement, protection, creating and managing habitat. What makes a suitable reintroduction sites (?)		Throughout range of species	WDFW, TNC, FWS, IAE			need \$						
		Share information between entities, establish partnerships, and create a working group	*		TNC, WDFW, FWS	FWS	2009 Legacy + FWS salary	need \$						

## MINUTES

We had a great turn out for the first meeting of the **Range-Wide Taylor's Checkerspot Working Group** held at Sawyer Hall, USFWS Lacey Field office. The meeting was resoundingly successful at sharing and integrating information between entities and sites as well as providing a venue for lively discussions regarding recovery and conservation of Taylor's checkerspot. Despite technical difficulties (power outage) the group worked through a morning of updates, using the [January 2008 Taylor's Workshop](#) as a baseline. The afternoon was focused on action planning. This initial meeting was focused on updates, action planning, and cementing partnerships. In subsequent meetings the update portions will pass quicker and the group will be able to focus on particular issues and have more in-depth and meaningful discussions.

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## *In Attendance*

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## *Survey & Monitoring – Population Updates*

### **British Columbia – Denman Island - Jenny Heron & Nick Page**

The known population in BC is in a clear-cut (logged between 1999 and 2002) on Denman Island. The site was not replanted after logging; rather it was sold directly to a developer. While the site is currently up for development, the government is pursuing transfer into public land. That transfer is in the works, but may take a long time. The population was first discovered on this site in 2005. It is unknown where this population came from; perhaps it was remnant in non-“natural” habitats.

**2082 individuals were observed on Denman (2-3 color morphs) during the 2009 flight season.** The population seems to have moved through forested bands throughout Denman Island. The population seems to be doing “well”. A word of caution is suggested from Fort Lewis, as that population has moved from doing very “well” with high numbers of individuals during the flight season to having very low numbers in a very short time.

On Denman in 2009 a mark/recapture project was initiated in 2009 to determine the level of duplicate counts and to see if they were seeing a change in spatial distribution and numbers dependent on habitat successional stages. There are many places where larvae have been observed near the road or on old skid trails. In 2010, a stricter mark/recapture project is planned to follow individuals and see where they go.

The butterflies were marked on their wings with very fine sharpies. Red, blue, green, and purple colors were used. All colors were clearly observable. **1220 individuals were marked, and 44 were re-captured.** Recaptures were both actual captures, and resights.

In 2008, surveys were conducted outside Denman Island, based on historic records and adjacency. There is a low availability of habitat throughout. **In May 2008, one individual was sighted on Vancouver Island, which is approximately 5km from Denman.**

Of note, Parks Canada has withdrawn from work on Taylor's checkerspot. The jurisdiction of Parks Canada is only on National Parks. There were plans to introduce Taylor's checkerspot onto Gulf Islands national Park. However, no suitable habitat is available and they have decided to withdraw for now. This is unfortunate as Parks Canada was able to inject funding in the past, and that will be missed.

### **Washington – Bald Hill, Grays Marsh, Eden Valley, Dan Kelly Ridge, Oly Nat'l Forest, San Juans - Ann Potter**

See

Priority Action	Task	Location	Priority	Implementing Party	2010		
					Funding request	Funding secured	Funding needed
1	Protect Occupied Sites	Minimize Direct Impacts to Occupied Sites					
		Redirect ATV use	Dan Kelly, Eden Valley, Bald Hill		DNR, WDFW		
		Minimize incompatible recreation	Scatter Creek		WDFW		
		Minimize training impacts and provide fire protection at Fort Lewis	R74/76, R51	*	DOD, FWS, WDFW, TNC		

		Pursue conservation easement, acquisition, and/or management plan							
		Finalize voluntary management plans on private land under the guidance of the WDFW & DNR Forest Practices Board.	Bald Hill Pvt Land / Clallam Co. Balds		WDFW, WDNR, FWS, TNC, Weyco				
		Pursue acquisition or conservation easement with willing sellers	Bald Hill Pvt Land	*	Weyco				
			Clallam Co. Balds	*	WDNR, WDFW				
			Denman Island	*	BC Ministry of Env				
			Fitton Green	*	Benton County				
			Dungeness Spit						
		Work with BPA to develop management agreement	Scatter Creek		WDFW				
		2	Improve / Enhance / Expand Habitat	Coordinate with US Forest Service. Reduce threats and collaborate on enhancing all sites.	Oly Nat'l Forest		USFS, FWS, WDFW		
				Control/remove invasive and encroaching species, e.g. Scot's broom, tall oatgrass, sulfur cinquefoil, Doug-fir. -- first priority at occupied sites, then proximate habitat, followed by unoccupied/future reintroduction sites	Bald Hill		WDNR		ACUB + FWS + WHIP
Scatter Creek					WDFW		ACUB		
AIA + 13th Div	*				Fort Lewis		Fort Lewis		
Benton County	*				Benton County				
Clallam County	*				WDFW, WDNR		FWS		
Oly Nat'l Forest	*								
Denman Island	*								
Ensure release sites are in suitable condition - south sound				*			ACUB		
Link restoration efforts to other species at risk									
Improve connectivity between sites	all non-prairie sites								
Improve larval and nectar plant materials production, particularly CAHI & PLLA	Range-wide			*	TNC, WDFW, FWS, IAE, Heritage Seedlings, Benton County		ACUB + WWRP + FWS		
Enhance larval food and nectar plants -- first priority at occupied sites, then proximate habitat, followed by unoccupied/future reintroduction sites	Reintroduction sites - 7s, Glacial, Tenalquot			*	TNC, WDFW, WDNR, Fort Lewis		ACUB		
	Bald Hill			*	WDNR		ACUB	need \$	
	Scatter Creek			*	WDFW		ACUB		
	AIA + 13th Div			*	Fort Lewis		Fort Lewis		
	Benton County			*	Benton County				
	Clallam County	*	WDFW, USFS						

			Denman Island	*	BC Ministry of Env			
2	Improve / Enhance / Expand Habitat	Develop management / restoration plans at occupied and unoccupied sites.	Bald Hill		WDNR, USFS, WDFW, Weyco		ACUB at NAP	need \$
			Scatter Creek		WDFW		ACUB	
			AIA + 13th Div		Fort Lewis			
			Oly Nat'l Forest					
			Benton County				?	
			Clallam County		WDNR, USFS, WDFW		?	
			Denman Island				?	
3	Increase Population Sizes and Number of Populations	Continue refining captive rearing, captive mating, and release methodology		*	WDFW, Oregon Zoo		ACUB	
		Develop new or additional facilities for captive rearing		*	USFS, FWS, Xerces, IAE, WDFW, Benton County, Oregon Zoo, TESC, TNC			need \$
		Identify potential future release sites -- is the habitat suitable for future dispersal from existing populations or translocation of larvae	All occupied, historic and potential sites		WDFW, DOD, FWS, TNC		done in SS, need in OR, Clallam Cty, CANADA	
		Address potential to augment existing populations -- what are drawbacks?			working group			
4	Survey / Monitor	Continue to survey suitable habitat at historic locations. eg. western AIA, Victoria Island, North Olympic Peninsula	All Occupied and historic Sites	*	WDFW, USFS, WDNR, Fort Lewis, USFS			need \$
		Survey sites adjacent to and neighboring occupied sites	Benton County	*				
			Oly Nat'l Forest	*				
		Annually monitor all known populations, including translocated populations, and potential habitat that may be selected for translocation	Bald Hill	*	WDFW, WDNR		ACUB + DFW	
			Scatter Creek	*	WDFW		ACUB	
			AIA & 13th Div	*	Fort Lewis, WDFW		Fort Lewis	
			Benton County	*			?	
			Clallam County	*	WDFW, USFS		WDFW + FWS + USFS	
Denman Island	*	BC Ministry of Env, Raincoast Applied Ecology		?				

	<b>Research</b>	Define butterfly habitat selection through research, i.e. oviposition & adult habitat, nectar and larval food plant density, phenology, and spatial arrangement		*				
		Survey habitat vegetation						
		Identify what defines proximate habitat, i.e. what is dispersal distance and barriers to dispersal						
		Conduct genetic and meta-population studies to determine population isolation/diversity						
<b>5</b>	<b>Outreach</b>	Develop outreach material (habitat mngmt guide, TCS brochure)for private landowners with an eye toward habitat enhancement, protection, creating and managing habitat. What makes a suitable reintroduction sites (?)	Throughout range of species		WDFW, TNC, FWS, IAE			need \$
		Share information between entities, establish partnerships, and create a working group		*	TNC, WDFW, FWS	FWS	2009 Legacy + FWS salary	need \$



## ***Appendix A***

for the summary report of **2009 Bald Hill Checkerspot surveys**.

In 2007 checkerspots were detected in only one bald. In 2008, no checkerspots were detected. In 2009, the number of balds surveyed was increased, no checkerspots detected.

**At Grays Marsh the high daily count was 240 individuals**, but that is not necessarily the number of butterflies that occur there. **At Eden Valley the high daily count was 150 individuals**. **At Dan Kelly Ridge the high daily count was 70-90 individuals**. However, Dan Kelly Ridge is an immense area and high daily counts will vary with effort. It is a very difficult place to survey due to the logistics of working on very steep slopes. Dan Kelly Ridge appears to be a stable population that uses both *Plantago* and *Castilleja hispida*, but not both in the exact same place.

In 2006 a new checkerspot site was found in the Olympic National Forest. FWS has funded USFS to do more extensive searches in that area including the network of balds and more clear-cuts. The first of those searches was conducted in 2009. At least one additional population was detected and possibly a second, for a **total of 2 to 3 populations in the Oly Nat'l Forest**. **High counts were 40 to 50 individuals per day, per site**. There is a lot more work to be done to figure out population numbers, host plant use, etc. This site is challenging to work in because of the very steep slopes. Additional surveys will be conducted in 2010.

WDFW has conducted extensive searches in San Juans for Island Marble. No checkerspots have been detected during those visits. WDFW has been unable to get onto Long Island where the only documented case of Taylor's checkerspot was in San Juans.

### **Washington - Fort Lewis – Mary Linders & Rod Gilbert**

See **Appendix B**  
for **Fort Lewis 2009 Survey Summary**

The Fort is using different survey methodology this year, distance sampling. In the past, they have used block counts that require a large person effort and cover relatively small areas. By using distance sampling, fewer surveyors are able to cover more ground and ultimately create population estimates.

There were very very low numbers this year never saw more than a few butterflies together at a time. In the past have had many individuals, and now very few. **Fort Lewis high daily count of 77**.

Surveys were conducted by ITAM outside the monitoring area, but no individuals were detected.

Have seen some decline in habitat quality, but fairly minor. It is a dynamic site. Mary is noticing that areas where *Plantago* is abundant are becoming increasingly disjunct from areas where nectar resources are. The weather was fairly awful and delayed the flight season a bit in

2009. About mid-May the weather broke and stayed nice, resulting in a 4-week flight season, which is unusual. There were far more males detected than females right up into the very end.

Heavy training on that site this year, but the heaviest happened somewhat removed from where the largest butterfly concentrations are. Numbers have been going down since 2006.

### **Oregon – Fitton Green, Beazell Memorial Forest – Dana Ross**

See **Appendix C**  
for **Cumulative Oregon Survey Summary 2003-2009**.

Surveys are along permanent transects (5m on either side) that have been running since day 1. On small areas, surveys generally strive for an absolute count. If the area is larger, a proportion of representative habitat is selected and then multiplied 2 or 3 depending on how big. **In 2009, 1000 individuals were detected at Fitton Green, and 765 individuals detected at Beazell Memorial Forest.**

There appears to be fairly stable populations at Fitton Green (since 2003) and Beazell since it was discovered in 2004. 2008-9 saw some moderate increases in numbers with a fairly steady trend up.

Beazell is a complex of several meadows and balds along a ridge. The areas are semi-adjacent / semi-isolated, with the approximate distance between main meadows at Beazell is 0.5 to 0.75 miles apart. Fitton Green is 3 areas, all within a stone's throw of the next.

### ***Captive Rearing and Translocations***

See **Appendix D & Appendix E**  
for **Captive Rearing / Translocation Summary Sheets**

### **Captive Rearing – Melissa Arnold, Elayne Barclay**

The Oregon Zoo has provided tremendous support to the Taylor's checkerspot captive rearing program. New this year is demonstrated programmatic support from the zoo by way of a new educational poster and husbandry guide. Throughout the project the zoo has determined how to raise the animals at all the different life stages and have also provided adult care and followed the individuals through captive breeding. In addition to rearing and breeding, in 2009 they have retained/hired staff support to do data analysis, report writing, and coordinating with WDFW.

At the 2008 workshop the zoo reported a discrepancy between the sizes of captive vs. wild adults. The captive reared animals were much smaller than wild adults. They learned through anecdotal information that larvae reared outside may be larger than those reared inside. The zoo conducted a trial of outside vs. inside reared animals. They are still analyzing the data, but there doesn't seem to be much size difference. However, outside individuals went back into diapause

instead of pupating. In 2009, the average size of females was larger than other captive reared animals in other years.

This year was the first time that they have had captive reared animals, which have been raised to adults, copulate in the lab and lay viable eggs. Those animals will be monitored to determine how they do.

Q: what stage of *Plantago* leaves are being fed post-diapause being fed? In Oregon the wild populations are preferentially eating young expanding leaves. This question led to a discussion of the difficulties of providing enough food for the captive rearing efforts. The larvae go through an amazing amount of *Plantago* each day. Some suggestions were to perhaps work with prisons to have them grow *Plantago* for the rearing efforts. Or the zoo could be growing *Plantago* on site, rather than having it collected.

Q: what is the connection between Oregon Zoo and WDFW? How is it funded, where are they released? The work is currently mainly funded by the Fort Lewis Army Compatible Use Buffer (ACUB) program. The goal of the ACUB is to preclude the need to list the federal candidate species that occur on Fort Lewis through a cooperative program whose objectives are to manage, maintain, and enhance prairie habitats outside Fort Lewis, increase the sizes and numbers of species' populations, and conduct associated research, planning, and monitoring.

### **Release – Mary Linders**

Over the course of the project considerable strides have been made in release strategy, e.g. which stage for release, in groups or singly. To date the best methods appear to releasing groups of post-diapause larvae. In 2009, **2250 post-diapause larvae were released spread over three different sites** – Scatter Creek South, Scatter Creek North, and Pacemaker.

2009 was the first year animals have been released at both Scatter Creek North and Pacemaker. At both these sites only one or two adults were detected flying during the 2009 flight season.

Animals were released at Scatter Creek South in 2007, 2008, and 2009. **In 2009, there were a total of 48 observations, with a high daily count of 19 individuals.** This is fairly similar to the numbers of individuals detected in 2007 and 2008, even though twice as many animals were released.

In 2009, there were an additional 5500 pre-diapause larvae placed in an unplanned release. Within one week the zoo went from 1000 eggs with 50% hatch rate to 10000 eggs with 100% hatch rate. Over 7000 animals hatched, which was too much for the zoo capacity to handle. 5500 hundred were released into the field on two different sites. These pre-diapause animals were released in groups of 25.

The bottom line is that the rearing and release is moving way faster than the restoration work, which may be affecting the success of the releases. Mary doesn't think that host plant is limiting in the few weeks left before pupating. Mary suspects that it may be the adult stage needs that could be limiting.

## ***Habitat Management***

### **Benton County Habitat Management – Al Kitzman**

See **Appendix F**  
for **Benton County Habitat Management Summary**

The biggest challenge with Fitton Green is that it is an unsecured site. This population was known in the late 90s, but Benton County parks didn't know about it until 2005. The MOU with Benton County parks and the private landowners is now extended to 5-yr agreement and is thus managed by Benton County Natural Areas.

There is a lot of well-established False Brome under the trees surrounding the Fitton Green meadows. Heavy viable seeds of false brome will spread quickly, and could displace everything within 5 to 7 years. Because largest population was on the site, the landowner was willing to let spray with herbicide where it was densest. Poast was effective in getting it to not re-seed, but did not kill the plant. So, they used glyphosate later in season. After glyphosate treatment they seeded with Roemer's fescue and nectar plant material. They are starting to see some establishment of the nectar and grasses and starting to see butterflies in those areas.

Primary challenges at Beazell were false brome, Scotch broom, and encroaching trees. So they have mowed through the broom and every 3 years afterward coming back and spraying the broom before it seeds again. Used crews of volunteers and corrections work crews to girdle and pull the trees out of the meadow complexes. Just in the last year they have begun mowing the meadows to reduce the structure of the high invasive grasses. They are seeing butterflies moving into those areas that were displaced by tall oatgrass. They are seeding and plugging nectar forbs. Collecting seed of *fragaria* and *Plantago*.

Suggestion to try fusillade on tall oatgrass. In south Puget Sound fusillade has yielded good control of tall oatgrass.

### **Fort Lewis Habitat Management – Rod Gilbert**

The occupied site at Fort Lewis (Range 76) is in the Artillery Impact Area, where there is very little access and habitat management activities are limited due to safety issues. They did spot spray for weeds, tall oatgrass in particular. There have been discussions of doing aerial spraying of a large oatgrass infestation near the occupied area, but they did not do it this year due to the low number of butterflies.

TA 14 Pacemaker: No work in release site (Siebert-staked area) Spot sprayed Fusilade around Castilleja plants adjacent to release site (spring). Sprayed four mounds w/Fusilade west of release site (spring and fall) to plant this winter w/nectar. Burned adjacent to release site (fall).

R51: Emergency release, no prior access, watered *Plantago* before release.

TA 7S: Boom sprayed 15 acres Fusilade (spring); plant fescue in fall on same 15 acres; burned in fall

Triangle: spot sprayed enhancement plots (Fusilade) in spring/fall; burned east side of Triangle in fall.

Collected a lot of *Plantago* seed this year and trying to get it grown and also did some transplanting

### **South Puget Sound Restoration – Hannah Anderson**

See **Appendix G**  
for **Summary of South Sound Butterfly Habitat Enhancements**

A cooperative project to restore South Sound prairie habitat in preparation for reintroductions is underway. We are working to remove invasives, increase plant production, and enhance sites through outplanting and seeding.

### **Clallam County Habitat Management – Dave Hays**

The big threat up there is disturbance from vehicles, ATV and otherwise. Because there are checkerspots laying in the roadways, the ATV use is a big threat. DNR is managing the road access for Dan Kelly site even though it is multiple owners they have been very active up there. DNR has been very aggressive trying to get trespassers off the areas with signage, and other means. However, the ATV users are also quite aggressive, often using chainsaws to clear trails on old fire breaks. Succession is also a threat at these bald sites. DFW has been removing trees and shrubs as well as doing some plant propagation, although this effort is in its infancy.

Grays marsh is a stabilized dune system with lots of *Collinsia* and *Plantago* where the butterflies occur. There is a very high native component, although not much nectar. DFW has been working on enhancing nectar for checkerspots. They are using dandelion right now. The plan is to bring natives that are found down the beach some and looking at checkerspot use.

DFW is interested in evaluating patches for enhancements. They have identified 20 to 30 variables including the presence of weeds, food plants, rare plants, shrub & tree encroachment, and connectivity. They are using that information to prioritize future work of areas that have the best potential for enhancements. This is the first year of the project, there will an end of year report.

### **Denman Island Habitat Management – Jenny Heron, Nick Page**

There is currently no funding to do habitat management at the occupied site. Once the site transfers to the Province, it will become a BC Park and will get its own resources.

There are some ideas to start a butterfly garden in a provincial park that is quite close to Denman Island. The garden would provide hostplants to transplant later or get butterflies to the garden, or operate solely as an outreach demonstration.

The last known Taylor's site was at Helliwell Provincial park, extirpated in 1990s. They would like to do some conifer removal. Difficult to get volunteers interested because it is such hard work.

Nick has been surveying for potential reintroduction sites on Vancouver Island and greater Victoria Island.

Lesson learned from Denman Island population is the value of disturbance and could be important to restoration efforts – scalloping soils, removing grass mats, etc.

## ***Oregon Habitat Research – Paul Severns***

See <http://www.southsoundprairies.org> for Power Point presentation slides and the article:

[Severns, P. M. & A.D. Warren. 2008. Selectively eliminating and conserving exotic plants to save an endangered butterfly from local extinction. \*Animal Conservation\*. 11:476-483.](#)

Paul presented his work on host plant species use and oviposition site preference. The question is **what are these butterflies preferring to lay eggs upon given the choices they have in the site?** The butterflies are keying in on areas dominated by low-stature grasses. In those low-stature areas they are keying in on areas with high concentrations of nectar.

There was also a discussion about post-diapause activity, timing, and host plant use. The Oregon checkerspots are definitely using *Plantago lanceolata* and their development appears to be timed to that plant. Every year post-diapause larvae become active sometime between mid-January and 1<sup>st</sup> week of Feb. On Denman they have seen them as early as Feb 2.

Host plant potentials in OR include *Collinsia parviflora* and *C. grandiflora* and *Castilleja levisecta*. *Collinsia* timing may be off for Oregon checkerspots, while in southwestern OR, the *Euphydryas* spp. there are completely dependent on *Collinsia*. It may be that year to year variation may play an important piece in host-plant selection. Ann has seen *Collinsia* used as a food plant in February.

Denman Is early post-diapause larvae use *Veronica scatalata* (native wetland, pre-diapause use, and oviposition) which comes out later. *Veronica sophiliphobia* (non-native) emerges earlier and they use those as they become available. Also on *Plantago major* they will use the older leaves too, while on *lanceolata* they only use the young leaves.

## ***Native Plant Materials Production***

See **Appendix H**  
for South Sound Plant Production summary.

Partners in the South Puget Sound have been working over the last few years to increase the availability of native plant materials to support restoration efforts. Great emphasis has been placed on growing plugs and seeds of butterfly resource plants. The Nature Conservancy runs Shotwell's Native Plant Nursery in Littlerock, WA, which produced a large amount of plugs of rare prairie plants. Seeds are wild collected by partners and volunteers. In addition to plug production at Shotwell's, South Sound partners are engaged in increasing the seed availability and creating capacity to be able to seed at scale. As the scale of restoration actions such as prescribed fire and herbicide application increases, the need to enhance with native plant materials at the broad scale increases respectively. Partners have contracted Webster's Nursery for initial seed beds.

Fort Lewis produces native plants to support the Integrated Training Area Management (ITAM) program actions. ITAM is charged with revegetation and restoration of training lands in response

to military training impacts. In addition, Fort Lewis has recently dedicated a 17-acre patch of prairie that will be used for seed propagation to support restoration efforts.

The Institute of Applied Ecology has been working with the BLM to begin growing Taylor's checkerspot nectar species and IAE is in discussion with Benton County to start a seed production program.

The Oregon Zoo is also a potential partners for growing native plant materials and would like to become more involved with the outplanting actions. The Zoo encourages partners to think of them as on-the-ground field partners in addition to the actions they can conduct on the zoo site itself.

## *Action Planning*

The group spent the afternoon reviewing and updating the draft wildlife action plan for the Taylor's checkerspot. An action plans is a range-wide outline of recovery tasks designed to get at the **Next Most Important Thing** to do for recovery of Taylor's checkerspot. The group was charged with asking themselves if they were given a sum of money to work on Taylor's checkerspot recovery what would they do with that money? The action plan is a working document, always subject to review and refinement. As we learn new things, work is conducted, and actions completed, the will plan change and grow.

The group went through the plan refining existing tasks, deleting and/or re-organizing existing tasks, and adding tasks to fill gaps in the structure. Once the full suite of tasks were listed, the group worked to identify priority tasks that were the most imminent and important to complete.

The draft action plan is provided below and in attachment. An asterisk (\*) in the priority column indicates that the associated action is higher priority than those that do not contain an asterisk. In the future, the group will work to give priority ranking to the high priority tasks.



Priority Action	Task	Location	Priority	Implementing Party	2010		
					Funding request	Funding secured	Funding needed
1	Protect Occupied Sites	Minimize Direct Impacts to Occupied Sites					
		Redirect ATV use	Dan Kelly, Eden Valley, Bald Hill		DNR, WDFW		
		Minimize incompatible recreation	Scatter Creek		WDFW		
		Minimize training impacts and provide fire protection at Fort Lewis	R74/76, R51	*	DOD, FWS, WDFW, TNC		
		Pursue conservation easement, acquisition, and/or management plan					
		Finalize voluntary management plans on private land under the guidance of the WDFW & DNR Forest Practices Board.	Bald Hill Pvt Land / Clallam Co. Balds		WDFW, WDNR, FWS, TNC, Weyco		
		Pursue acquisition or conservation easement with willing sellers	Bald Hill Pvt Land	*	Weyco		
			Clallam Co. Balds	*	WDNR, WDFW		
			Denman Island	*	BC Ministry of Env		
			Fitton Green	*	Benton County		
		Dungeness Spit					
Work with BPA to develop management agreement	Scatter Creek		WDFW				
2	Improve / Enhance / Expand Habitat	Coordinate with US Forest Service. Reduce threats and collaborate on enhancing all sites.	Oly Nat'l Forest		USFS, FWS, WDFW		
		Control/remove invasive and encroaching species, e.g. Scot's broom, tall oatgrass, sulfur cinquefoil, Doug-fir. -- first priority at occupied sites, then proximate habitat, followed by unoccupied/future reintroduction sites	Bald Hill		WDNR		ACUB + FWS + WHIP
			Scatter Creek		WDFW		ACUB
			AIA + 13th Div	*	Fort Lewis		Fort Lewis
			Benton County	*	Benton County		
			Clallam County	*	WDFW, WDNR		FWS
			Oly Nat'l Forest	*			
			Denman Island	*			
		Ensure release sites are in suitable condition - south sound		*			ACUB
Link restoration efforts to other species at risk							

		Improve connectivity between sites	all non-prairie sites					
		Improve larval and nectar plant materials production, particularly CAHI & PLLA	Range-wide	*	TNC, WDFW, FWS, IAE, Heritage Seedlings, Benton County		ACUB + WWRP + FWS	
		Enhance larval food and nectar plants -- first priority at occupied sites, then proximate habitat, followed by unoccupied/future reintroduction sites	Reintroduction sites - 7s, Glacial, Tenalquot	*	TNC, WDFW, WDNR, Fort Lewis		ACUB	
			Bald Hill	*	WDNR		ACUB	need \$
			Scatter Creek	*	WDFW		ACUB	
			AIA + 13th Div	*	Fort Lewis		Fort Lewis	
			Benton County	*	Benton County			
			Clallam County	*	WDFW, USFS			
Denman Island	*	BC Ministry of Env						
2	Improve / Enhance / Expand Habitat	Develop management / restoration plans at occupied and unoccupied sites.	Bald Hill		WDNR, USFS, WDFW, Weyco		ACUB at NAP	need \$
			Scatter Creek		WDFW		ACUB	
			AIA + 13th Div		Fort Lewis			
			Oly Nat'l Forest					
			Benton County				?	
			Clallam County		WDNR, USFS, WDFW		?	
			Denman Island				?	
3	Increase Population Sizes and Number of Populations	Continue refining captive rearing, captive mating, and release methodology		*	WDFW, Oregon Zoo		ACUB	
		Develop new or additional facilities for captive rearing		*	USFS, FWS, Xerces, IAE, WDFW, Benton County, Oregon Zoo, TESC, TNC			need \$
		Identify potential future release sites -- is the habitat suitable for future dispersal from existing populations or translocation of larvae	All occupied, historic and potential sites		WDFW, DOD, FWS, TNC		done in SS, need in OR, Clallam Cty, CANADA	
		Address potential to augment existing populations -- what are drawbacks?			working group			
4	Survey / Monitor	Continue to survey suitable habitat at historic locations. eg. western AIA, Victoria Island, North Olympic Peninsula	All Occupied and historic Sites	*	WDFW, USFS, WDNR, Fort Lewis, USFS			need \$

		Survey sites adjacent to and neighboring occupied sites	Benton County	*				
			Oly Nat'l Forest	*				
		Annually monitor all known populations, including translocated populations, and potential habitat that may be selected for translocation	Bald Hill	*	WDFW, WDNR		ACUB + DFW	
			Scatter Creek	*	WDFW		ACUB	
			AIA & 13th Div	*	Fort Lewis, WDFW		Fort Lewis	
			Benton County	*			?	
			Clallam County	*	WDFW, USFS		WDFW + FWS + USFS	
			Denman Island	*	BC Ministry of Env, Raincoast Applied Ecology		?	
	<b>Research</b>	Define butterfly habitat selection through research, i.e. oviposition & adult habitat, nectar and larval food plant density, phenology, and spatial arrangement		*				
		Survey habitat vegetation						
		Identify what defines proximate habitat, i.e. what is dispersal distance and barriers to dispersal						
		Conduct genetic and meta-population studies to determine population isolation/diversity						
<b>5</b>	<b>Outreach</b>	Develop outreach material (habitat mngmt guide, TCS brochure)for private landowners with an eye toward habitat enhancement, protection, creating and managing habitat. What makes a suitable reintroduction sites (?)	Throughout range of species		WDFW, TNC, FWS, IAE			need \$
		Share information between entities, establish partnerships, and create a working group		*	TNC, WDFW, FWS	FWS	2009 Legacy + FWS salary	need \$

## *Appendix A*

### **ACUB Project Progress Report August 26, 2009**

**Project Title:** Monitoring Taylor's checkerspot butterfly in the Bald Hill Landscape

**Project Lead:** Ann Potter, Washington Department of Fish & Wildlife [potteaep@dfw.wa.gov](mailto:potteaep@dfw.wa.gov)

**Project Site:** Bald Hill

**Executive Summary:** Taylor's checkerspot (*Euphydryas editha taylori*) was historically documented from over 20 south Puget Sound sites. Today, two populations may be extant in this region, however, the occupancy status of one, the Bald Hill population, is in question. Taylor's checkerspots in the Bald Hill area inhabit balds: small, forest openings on slopes, which are dominated by herbaceous vegetation. Between 2002 and 2006, the Washington Department of Fish and Wildlife searched for Taylor's checkerspot in over 80 balds in this landscape. Taylor's checkerspots were detected in 17 balds (21%). Seven balds (8.7%) were found occupied by greater than two checkerspots during multiple years: at most of these sites 10 or more butterflies were encountered during multiple years. Under an ACUB and WDFW sponsored project, these seven and five adjacent balds were intensively surveyed for Taylor's checkerspot in 2007 and 2008. Surveys during 2007 and 2008 were conducted using distance sampling methods, with the goal of estimating butterfly population size, densities, and detectability, and evaluating distance sampling survey methods for Taylor's checkerspot in this landscape. However, during this two-year survey effort only two Taylor's checkerspots were observed at one bald during a single visit. Despite these results it is possible that Taylor's checkerspot persists in this landscape. Small numbers of adults may have been present at surveyed balds and not detected, or may persist in nearby balds that were not surveyed. Past monitoring of Taylor's checkerspot at these sites has indicated tremendous annual variation in adult numbers. Other *Euphydryas editha* subspecies are capable of delayed larval development, a multi-year instead of the typical single year cycle, which depending on the number of larvae doing so results in few or no adults during the additional larval years. It is also possible that Taylor's checkerspot is no longer present in the Bald Hill landscape. Determining the status of Bald Hill populations is important to Taylor's checkerspot conservation and can only be accomplished with annual survey effort for several consecutive years.

During the Taylor's checkerspot Bald Hill flight period we conducted 59 survey visits to 15 balds previously determined occupied and five neighboring balds. Visits totaled 63 survey hours and were conducted between April 15 and June 4. Fifteen of the 17 occupied balds were surveyed; 12 received greater than one visit. During our 2009 survey effort we did not encounter Taylor's checkerspot. Thirty-five visits were made to the 7 balds previously found occupied by greater than two checkerspots in multiple years. For these seven highest occupancy status bald sites, 2009 is the fourth consecutive year of survey without detection for two, the third consecutive year of survey without detection for four, and the second consecutive year of survey without detection for one.

**Project Goals and Objectives:** Taylor's checkerspot 2009 surveys at Bald Hill are part of a multi consecutive year effort to determine the occupancy status for balds previously found occupied, neighboring balds, and other balds in the landscape.

**Methods:** We developed a complete list of survey sites: balds where *taylori* had previously been detected and adjacent neighbors. We compiled a survey effort spreadsheet with survey date, observers, type of visit, and survey results, for all years of survey at each occupied site. We contacted and coordinated access with landowners to conduct searches: survey balds are located on land managed by Department of Natural Resources or Weyerhaeuser. Surveys focused on balds in the geographic area north of the Deschutes River, where all Taylor's checkerspots have been detected. We prioritized our survey effort as follows: 1) seven balds previously found occupied by greater than two checkerspots during multiple years, 2) balds where single butterflies were detected during multiple years, 3) balds where a single butterfly was detected during a single year, 4) balds adjacent to those with multi-year detections, and 5) other balds in the landscape.

Survey timing was selected to favor adult detection as they are the most visible and reliably identifiable life stage of Taylor's checkerspot, and based on Bald Hill Taylor's checkerspot phenology observed in prior years, adjusted for 2009 conditions. Adult surveys in the Bald Hill landscape typically commence in early to mid-April and continue to early June. During each survey visit, we systematically traversed and visually inspected entire balds (non-forest, grass and/or forb dominated areas), searching for and identifying target-species-like butterflies. Due to the fragile nature of bald vegetation, we conducted complete site searches without walking through every square meter and we took advantage of existing pathways and trails to minimize trampling. Also to minimize trampling impacts, survey visits were done with only one or two biologists. We also employed a stationary focal survey method: during each survey observers watched for approximately 30 minutes from bald vantage points located in previously identified checkerspot concentration areas. Surveys were primarily conducted during butterfly survey conditions established by Pollard and Yates (1993): 1) between 1030 and 1600 hours; 2) ambient temperature  $\geq 53$  degrees F; 3) sufficient sunshine to cast a distinct shadow; and 4) wind exposure less than 10 mph. A few surveys were done without "distinct shadow" sunlight conditions: when the temperature exceeded 65 degrees F, as described by Pollard and Yates (1993). For each survey visit, a form was completed detailing weather conditions, site characteristics, and all butterfly species observed.

**Results and Discussion:** During the Taylor's checkerspot Bald Hill flight period we conducted 59 survey visits to 15 balds previously determined occupied and five neighboring balds. Visits totaled 63 survey hours and were conducted between April 15 and June 4. Fifteen of the 17 occupied balds were surveyed; 12 received greater than one visit. The two previously occupied balds that were not visited are very small sites where one checkerspot was observed in a single year.

During our 2009 survey effort we did not locate Taylor's checkerspot. Thirty-five visits were made to the 7 balds previously found occupied by greater than two checkerspots in multiple years. For these seven highest occupancy status bald sites, 2009 is the fourth consecutive year of survey without detection for two, the third consecutive year of survey without detection for four,

and the second consecutive year of survey without detection for one. Table 1 lists all balds surveyed in 2009, their survey and detection history, and number of visits in 2009.

**Table 1. Survey and detection history for Taylor’s checkerspot occupied and neighboring balds surveyed in 2009**

Bald Site Name	Occupancy Status	TC Survey Year(s)	TC Detection Year(s)	Highest # <sup>2</sup> TC (Year)	# 2009 Visits
<b>1164 North A<sup>1</sup></b>	<b>occupied</b>	<b>2002 - 2009 (8)</b>	<b>2002 - 2006 (5)</b>	<b>65 (2004)</b>	<b>4</b>
1164 North B	occupied	2004 (1)	2004 (1)	1 (2004)	0
1164 North C	occupied	2004 (1)	2004 (1)	2 (2004)	0
1175	occupied	2004 - 2006, 2009 (4)	2004 - 2005 (2)	1 (2005)	1
1176 East D	---	2004 - 2007, 2009 (5)	---	---	1
<b>1176 NE Spur A</b>	<b>occupied</b>	<b>2004 - 2009 (6)</b>	<b>2004, 2005, 2007 (3)</b>	<b>18 (2005)</b>	<b>5</b>
<b>1176 Small B</b>	<b>occupied</b>	<b>2002 - 2009 (8)</b>	<b>2002 - 2006 (5)</b>	<b>28 (2005)</b>	<b>6</b>
1176 Small Unnamed	occupied	2005, 2006, 2009 (3)	2005 (1)	8 (2005)	1
Bald Hill End B	occupied	2002 - 2006, 2007, 2009 (7)	2002 (1)	1 (2002)	2
Bald Hill End C	occupied	2002 - 2006, 2007, 2009 (7)	2002, 2005 (2)	1 (2005)	2
Bald Hill End D	neighbor	2004, 2005, 2009 (3)	---	---	2
East Quarry	neighbor	2002 - 2005, 2009 (5)	---	---	2
Fossil Rock	occupied	2003 - 2006, 2009 (5)	2003 (1)	1 (2003)	2
<b>NAP – North</b>	<b>occupied</b>	<b>1996, 1997, 2000, 2002 - 2009 (11)</b>	<b>1996, 1997, 2000, 2002 - 2006 (8)</b>	<b>30 (2003)</b>	<b>5</b>
NAP – South #1	occupied	2003 - 2009 (7)	2004, 2005 (2)	2 (2004)	3
NAP – South #2	neighbor	2003 - 2009 (7)	---	---	2
NAP – South #3	occupied	2002 - 2009 (8)	2004 (1)	1 (2004)	2
NAP – South #5	neighbor	2002 - 2009 (8)	---	---	3
<b>NAP – South #6</b>	<b>occupied</b>	<b>2002 - 2009 (8)</b>	<b>2002, 2004, 2005 (3)</b>	<b>10 (2005)</b>	<b>3</b>
<b>NAP – South #7</b>	<b>occupied</b>	<b>2003 - 2009 (7)</b>	<b>2004, 2005 (2)</b>	<b>3 (2004)</b>	<b>6</b>
<b>NAP – South #8</b>	<b>occupied</b>	<b>1999, 2002 - 2009 (9)</b>	<b>1999, 2002 - 2006 (6)</b>	<b>111 (2004)</b>	<b>6</b>
West Quarry	occupied	2002, 2004 - 2007, 2009 (6)	2004 (1)	1 (2004)	1

<sup>1</sup> Seven balds found occupied by >2 Taylor’s checkerspots during multiple years are shaded.

<sup>2</sup> Highest number of Taylor’s checkerspots detected during single visit – all years.

Table 2 lists the 19 butterfly species identified during our surveys. Our effort was not a complete census of species inhabiting the Bald Hill landscape as it was limited to early-spring: additional species emerged and were present as adults as the spring and summer progressed. Two western Washington butterfly species of concern were detected while searching for Taylor’s checkerspot: Propertius duskywing (*Erynnis propertius*) Subfamily Pyrginae, and hoary elfin (*Incisalia polia*) Subfamily Lycaeninae. Propertius duskywing, is an oak-obligate species, larvae feed only Garry oak (*Quercus garryana*). Historically, they were regularly found associated with oak woodlands in southwest Washington, however, recent surveys in this region have located this butterfly only at Bald Hill. Propertius duskywing was detected in 10 of 20 balds surveyed. The hoary elfin is a small brown butterfly with several widely disjunct populations, some of which are currently recognized as separate subspecies (including the endangered northern California and southern Oregon *I. p. maritima*): south Puget Sound hoary elfin has been discussed by taxonomists as likely to be a distinct subspecies. Kinnikinnik (*Arctostaphylos uva-ursi*) is hoary elfin’s larval host plant. During our surveys, hoary elfin was only detected at one bald (NAP – North).

**Table 2. Nineteen butterfly species detected during 2009 Bald Hill Taylor's checkerspot surveys**

<b>Common Name</b>	<b>Scientific Name</b>
Silver-spotted Skipper	<i>Epargyreus clarus californicus</i>
Propertius Duskywing	<i>Erynnis propertius</i>
Two-banded Checkered Skipper	<i>Pyrgus ruralis</i>
Arctic Skipper	<i>Carterocephalus palaemon</i>
Anise Swallowtail	<i>Papilio zelicaon</i>
Western Tiger Swallowtail	<i>Papilio rutulus</i>
Pale Swallowtail	<i>Papilio eurymedon</i>
Margined White	<i>Pieris marginalis</i>
Sara's Orangetip	<i>Anthocaris sara flora</i>
Brown Elfin	<i>Incisalia augustinus</i>
Hoary Elfin	<i>Incisalia polia</i>
Spring Azure	<i>Celestrina argiolus</i>
Silvery Blue	<i>Glaucopsyche lygdamus</i>
Mylitta Crescent	<i>Phyciodes mylitta</i>
Anglewing sp.	<i>Polygonia</i> sp.
California Tortoiseshell	<i>Nymphalis californica</i>
Painted Lady	<i>Vanessa cardui</i>
Lorquin's Admiral	<i>Limenitis lorquini</i>
Ochre Ringlet	<i>Ceononympha tullia eunomia</i>

**Future Plans:** We plan to continue annual surveys for Taylor's checkerspot in the Bald Hill landscape for at least 5 years after detection. As one of two possibly extant south Puget Sound populations, determining the status and locating any individuals present is critical.

**References:**

Pollard, E. and T.J. Yates, 1993. Monitoring butterflies for ecology and conservation. Chapman and Hall. London, UK. 274 p

## **Appendix B**

### **Distance sampling surveys for Taylor's checkerspot - Range 76, Fort Lewis**

Mary Linders, Washington Department of Fish and Wildlife,

Rod Gilbert, Fort Lewis Military Installation

#### **Project goals**

Project goals are to 1) assist in development of an accurate and efficient regionally-accepted monitoring method for Taylor's checkerspot, 2) establish a minimum population estimate for the area surveyed to assess the impact of collecting animals for captive rearing, 3) test the distance sampling method as a means of estimating density and controlling for differences in detectability between years and 4) reduce the overall level of survey effort.

#### **Methods**

A total of twelve 700-meter transects were established at Range 76 covering the area most used by Taylor's checkerspot; transects are placed at 50-meter intervals with additional pin flags marking 50 meter segments along the transect line. Most surveys were conducted by two trained observers, with maximum participation of 4 observers. Surveys were conducted throughout the Taylor's checkerspot flight period in 2009. Qualifying surveys are those in which 1) weather conditions meet the guidelines established below, 2) at least 1 Taylor's checkerspot butterfly is counted, and/or 3) surveys are distributed within the known or anticipated flight season based on best available data. Surveys were conducted: 1) between 1030 and 1600 hours; 2) ambient temperature  $\geq$  53 degrees F; 3) sufficient sunshine to cast a distinct shadow; and 4) wind exposure less than 10 mph (Pollard and Yates 1993). Note: If temperature exceeds 65 degrees F, surveys may be done in "soft shadow" sunlight conditions.

Raw counts of adult Taylor's checkerspots observed during distance sampling at Range 76 on Fort Lewis Military Installation in 2009.

<b>Survey Date</b>	<b>Count</b>	<b>Full/short survey</b>	<b>Protocol weather?</b>
1-May	54	Full	Yes
8-May	26	Full	No
8-May	13	Full	No
15-May	46	Short	Yes
16-May	77	Short	Yes
17-May	47	Short	Yes
18-May	23	Full	Yes
21-May	22	Full	Yes
22-May	34	Short	Yes
27-May	4	Short	Yes
28-May	2	Short	Yes

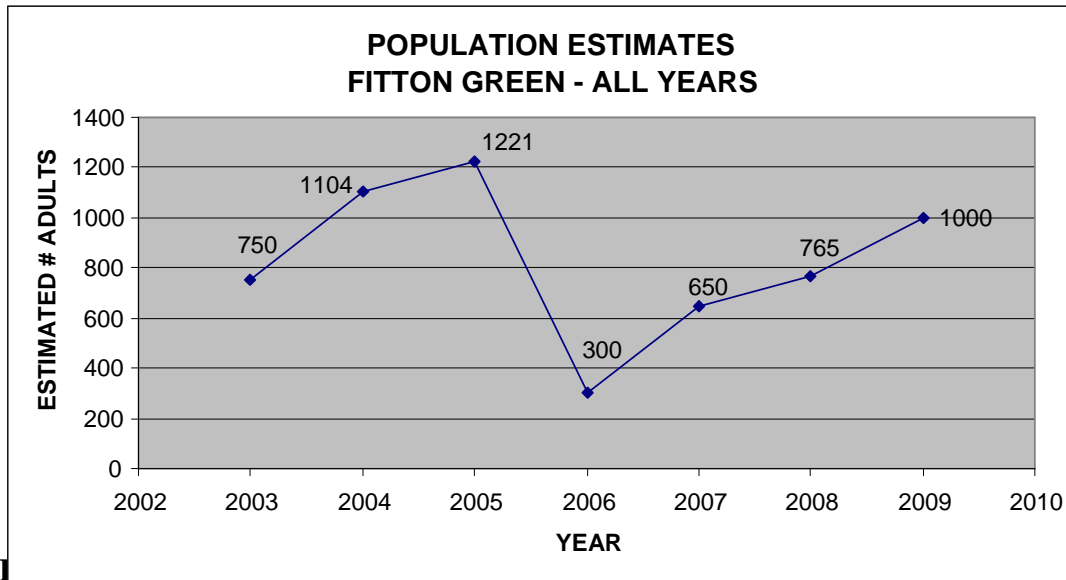


*Appendix C*

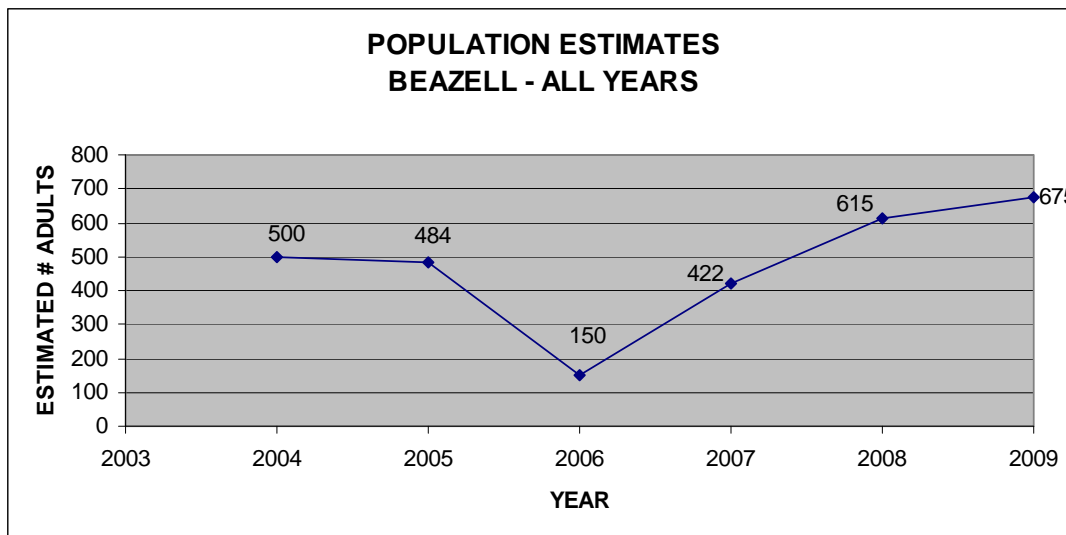
**Taylor’s Checkerspot in OREGON:  
2009 Update and Cumulative Summary of Population Estimates**  
(Prepared 9/23/09 by Dana Ross)

2 Populations (Both in Benton County): Flight from about “April 16-May 30”

**Fitton Green Natural Area** (3 semi-adjacent meadows)  
2009 – Population estimate up about 30% to 1,000 adults.



2009 – Population estimate up about 9% to 675 adults.



## ***Appendix D***

### **Summary of the Taylor's Checkerspot Program at the Oregon Zoo since January 2008 (end of 2007-2008 season, 2008-2009 season, and beginning of 2009-2010 season)**

#### **2007-2008 Season**

- 1st record of egg through adult copulation (captive-reared females copulated with wild males) in lab in 2008 (n = 25)
- 1st record of oviposition by captive-reared adult females mated to wild males in lab in 2008 (n = 10)
- 1st record of oviposition by wild females in lab in 2008 (n = 10)
- 1st observation of breeding behavior between adults in field released as post-diapause larvae
- 1st record of egg through 2<sup>nd</sup> diapause larvae eclosing in lab (n = 3)
- Initiated post-diapause rearing trials to evaluate size of captive-reared versus wild adults (free feeding on diverse species of potted host plants in tanks versus cut plants in bins) using weight and photometric analysis
- Established collaboration with The Nature Conservancy to experiment with training dogs to locate larvae in the field
- Result:
  - 611 larvae hatched in 2007
  - 600 larvae into diapause in 2007
  - 598 larvae survive diapause in 2008
  - 340 larvae released post-diapause in 2008
  - 104 larvae pupated in 2008
  - 40 pupae released in 2008
  - 42 pupae eclosed into butterflies in 2008
  - 115 larvae into 2<sup>nd</sup> diapause in 2008
    - ◆ 13 survive 2<sup>nd</sup> diapause in 2009
    - ◆ 6 pupate in 2009
    - ◆ 6 eclose in 2009
    - ◆ 1 into 3<sup>rd</sup> diapause in 2009
  - 0 survive in 2009

### **2008-2009 Season**

- 1st record of oviposition by captive-reared adult females mated with captive-reared males in lab in 2009 (n = 37)
- 1<sup>st</sup> record of oviposition by captive-reared 2<sup>nd</sup> diapause adults in 2009 (n = 2)
- 1<sup>st</sup> record of larvae pupating and eclosing without going through diapause in 2009 (n = 2)
- 1st record of larvae entering 3<sup>rd</sup> diapause in lab in 2009
- Post-diapause rearing trials to evaluate size of captive-reared versus wild adults (indoor rearing in bins versus outdoor rearing in bins)
- Successfully marked individual males to track parentage of eggs
- Results:
  - 1,109 eggs laid from females mated in lab in 2008
  - 2,515 eggs laid by wild caught females in the lab in 2008
  - 2,568 larvae into diapause in 2008
  - 2,522 larvae survive diapause in 2009
  - 2,252 post-diapause larvae released in 2009
  - 90 larvae into 2<sup>nd</sup> diapause in 2009
  - 169 larvae pupate in 2009
  - 160 pupae eclose into adults in 2009
  - No difference in size between conditions in rearing trial, but more pupated when reared indoors (72% vs 54%) and more went into 2<sup>nd</sup> diapause when reared outdoors (44% vs 22%).

### **2009-2010 Season**

- Over 10,000 eggs laid, ALL from captive-reared and captive-bred adults in 2009
- Over 7,500 larvae hatched
  - Over 5,000 released prediapause
  - About 2,500 in diapause at zoo
- Completed husbandry manual

## *Appendix E*

### **Captive rearing and translocation of Taylor's checkerspot in South Puget Sound**

Mary Linders, Washington Department of Fish and Wildlife

Rapid extinction of several Taylor's checkerspot populations in south Puget Sound in the late 1990s illustrated the need for a proactive approach to recovery. Habitat restoration is proceeding on several sites. The goal of this project is to establish new populations to stem decline and move toward recovery. Funding was awarded for implementation of the Taylor's checkerspot captive rearing program in 2008-2009 and release and monitoring of Taylor's checkerspot at field sites in 2009. A captive rearing program for Taylor's checkerspot was established at the Oregon Zoo in 2004 and has been ongoing since that time. Large annual advances in captive propagation have resulted in high survival during all life stages from egg to adult; postdiapause rearing conditions are being refined to improve survival and weight gain during that phase. Cumulative survival from hatching to postdiapause was 91.9 percent (2522 survived of 2743 hatched larvae; Table 1) in 2008-2009. This represents a significant increase in the scale of propagation efforts relative to 2007-2008, with negligible change in survival rates. Co-locating females with groups of males proved relatively successful as a captive mating strategy with 112 mating attempts resulting in 37 copulations; some males mated more than once. Captive propagation at the Oregon Zoo is at capacity with sufficient space and staff for about 2,000 postdiapause larvae; a second rearing facility will be established in 2010 to expand capacity and minimize risks of the captive propagation program.

A record number (2,247) of postdiapause larvae were released in 2009, with about 750 larvae released at each of three sites (Scatter Creek South, Scatter Creek North and Pacemaker Airstrip). Flight season monitoring at these sites in 2009 revealed few adults. Very cool weather until mid-May appeared to delay the flight season and is assumed to have influenced the outcome of the release, as numbers were also quite low at the source site on Fort Lewis. A total of 48 observations of adult Taylor's checkerspots were made during distance sampling surveys ( $n = 7$ ) at Scatter Creek South, with a maximum of 19 adults observed in a single survey. Just two adult checkerspots were observed at Scatter Creek North and a single adult was observed at Pacemaker Airstrip. Releases of small numbers of post diapause larvae at Scatter Creek South in 2007 and 2008 may have contributed to the higher numbers observed there relative to the other release sites. Similar to Scatter Creek South, adults at Scatter Creek North and Pacemaker were attracted to conifer trees 40 and 100 m, respectively, from release plots; some adults may have dispersed due to low densities, a phenomenon characteristic of male checkerspots. Because checkerspot larvae are capable of multi-year diapause, we do not know whether poor flight season returns were the result of high post-release mortality, a high rate of return to diapause, or both. All release sites will be monitored again in 2010; no new releases will occur at Scatter Creek North and Pacemaker to improve our understanding of factors that may have influenced the poor returns in 2009. A fledgling population appears to be taking hold at Scatter Creek South and releases will continue there in an effort to bolster numbers and reduce risk of extinction. Adults at Scatter Creek South were observed nectaring, in territorial displays by males, mating chases, routine movement patterns, and one oviposition observation. Collectively these behaviors suggest habitat recognition and confer a measure of site fidelity; the only known egg cluster disappeared prior to hatching. Habitat restoration continues in the vicinity of the release

at Scatter Creek South and is expanding to accommodate additional release areas; work is also progressing at several other sites in South Puget Sound.

*Release of prediapause Taylor's checkerspot larvae in 2009*

A total of 5,443 prediapause larvae were released on 12, 18 June 2009 into a single 30 x 30 m-plot on each of two sites [Fort Lewis AIA (2956) and Scatter Creek South (2487)]. Larvae are the offspring of captive- mated Taylor's checkerspots reared at the Oregon Zoo. This unplanned release resulted from increased effort and unexpected success in captive mating Taylor's checkerspots at the Oregon Zoo. Few adults were observed at the Fort Lewis source site in 2009, so no wild adults were collected. Instead the Zoo increased the number of adults included in captive mating trials. Simultaneously, a long run of cool cloudy weather was abruptly replaced by clear skies and temperatures in the 70s °F, which resulted in a dramatic increase in mating, oviposition and hatching success. Within one week the number of eggs laid increased from about 1,000 to over 10,000, with hatch rate increasing from 50 percent to nearly 100 percent. One post-release check of prediapause larvae at Scatter Creek was made on 22 June 2009. Fourteen large larvae were observed in addition to extensive foraging sign. Release plots will be monitored during the 2010 flight season.

Table 1. Number, stage-specific survival and cumulative percent of total annual cohort for Taylor's checkerspots reared at the Oregon Zoo in Portland in 2008-2009. Released animals are removed from successive calculations of stage-specific survival.

Survival to next life stage	#	% stage survival	cumulative % of total
# eggs	3,624		
Egg to hatching	2,743	75.7	24.3
Hatching to warm diapause	2,590	94.4	28.5
<i>Diapause study</i>	22		
Warm diapause to cold	2,567	100.0	28.6
Cold diapause to postdiapause	2,522	98.2	30.4
<i>Postdiapause release</i>	2,252	89.3	37.9
Postdiapause to pupation	170	63.0	95.3
<i>Pupal release</i>	na	Na	na
Pupae eclosed as adults	165	97.1	95.4
# that re-entered diapause	90	33.3	97.5
Percent cohort eclosed Y1@ Zoo			4.6

## Appendix F

### Taylor's Checkerspot Restoration in Oregon Al Kitzman, Benton County Natural Areas and Parks

2 major sites: Fitton Green Complex and Beazell Memorial Forest

Fitton Green Complex: Pop. high approx. 1500, discovered in late 90's on 3+ acres

Issues:

- ❑ Private land owner not interested in managing resource for Taylor's. B.C.N.A.P. created an M.O.U. with owner to manage for Taylor's.
- ❑ Highly invasive false-brome dense in forest, along meadow fringe, spotted throughout 2 occupied meadows. Would lose resource in 5-7 yrs if nothing done.

Restoration Strategy:

- ❑ Mowed F.b. seed heads in late May, early June. Seed bank reduced 75%.
- ❑ Dense stands F.b. sprayed w/ glyphosate in fall. Very effective.
- ❑ F.b. within core meadow sprayed w/ Poast in fall. Poor success rate, only burned, did not kill.
- ❑ 2<sup>nd</sup> yr, sprayed all F.b. in fall w/ glyphosate
- ❑ 2<sup>nd</sup> yr, seeded bare ground w/ *Festuca roemerii*, *Elymus glaucus* (fringe of meadow only), *Calochortus tolmiei*, *Lomatium nudicaula*, *Plectritis congesta*, *Sidalcea malviflora* ssp *virgata*, *Clarkia amoneia*, *Madia elegans*, *Iris tenax*, *Eriophyllum lanatum*.

Results are promising, adults starting to expand into previously unoccupied areas due to false-brome.

Beazell Memorial Forest: Pop. high approx. 500, discovered in 2004 by Dana Ross

Issues:

- ❑ Degraded habitat due to Scotch broom, Douglas fir, False-brome, Tall oatgrass.

Restoration Strategy:

- ❑ Mow out the old growth Scotch broom and spot spray new recruits every 3 years. Spotty younger broom spot sprayed.
- ❑ Multiple volunteers and crew worked many year to girdle or clear fir trees from meadow fringe and interior meadow. Leaving the BIG ones, taking out 10-12" DBH trees. Seed open ground in fall with roemers.
- ❑ False-brome annually spot spraying w/ glyphosate.
- ❑ Mowing meadows 4-6" in fall. Started last year, very successful expansion into mowed areas.
- ❑ Collecting *Fragaria virginiana*, giving to contractor to grow out, we plant out. Also growing out *Calochortus* seed (ready 3 years after planting)
- ❑ This year we start burning in limited areas, wait 2 weeks, apply glyphosate if mostly non-natives, seed with nectar plants and plant out *Fragaria* (primary nectar source) and rhoemers.
- ❑ Collected *Plantago lanceolata* (host) seed to plant this fall.
- ❑ Wipe tall oatgrass in late May/early June w/ glyphosate.

Results again promising. Question if restoration or other variables are leading to gradual increase in #'s

## *Appendix G*

# Cooperative Butterfly Habitat Enhancements at Unoccupied Sites in the South Puget Sound

Summary Fact Sheet – September 2009

### Project Goal

Efficiently move habitat condition closer to appropriate level for Taylor's checkerspot and mardon skipper reintroductions within identified management units.

### Project Objectives

- 1) Based on best available knowledge, an interdisciplinary team will develop criteria to aid in identification of appropriate habitat for Taylor's checkerspot and Mardon skipper.
- 2) Management units at unoccupied potential receiving sites will be identified and outlined based on established criteria.
- 3) Based on best available knowledge, and using adaptive management principles, the team will assign, prioritize, and implement restoration activities to identified management units, including control of invasive plants and enhancement of important butterfly vegetation. Methodology to fulfill assigned management unit activities will be developed.
- 4) All restoration activities, including control treatments and outplantings, will be monitored with established standardized protocols to determine efficacy of actions.
- 5) Nursery capacity at Shotwell's Landing native nursery, operated by The Nature Conservancy, will be enhanced as necessary to accommodate the planting requirements of this project.

*Objective 3: Based on best available knowledge, and using adaptive management principles, the team will assign, prioritize, and implement restoration activities to identified management units, including control of invasive plants and enhancement of important butterfly vegetation.*

*Methodology to fulfill assigned management unit activities will be developed.*

1. The team outlined major categories of restoration actions to occur at each management unit and synthesized actions in a butterfly habitat matrix.
2. Site managers developed work plans outlining projected restoration actions for their sites based on the restoration actions identified in the butterfly habitat matrix.
3. The team developed a protocol for conducting standardized nectar surveys in the management units to identify locations of butterfly resources and reveal those resources lacking to guide enhancement plantings. Site managers conducted nectar surveys at their respective sites during May 2008.
4. Site managers conducted restoration actions emphasizing control of invasive plants across their management units in 2008 and the first half of 2009.
5. The team outlined restoration targets for butterfly resource plantings to guide fall planting efforts.
6. Site managers planted nursery grown seedlings and seeds of butterfly nectar and larval host plants in the fall 2008 and monitored growth and survival in May 2009.

A total of 13,299 forb and 29,328 grass seedlings were planted into the management units during the 2008 fall planting season. Average percent survival and flowering across all sites, for butterfly resources planted in fall 2008 and early winter 2009, measured in May, 2009 at butterfly enhancement plots in project sites in Thurston County, WA.

	<b>average percent survival</b>	<b>average flowering</b>
<i>Castilleja hispida</i>	84.7% (n=1462 plants)	0.13 flowering stems / plant
<i>Armeria maritima</i>	96.2% (n=581 plants)	1.44 flowering heads / plant
<i>Lomatium utriculatum</i>	92.2% (n=403 plants)	0.16 flowering heads / plant
<i>Lomatium triternatum</i>	55.6% (n=126 plants)	0 flowering heads / plant
<i>Fragaria virginiana</i>	85 % (n=225 plants)	20.3% of plants in flower
<i>Viola adunca</i>	84.3% (n=633 plants)	74.3 % of plants in flower
<i>Danthonia californica</i>	75.4% (n=166 plants)	n/a

Future directions of the butterfly habitat enhancement team include:

- Continuation of restoration actions – invasive control, prescribed burns, etc.
- Vegetation monitoring is scheduled for spring 2010 to assess year 2 metrics from 2008 plantings, and year 1 metrics from 2009 outplantings.
- Continued enhancement of larval food and nectar plants
- *Plantago* enhancements – seeding and translocation

### Questions for Future Research

1. What is the long – term (3+ years) survival of the enhancement plantings and thus the sustainability of restoration success?
2. What size and arrangement of enhancement patches are likely to promote viable populations of target butterflies and their plant resources?
3. Do the target butterflies (or other wildlife) use the enhancement plots (currently being coordinated by Mary Linders, WDFW)?
4. What are best management practices for controlling invasive forbs such as *Hypochaeris radicata* and *Leucanthemum vulgare*?

Additional important questions that are not likely to be primary targets of the current agenda for the ACUB butterfly habitat enhancement team due to limited resources, but warrant future consideration:

1. What is the influence of different microsites in long-term survival of restoration plantings?
2. What is the role of pollinators in sustaining the populations of butterfly resources (both planted and naturally occurring)?
3. What are the potential influences of climate change on the target butterflies and their plant resources, and what management actions could mitigate those impacts?
4. What is the best means of planting the target butterfly plant resources, based on the differential success of seeds vs. seedling plugs for each plant species?
5. Are there alternative site preparation techniques that promote better enhancement planting success?



## ***Appendix H***

### **South Sound Seed Production Summary Fact Sheet**

As restoration of western Washington's grasslands evolves, land management strategies have matured to include complex actions that foster the creation of habitat suitable for target prairie species. Sowing prairie grasses and forbs directly onto treated units within protected prairie has emerged as an effective step towards habitat creation. Consequentially, the South Sound prairie restoration community is formulating a collaborative strategy for the development of ecoregional seeding infrastructure. This strategy strives to address the availability, sourcing, and planting protocols for seeds used in habitat enhancements and will outline the development of necessary regional seed production infrastructure. The next five years of development of seed production for the south Sound prairies will revolve around infrastructure evolution to meet the needs of an entire region.

Regional partners began by evaluating the benefits and risks of commercial, public and partner-based efforts for any appropriate phases of seed production. We also selected and prioritized a list of prairie grass and forb species to be put into production. Selection parameters considered a variety of appropriate factors, including: use to butterflies, resistance to invasives, historical extant, current distribution, structure, soil and moisture needs, and ease of seed production. Estimated regional needs roughly approximate the ability to produce 1500 lbs of forb and grass seed per year; production beginning at Shotwell's Nursery (small scale), trial areas at Webster's Nursery (middle scale), and a five acre larger-scale production area at Webster's Nursery.

Shotwell's Nursery will host rare plants, smaller lots, and custom scale production for overall high diversity and low volume seed production projects. Webster's Nursery will continue to expand its role in regional seed production as a middle-scale production area with two main thrusts. Over the next five years one "block" (Webster's nursery production unit) will be broken up into Area I and Area II. At one acre Area I will be the site of pilot research of middle scale production. Cropping methodologies, irrigation options, yield potentials and labor costs will be examined in this section of production which will maintain service options including irrigation and fertilization. Plugs may be used for crop establishment. Area II (the remaining five acres of Block 24) will serve as the region's largest scale of seed production until other sites become available or come online. Ideally Area II will be non-irrigated, seed-established, and cultivated with a suite of 8-10 ft wide size-appropriate sowing and harvesting machinery.

Plants sown for seed production in fall 2008 at Webster's include:

*Danthonia californica*

*Eriophyllum lanatum* var. *lanatum*

*Plectritis congesta*

*Lupinus albicaulis*

*Lomatium ultriculatum*

*Collinsia parviflora*

*Ranunculus occidentalis*

*Viola adunca*

*Balsamorhiza deltoidea*

*Lomatium triternatum*

*Potentilla gracilis*

*Castilleja hispida*

*Solidago missouriensis*