

Appendix N. Taylor's Checkerspot Management Plan

Benton County Taylor's Checkerspot Butterfly Management Plan



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Table of Contents

1	Introduction.....	5
2	Species Description, Reproduction, and Ecology	5
2.1	Conservation Status	5
2.2	Taxonomy	6
2.3	Species Description.....	6
2.3.0	Reproduction/Life Cycle.....	6
2.3.1	Population Status	8
2.3.2	Range	9
2.3.3	Habitat.....	9
2.3.4	Host Species.....	9
2.3.5	Nectar Species	10
2.4	Threats	14
2.4.0	Habitat Loss, Fragmentation, and Degradation.....	14
2.4.1	Fire Suppression	14
2.4.2	Invasive Non-Native Species.....	14
2.4.3	Vegetation Management.....	15
2.4.4	Weather	15
2.4.5	Diseases.....	15
2.4.6	Parasitism.....	15
2.4.7	Predation.....	15
2.4.8	Pesticides	15
2.4.9	Small Population Size	16
2.4.10	Overutilization for Scientific or Education Purposes.....	16
2.4.11	Public Use Activities	16
3	Habitat Management Guidelines.....	16
3.1	Guidelines for Sites with Taylor’s Checkerspot Butterfly.....	17
3.2	Guidelines for Sites without Taylor’s Checkerspot Butterfly	19
4	Site Specific Management Recommendations.....	19
4.1	Beazell Memorial Forest	19
4.1.0	North Meadow	20
4.1.1	Middle Meadow	21
4.1.2	Small Steep Double Meadows (south of the Middle Meadow).....	22
4.1.3	Summit Meadow	22
4.1.4	South Meadow.....	23
4.1.5	Caretaker’s House Meadow.....	24
4.2	Fitton Green Natural Area.....	26
4.2.0	South Meadow	26
5	Future Research.....	28

List of Tables

Table 1. Life cycle of Taylor’s Checkerspot Butterfly in Oregon.....6
Table 2. Taylor’s checkerspot butterfly populations in Oregon 2002-2008.....8
Table 3. Taylor’s checkerspot butterfly larval host species in Washington and Oregon.
..... 10
Table 4. Detailed information about host plants for Taylor’s checkerspot butterfly..... 11
Table 5. Taylor’s checkerspot butterfly nectar plant species range-wide. 12
Table 6. Detailed information about Taylor’s checkerspot nectar plants known in
Oregon. 13
Table 7. General habitat restoration/enhancement schedule. 19
Table 8. Site information for meadows at Beazell Memorial Forest. 20

List of Figures

Figure 1. Meadow locations at Beazell Memorial Forest. 25
Figure 2. Fitton Green Natural Area adjacent to the BPA Powerline Easement. 27

1 Introduction

Taylor's checkerspot butterfly (*Euphydryas editha taylori*) is endemic to the Pacific Northwest, and is currently known from only two locations in Oregon, both of which are in Benton County: Bezell Memorial Forest (owned and managed by Benton County Natural Areas and Parks Department) and the Fitton Green Natural Area/Bonneville Power Administration powerline area (private and public property). Benton County is preparing a Prairie Species Habitat Conservation Plan (HCP) to address the protection and conservation of this butterfly along with the Fender's blue butterfly (*Icaricia icarioides fenderi*) and five plant species: Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*), Willamette daisy (*Erigeron decumbens* var. *decumbens*), peacock larkspur (*Delphinium pavonaceum*), Bradshaw's lomatium (*Lomatium bradshawii*), and Nelson's checkermallow (*Sidalcea nelsoniana*).

Benton County seeks to ensure the protection and conservation of known populations of Taylor's checkerspot butterfly on County owned or managed lands, focusing management actions on the protection, enhancement, and maintenance of suitable habitat at key locations. The guidelines set forth in this management plan will assist Benton County in managing their lands in a way that is consistent with protection and conservation of Taylor's checkerspot butterfly. This plan will be updated at least once every ten years, to take into account changes in management techniques and status of the species.

2 Species Description, Reproduction, and Ecology

2.1 Conservation Status

Taylor's checkerspot butterfly has been identified as a candidate for federal listing (USFWS 2006). Although invertebrates are ineligible for state listing in Oregon, the Oregon Natural Heritage Information Center considers it to be threatened or endangered throughout its range (ORNHIC 2007). The Natural Heritage Network ranks the butterfly as G5/T1/S1: species is widespread, abundant, and secure throughout its range, but the subspecies is threatened or endangered, and is critically imperiled in Oregon (ORNHIC 2007).

A petition to list the butterfly was filed by several environmental organizations in 2002 (Xerces et al. 2002); however, the USFWS has not published a decision on the petition

to list (USFWS 2008). If the USFWS lists the species as threatened or endangered under the ESA, a recovery plan and/or critical habitat may be established for the species.

2.2 Taxonomy

Taylor's checkerspot butterfly is a member of the family Nymphalidae – the brush-footed butterflies (Xerces et al. 2002; Stinson 2005), and a subspecies of Edith's checkerspot (*Euphydryas editha*) (Stinson 2005). Checkerspots get their name from the checkerboard pattern on the upper side of their wings (Stinson 2005).

2.3 Species Description

Taylor's checkerspot is a medium sized butterfly with orange, black, and white coloring. The short stubby wings of this subspecies span less than 5.7 cm (2.25 inches) (Xerces et al. 2002). The upper wings are generally black with checkered bands of red-orange, cream and black; the underside forewing is orange with black bars and cream spots; the hindwing has alternating bands of orange and cream spots; and the head and abdomen are black (Stinson 2005).

In Oregon, this subspecies is the darkest of the *E. editha* subspecies (USFWS 2006), with rows of red and cream spots separated by heavy black bands, and with wings proportionately broader and rounder than other subspecies (Stinson 2005, citing Dornfeld 1980). Caterpillars are black with white speckles and bear black branching bristles with an orange base (Stinson 2005, citing Dornfeld 1980 and Guppy & Shepard 2001). Eggs are pale yellow and transparent when first laid, later turning orange and brown (Stinson 2005, citing Scott 1986).

Taylor's checkerspot does not migrate and is one of the first butterflies to appear in spring (Stinson 2005).

2.3.0 Reproduction/Life Cycle

Taylor's checkerspot butterfly goes through four distinct life stages: egg, larva (caterpillar), pupa, adult (Table 1).

Table 1. Life cycle of Taylor's Checkerspot Butterfly in Oregon.

LIFE STAGE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
ADULTS	-	-	x	X	X	x	-	-	-	-	-	-
EGGS	-	-	-	X	X	X	x	-	-	-	-	-
LARVAE (PRE-DIAPAUSE)	-	-	-	X	X	X	x	-	-	-	-	-
LARVAE (IN DIAPAUSE)	x	x	-	-	x	x	X	X	X	X	X	X
LARVAE (POST-DIAPAUSE)	x	X	X	X	x	-	-	-	-	-	-	-

LIFE STAGE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
PUPAE	-	x	X	X	x	x	-	-	-	-	-	-

PRESENT: **X**-typical, x-some years.

2.3.0.0 Mating/Egg Laying

Taylor's checkerspot butterfly typically flies from early April through May (Table 1) when mating occurs. Males perch and patrol to find females (Stinson 2005, citing Scott 1986). Taylor's checkerspot butterflies are polygynous with males mating multiple times and females mating once (occasionally twice) with one brood per year (Stinson 2005). Only one to two of the eggs from each female generally survive to adulthood (Stinson 2005, citing Scott 1986). Female butterflies recognize host plant species by the size, color, and shape of the leaf (Stinson 2005); the female then confirms the plant is the correct type by tasting it using forelegs and antennae (Baron & Backhouse 1999). Eggs are laid only on specific host plants.

2.3.0.1 Larvae/Pupation

Eggs hatch simultaneously after about 2 weeks (Stinson 2005) with the resulting gregarious larvae then moving in search of larval food sources (Weiss et al. 1987). Newly hatched larvae starve if food is not available within 10 cm (3.9 inches) (Singer & Ehrlich 1979). Larvae will grow until the fourth or fifth instar (approximately half-grown caterpillars) at which time they will enter diapause as their host plants senesce (Weiss et al. 1987). During diapause no feeding, growth, or development occurs (Scott 1986). The caterpillars resume eating when temperatures rise in the late winter (late January to March), and continue feeding for several weeks. When the caterpillar is fully grown it finds a sheltered spot and enters pupation (Dornfeld 1980). Larval growth rate is affected by microclimate (slope, aspect, degree of sun exposure) (Stinson 2005), with larvae preferring warmer locations (Weiss et al 1987).

2.3.0.2 Pupa

Pupation generally lasts two weeks after which the adult emerges (Pyle 1981).

2.3.0.3 Adults

Adults emerge over a one to several week period of time, with males emerging a few days before females (Stinson 2005). Adult butterflies are active for several days to two weeks. During the flight period male and female adults mate and then females lay their eggs. Adult females emerging earlier in the season improve offspring survival (Stinson 2005). The flight period for adults is typically from early April through May.

Dispersal capabilities of Taylor's checkerspot butterflies have not been studied. In Oregon in 2004, several Taylor's checkerspot butterflies were observed dispersing when weather was good and the butterfly population numbers were high (Stinson 2005 citing M. Vaughn pers. comm.). According to Stinson (2005), male checkerspot butterflies generally do not emigrate with increasing population densities; and checkerspot larvae will move in search of food (host plants) or pupation sites. The timing of available host

and nectar species with the adult flight period is vital to species survival (Baron & Backhouse 1999).

2.3.1 Population Status

Population size can fluctuate greatly from year to year (Table 2), and individual populations are susceptible to local extinction. Taylor's checkerspot butterfly was thought to be extinct in Oregon until a population was discovered in 1999 (A. Warren pers. comm.) on private land owned by Weyerhaeuser Corporation, under a utility easement maintained by the Bonneville Power Administration⁵ near Fitton Green Natural Area (ORNHIC 2006). In 2002, there were only four confirmed populations of Taylor's checkerspot butterfly (Xerces et al. 2002) – three in Washington and one in Oregon. In 2004, a population of Taylor's checkerspot butterfly was discovered at Beazell Memorial Forest (owned and managed by Benton County). This site was found to support a population of approximately 500 butterflies (Ross 2005). As of 2004, Oregon's two populations of Taylor's checkerspot butterfly comprised greater than 75% of the known populations in Oregon and Washington (ORNHIC 2006).

Table 2. Taylor's checkerspot butterfly populations in Oregon 2002-2008.

Site	Population Abundance						
	2002	2003	2004	2005	2006	2007	2008
Fitton Green Natural Area/BPA Powerline Corridor	1,000	750	1,104	1,221	300	650	**765
Fitton Green Natural Area (South Meadow)	NS	NS	NS	NS	1	1	NS
Beazell Memorial Forest	NS	NS	*500	484	150	422	615
Fort Hoskins Historic Park	NS	NS	NS	1	0	0	NS
TOTAL	---	---	1,104	1,706	450	1073	1380

NS – Not surveyed *Rough estimate **Includes additional habitat

In 2006, Taylor's checkerspot butterfly abundance in Oregon dropped significantly (Table 2; Ross, 2006). The flight period was delayed and compressed and resulted in a significant drop in butterfly abundance. The first documented butterfly was observed on April 20th, more than one week later than normal. Subsequent warm weather accelerated adult activity with the peak flight period occurring in late April; few

⁵ The Bonneville Power Administration has entered into an agreement with the Xerces Society to manage the site, in part, for the conservation of Taylor's checkerspot butterfly.

butterflies were observed in early to mid May. Butterfly abundance appeared to fully recover at Bezell in 2007 and 2008 (Ross 2008).

In 2006 and 2007, additional potential habitat was surveyed, however, no new Taylor's checkerspot populations were found (Ross 2006; Ross 2007).

2.3.2 Range

Historically Taylor's checkerspot butterfly was found in the Willamette Valley, Puget Sound, and south Vancouver Island (Xerces et al. 2002); although its precise historic range is not known (Butterfly Conservation Initiative 2006). Historically there were at least 23 recorded populations in British Columbia; 34 recorded populations in Washington, and 13 recorded populations in Oregon (USFWS 2006). In British Columbia, where Taylor's checkerspot butterfly was recently thought to be extinct a previously unknown population was discovered at Denman Island (USFWS 2006) In Washington, the butterfly is currently known from just 10 sites, and may occur at another 3 sites (Stinson 2005).

In Oregon, the subspecies historically occurred in Benton, Polk, and Lane Counties at 14 sites (USFWS 2006). Today the butterfly is known only from Benton County: Bezell Memorial Forest and near Fitton Green Natural Area/BPA Powerline corridor (Ross 2006), although one butterfly was found at Ft. Hoskins Historic Park in 2005 (Ross 2006).

2.3.3 Habitat

Habitat quality is more important than habitat size (Ehrlich 1992), and habitat heterogeneity is the most important factor in determining habitat quality (Weiss et al. 1987).

Taylor's checkerspot butterfly requires upland prairie habitat, dominated by short-stature grasses such as native fescues (e.g., *Festuca roemerii*) (Stinson 2005). The best prairie habitats include a high abundance of the larval host plant and a diversity of adult nectar sources (USFWS 2006). Each species of butterfly has specific larval host plant and adult nectar plant requirements, where the larval host and nectar plant species may be the same or different (Baron & Backhouse 1999). Taylor's checkerspot requires different plant species to provide adult versus larval nutrition.

2.3.4 Host Species

Pristine native habitats are not always required to sustain some populations of Taylor's checkerspot as powerline rights-of-way are used (in part) by some populations; nor are native plant species always necessary. Larvae primarily feed on paintbrush and plantain species, but utilize other species as well (Stinson 2005) (Table 3). In Washington, Taylor's checkerspot caterpillars feed primarily on English (=narrowleaf) plantain (*Plantago lanceolata*), harsh paintbrush (*Castilleja hispida*), seablush (*Plectritis*

congesta), and blue eyed Mary (*Collinsia parviflora*) (Stinson 2005). In Oregon the primary larval host species is English plantain, a non-native species; and the delay in growth of this host plant in 2006 may have reduced the number of adult Taylor's checkerspot butterflies that year (Ross 2006). For more information about host species, see Table 4.

2.3.5 Nectar Species

Adult butterflies utilize a variety of nectar species (Table 5). Nectar availability affects how many eggs a female butterfly can lay – the more nectar available, the more eggs can be laid (Baron & Backhouse 1999). Adults require food in the form of nectar during their search for breeding partners (Baron & Backhouse 1999), as well as for producing and laying eggs, and producing sperm (Stinson 2005).

The primary nectar species utilized by Taylor's checkerspot in Oregon is strawberry (*Fragaria virginiana*), followed by Tolmie's mariposa lily (*Calochortus tolmiei*), sea blush (*Plectritis congesta*), bi-colored flaxflower (*Linanthus bicolor*) and dandelion (*Taraxacum officinale*) (Ross 2006). Common lomatium (*Lomatium utriculatum*) is also used at one site (D. Thomas pers. comm.). Depending on the timing of the butterflies' flight period, not all of the potential nectar sources may be available for use. For more information on the nectar plant species utilized by Taylor's checkerspot butterfly in Oregon see Table 6.

Table 3. Taylor's checkerspot butterfly larval host species in Washington and Oregon.

Scientific Name	Common Name	Native/ Introduced
<i>Castilleja hispida</i>	Harsh paintbrush	Native
<i>Castilleja attenuata</i> / <i>Orthocarpus attenuatus</i>	Attenuate Indian paintbrush	Native
<i>Orthocarpus pusillus</i> / <i>Triphysaria pusillus</i>	dwarf's owl clover	Native
<i>Collinsia grandiflora</i>	giant blue eyed Mary	Native
<i>Collinsia parviflora</i>	Maiden blue eyed Mary	Native
<i>Plectritis congesta</i>	shortspur seablush	Native
<i>Plantago lanceolata</i>	English/narrowleaf plantain	Introduced
<i>Plantago elongata</i>	prairie plantain	Native

Stinson (2005)

Table 4. Detailed information about host plants for Taylor's checkerspot butterfly.

Latin Name	<i>Plantago lanceolata</i>	<i>Castilleja</i> spp.
Common Name	English plantain	paintbrush
Native or Introduced	Introduced	Native
Annual or Perennial	annual, biennial, perennial	perennial
Form	herb	herb
Bloom Time	April through May	Variable, depending on species
Senescence	After August 15	After August 15
Range	Widespread throughout U.S.	Variable
Benton County Distribution	Common	uncommon
Habitat	Roadsides, open meadows	
Nectar Production		
Collection and Planting	Recommended where localized augmentation of larval host plant is needed. Otherwise, not recommended (non-native weed).	Allow seed pods to dry on the plant before collecting. Usually require a host plant because of their parasitic lifestyle.
Species Descriptions	1.5-9 dm tall, brown-woolly at the base, leaves 5-40 cm long,, pubescent, long-lanceolate, 3-several-ribbed, gradually tapered to the short petiole, usually irregularly denticulate; spike 1-8 cm. long, dense; stamens 4 (Gilkey & Dennis 2001)	

Table 5. Taylor's checkerspot butterfly nectar plant species range-wide.

Scientific Name	Common Name	Native/ Introduced
<i>Armeria maritima</i>	Thrift	Native
<i>Balsamorhiza deltoidea</i>	deltoid balsamroot	Native
<i>Berberis</i> spp.	Oregon grape	Native
<i>Calochortus tolmiei</i>	Tolmie's mariposa lily	Native
<i>Camassia quamash</i>	common camas	Native
<i>Cerastium arvense</i>	field chickweed	Native
<i>Eriophyllum lanatum</i>	woolly sunflower	Native
<i>Fragaria</i> spp.	Strawberry	Native
<i>Linanthus bicolor</i>	bicolored flaxflower	Native
<i>Lomatium triternatum</i>	nineleaf biscuitroot	Native
<i>Lomatium utriculatum</i>	common lomatium	Native
<i>Malus</i> sp.	apple	Cultivated
<i>Mimulus</i> spp.	monkey-flower	
<i>Plectritis congesta</i>	shortspur seablush	Native
<i>Potentilla anserina</i>	Silverweed	Native
<i>Ranunculus occidentalis</i> *	Western buttercup	Native
<i>Sedum</i> sp.	Stonecrop	
<i>Taraxacum officinale</i>	common dandelion	Introduced
<i>Zigadenus venenosus</i>	meadow death-camas	Native

*This species is only used when other nectar species are not available.

Source: Stinson 2005

Table 6. Detailed information about Taylor's checkerspot nectar plants known in Oregon.

Latin Name	<i>Calochortus tolmiei</i>	<i>Fragaria virginiana</i>	<i>Linanthus bicolor</i>	<i>Lomatium utriculatum</i>	<i>Plectritis congesta</i>	<i>Taraxacum officinale</i>	<i>Malus sp.</i>
Common Name	Mariposa lily	Wild strawberry	Bi-colored flax flower, baby stars	Common lomatium	seablush	<i>Dandelion</i>	Apple
Native or Introduced	Native	Native	Native	Native	Native	Introduced	Introduced
Annual or Perennial	Perennial	Perennial	Annual	Perennial	Annual	Annual/Biennial	Perennial
Growth Form	Forb	Forb	Forb	Forb	Forb	Forb	Tree
Bloom Time	Mid May-early June	Mid April- Mid May	May-June	Mid April-May	May-June	April-September	Late April-May
Senescence							
Relative preference of Taylor's checkerspot	+++	+++				+	
Benton County Distribution	Common	Extremely common	Somewhat common	Uncommon	Uncommon	Extremely common	Somewhat common
Habitat	Open meadows	Open meadows, roadsides	Open meadows	Moist meadows	Open meadows	All unshaded habitats	Varies
Nectar Production	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Collection and Planting	Bulbs best propagule. Slow to propagate from seed.	Fruits must be collected for seeds.	Seed.	Seed.	Seed.	Not recommended or needed-weedy species.	Cultivated species.
Species Description	Small lily, 15-30 cm tall, one basal leaf, pale pink/white flower, 2.5-4 cm diameter, pubescent petals.	Stoloniferous with blue-green toothed leaves, pale flowers, red fruit with seed like achenes.	Small annual, 2.5-15 cm tall, divided leaves clustered at stem nodes, flower tube 15-25 mm long, short pink lobes.	Stems 3-60 cm tall, leaves finely divided, flat topped umbel of yellow flowers.	Plants 5-60 cm tall, opposite upper leaves, dense inflorescences of small (~3mm across) pink tubular flowers.	Taprooted, basal leaves, flowering stem ≥ 40 cm. Leaves pinnately lobed, flower heads yellow.	Small deciduous tree, whitish to pale pink flowers, Typically an escaped cultivated species.

2.4 Threats

2.4.0 Habitat Loss, Fragmentation, and Degradation

Fragmentation, degradation, and loss of habitat are primary factors affecting Taylor's checkerspot butterfly populations (Stinson 2005). Suitable prairie habitat has been lost to agricultural and residential development, succession (encroachment of trees), loss of natural disturbance regimes, and invasive species.

In Oregon, the butterfly's current habitat is shrinking and its quality is diminishing, due primarily to the spread of invasive species, particularly false brome (*Brachypodium sylvaticum*) (Ross 2005). Successional processes which increase the shrub and tree layers are also a continuing threat. Scotch broom (*Cytisus scoparius*), rose (*Rosa* sp.), hawthorn (*Crataegus* sp.), and Douglas-fir (*Pseudotsuga menziesii*) continue to be problematic (Stinson 2005; Ross 2005).

When habitats become fragmented and suitable habitat becomes more widely separated, the butterflies are less able to disperse to these far away sites (Baron & Backhouse 1999). At existing sites, butterfly population size may diminish for any number of reasons (e.g., weather, invasive species competition with nectar and host plants species) which may lead to a decrease in the rate of dispersal and natural recolonization of peripheral sites with suitable habitat.

2.4.1 Fire Suppression

Due to the influx of European settlers onto prairie habitats, the elimination of human-caused disturbances, such as fire, have resulted in the rapid conversion of prairie habitat to Douglas-fir forests (ODFW 2006) reducing habitat availability for Taylor's checkerspot and other prairie-dependent species (Baron & Backhouse 1999). However, fire itself can have a detrimental affect on Taylor's checkerspot butterfly, killing larvae, eggs, and pupae, depending on when prescribed burning activities occur and over how much of the occupied habitat (Xerces et al. 2002).

2.4.2 Invasive Non-Native Species

Invasive non-native species directly compete with host and nectar plant species for water, nutrients, and light and often prevent or reduce butterfly access to host and/or nectar species (Potter et al. 1999; Hays et al. 2000).

Non-native species that threaten native prairie habitats in Benton County include scotch broom, colonial bentgrass (*Agrostis tenuis*), tall oatgrass (*Arrhenatherum elatius*), common velvetgrass (*Holcus lanatus*), Kentucky bluegrass (*Poa pratensis*), sweet vernalgrass (*Anthoxanthum odoratum*), false brome (*Brachypodium sylvaticum*), rose (*Rosa* sp.), oxeye daisy (*Leucanthemum vulgare*), and meadow knapweed (*Centaurea xpratensis*) (Baron & Backhouse 1999; Stinson 2005; Ross 2005).

2.4.3 Vegetation Management

Mowing may kill larvae, eggs, and pupae, depending on the time of year. Hand pulling of vegetation may result in the trampling of eggs, larvae, and pupae (Xerces et al. 2002).

2.4.4 Weather

Weather plays a significant role in the mortality rate of Taylor's checkerspot butterflies (Ross 2006; Stinson 2005); and poses the greatest natural threat. Wind, rain, and hail may knock small caterpillars and egg clusters from host plants. Unseasonably cold weather may kill larvae and adult butterflies (Stinson 2005, citing Guppy & Shepard 2001). Droughts can affect host or nectar species resulting in starvation of the butterfly adults and larvae. The greatest mortality rate occurs during the pre-diapause stage when food plants senesce and the caterpillar is unable to enter the diapause stage (Ehrlich 1987).

2.4.5 Diseases

While Taylor's checkerspot is susceptible to bacterial, fungal, and viral diseases, it is not known at this time what specific diseases may affect the insect at each life stage.

2.4.6 Parasitism

Parasitic flies and wasps lay eggs on the eggs, larvae, and pupae of butterflies (Stinson 2005). The tachinid fly, *Siphosturmia confusa*, is a known parasite of Taylor's checkerspot with the level of parasitism varying from year to year (Stinson 2005, citing Tothill 1913). In Oregon, late instar Taylor's checkerspot caterpillars bearing parasitic wasp larvae and pupae have been observed (Ross 2005).

2.4.7 Predation

Other arthropod groups (i.e. spiders, wasps, dragonflies etc.) are primary predators of butterflies, while lizards, toads, small mammals and small birds also prey on them (Stinson 2005 citing Guppy & Shephard 2001). In Oregon, predation on adult Taylor's checkerspot butterflies by web-spinning spiders and crab spiders has been observed several times (Ross 2005). The degree of impact to associated butterfly populations has not been measured but may be significant (Ross 2005).

2.4.8 Pesticides

Butterflies are very sensitive to pesticides (Ehrlich 1992). Use of pesticides to eradicate gypsy moths may have a lethal effect on associated populations of Taylor's checkerspot and could lead to local population extinctions (Xerces et al. 2002). The chosen pesticide to eradicate the Asian gypsy moth (*Lymantria dispar*) is Btk (*Bacillus thuringiensis* var. *kurstaki*), a pesticide containing a suspension of bacteria used to kill forest and garden insect pests. Btk kills butterfly larvae that ingest foliage sprayed with the pesticide (Barry et al. 1993; Whaley et al. 1998). Btk is generally applied during early spring, a time when Taylor's checkerspot larvae are actively feeding. While

buffers around spray projects may be established, spray drift can negatively impact butterfly populations more than 3 km (2 mi) from the target spray area.

2.4.9 Small Population Size

The small size of remaining Taylor's checkerspot populations makes them especially vulnerable to extinction. Genetic exchange between isolated populations and recolonization of vacant habitat patches is necessary for long-term persistence. Most remaining sites with potentially suitable habitats are beyond a reasonable dispersal distance thereby rendering natural recolonization unlikely (USFWS 2006).

2.4.10 Overutilization for Scientific or Education Purposes

Scientific studies involving the mark-recapture of butterflies have been shown to be detrimental to other *E. editha* subspecies in California (Xerces et al. 2002, citing McGarrahan 1997). Collection of this species, due to its rarity, is also a potential threat (Xerces et al. 2002).

2.4.11 Public Use Activities

Recreational activities, including walking, horseback riding, off-road vehicle use, and picnicking can trample Taylor's checkerspot adults, pupae, larvae, and eggs (Xerces et al. 2002).

3 Habitat Management Guidelines

The following management guidelines are recommended for all County properties having the potential to be occupied by Taylor's checkerspot butterfly (areas known to be occupied or areas of suitable habitat within a reasonable dispersal distance of a known population).

High quality habitat for Taylor's checkerspot in Benton County is generally found within meadows protected by trees and with a south to west exposure and modest slope. The best habitats are dominated by short stature grasses and have an abundance of English plantain and strawberry with a diversity of additional nectar species. These sites will nearly always be of native upland prairie origin. Disturbed or degraded habitats can continue to support Taylor's checkerspot if patches of high quality habitat persist.

Taylor's checkerspot is capable of re-colonizing formerly occupied sites once habitat is again made suitable, but appears to be most successful at doing this if restored sites are close to existing populations of some size. The removal of trees, shrubs and dense, tall grasses combined with the restoration of desired plant species – either naturally or by purposeful augmentation – has been shown to be effective.

3.1 Guidelines for Sites with Taylor's Checkerspot Butterfly

The following guidelines are recommended to avoid negative impacts to Taylor's checkerspot individuals and their habitat:

- Annually define and mark breeding habitat:
 - Establish a 5 to 10 meter buffer around known Taylor's checkerspot butterfly breeding areas within which management activity should be avoided. The perimeter of this area should be clearly marked (flagged) and should also be recorded with a handheld GPS unit (to better assess changes in breeding habitat availability over time).
- Time management activities to avoid flight period:
 - Disturbance to the breeding habitat should be reduced to the extent possible during the flight period (generally April to May).
 - Habitat management activities should be scheduled and conducted according to the timing guidelines presented in Table 7.
- Mow within the following guidelines:
 - Where mowing is used to maintain quality habitat within a single Taylor's checkerspot butterfly site, one-half of the entire (non-breeding core) area may be mowed per year unless additional mowing is deemed necessary to maintain the appropriate low vegetation profile.
 - A mower with a large rotary deck should be used, and blade height set to a minimum 15 cm (6 in) so blades rarely gouge the ground (no more than five percent of the area mowed) and to minimize impacts to low stature native prairie species and Taylor's checkerspot butterfly larvae, if present.
 - Flail mowers will generally not be used.
 - Line trimmers may be used in occupied habitat in early spring, when necessary.
 - Mowed vegetation, to include cut branches from trees and shrubs and excessive cut grass, should be removed from butterfly habitat whenever possible. May be left in place if it is shown to naturally degrade or be dispersed over the winter by natural events within the first post-treatment year.
 - Mowers with rubber tracks or high floatation tires that exert less than 4 psi should be utilized when possible.
- Burn within the following guidelines:
 - Must be conducted with extreme caution when any Taylor's checkerspot butterfly life stage is active and/or vulnerable to its application anywhere on site (Table 7).
 - It is recommended that no more than 1/3 of a site be burned during a given year.
- Use herbicide as necessary within the following guidelines:

- Must be conducted with extreme caution when any Taylor's checkerspot butterfly life stage is active and/or vulnerable to its application anywhere on site (Table 7).
- No broadcast spraying of herbicides when butterfly or larvae are active – (January 15th – August 31st). Careful spot-spraying of herbicides targeted at noxious weeds that does not impact larvae, nectar or host species, and does not disrupt normal butterfly behavior can occur at any time.
- Targeted application of herbicides is preferred over broadcast applications.
- Utilize lowest residual, least toxic herbicide that gives desired control.
- Remove encroaching trees and shrubs:
 - Identify encroaching trees and shrubs and remove (entirely) every few years by cutting, pulling or mechanical grinding, and removal (trees may be girdled initially but all related woody material must be removed from the meadow environment).
- Re-seed any bare soil created:
 - When management practices expose bare ground (i.e. herbicides, tree removal), native nectar species, short stature native bunch grasses or host plants should be planted as deemed appropriated to enhance habitat.
- Follow the monitoring and adaptive management guidelines in the HCP:
 - Follow habitat restoration monitoring guidelines in Chapter 7: Monitoring and Adaptive Management, of the Benton County Prairie Species HCP.
 - Conduct annual population estimates as possible, to determine management effects on Taylor's checkerspot butterfly populations.
- Maintain and augment host plants:
 - English plantain is the primary larval host species being utilized by Benton County Taylor's checkerspot populations. Habitat management activities should maintain and/or enhance populations of this plant wherever Taylor's checkerspot occurs and at sites where potential recolonization or the purposeful introduction of the butterfly may occur.
 - The potentially useful introduction of native and likely historical larval host plant species may occur at occupied sites on an experimental basis but not at the expense of English plantain or other documented plant resources. Documented use of any alternate host plant by Taylor's checkerspot, while of potential value to the butterfly's long term conservation, in no way diminishes the importance of English plantain as *the* essential larval host plant.
- Maintain and enhance nectar plants:
 - Strawberry is the primary nectar species for Benton County Taylor's checkerspot populations for the foreseeable future. Habitat management activities should maintain and/or enhance populations of this plant.
 - Additional nectar plants may be introduced to occupied sites but not at the expense of strawberry.

Table 7. General habitat restoration/enhancement schedule.

MANAGEMENT ACTIVITY	Taylor's checkerspot butterfly	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	MOW	PRESENT	o	o	o	o	o	o	o	X	X	X	X
	ABSENT	MAY OCCUR AT ANY TIME											
BURN	PRESENT	o	o	o	o	o	o	o	X	X	X	X	X
	ABSENT	MAY OCCUR AT ANY TIME											
HERBICIDE	PRESENT	o	o	o	o	o	o	o	o	X	X	X	X
	ABSENT	MAY OCCUR AT ANY TIME											
HAND PULLING	PRESENT	X	o	o	o	o	o	o	X	X	X	X	X
	ABSENT	MAY OCCUR AT ANY TIME											
CUTTING TREES/SHRUBS	PRESENT	X	o	o	o	o	o	o	X	X	X	X	X
	ABSENT	MAY OCCUR AT ANY TIME											

X= Optimal time for activity; o = activity should not occur during this timeframe.

3.2 Guidelines for Sites without Taylor's Checkerspot Butterfly

- Site improvement activities should be timed to maximize their effectiveness.
- More than one restoration regime should be considered (when practical) as individual site responses may vary.
- All trees and shrubs cut/pulled from within or bordering Taylor's checkerspot butterfly habitat should be removed from the area if deemed problematic.
- Mowed vegetation from grasses and forbs may be left in place unless deemed problematic.
- Populations of larval host and nectar species should be enhanced. Seeding or planting of English plantain and strawberry (and other desired plant species) may be required post-treatment to encourage their immediate establishment.
- Sites should be surveyed annually during the flight period to determine whether efforts have been successful at promoting Taylor's checkerspot colonization.

4 Site Specific Management Recommendations

4.1 Bezell Memorial Forest

- Meadows at Bezell Memorial Forest are labeled in Figure 1 and described briefly in terms of size, aspect, elevation and soils in Table 8.

- Follow all recommended guidelines set forth in Section 3.1 and 3.2

Table 8. Site information for meadows at Beazell Memorial Forest.

Beazell Meadow	Acres	Aspect	Elevations (Feet)	Soils
North	15.5	SSW	860'-1300'	Witzel-Ritner Complex, 12-30% Slopes, Price-McDunn-Ritner Complex, 30-60% Slopes
Middle	5.5	SW	1280'-1380'	Witzel-Ritner Complex, 12-30% Slopes and 30-60%
Double Small Steep	2.75	WSW	1400'-1220'	Witzel-Ritner Complex, 12-30% Slopes and 30-60%
Summit	15.5	WSW	1400'-1630'	Witzel-Ritner Complex, 12-30% Slopes and 30-60%
South	3.75	SW	1090'-1260'	Dixonville-Gellatly Complex 12-30% Slopes
Caretaker's House	0.75	W	660'-710'	Dixonville-Gellatly Complex 12-30% Slopes

4.1.0 North Meadow

4.1.0.0 Site Description

Taylor's checkerspot present? Yes, but declining.

Habitat: Butterflies primarily use an acre or two of the flatter, summit portion of this relatively steep meadow. The area used by Taylor's checkerspot contains a small amount of remnant prairie plant species within an otherwise highly degraded area dominated by tall grasses and non-native plants (Scotch broom, rose, blackberry, thistle, false-brome). Bracken fern and snowberry are also present. The larval host plant, English plantain, is scarce and has been decreasing in abundance over the past several years. Nectar species, including strawberry, are in relatively low abundance and may also be disappearing from the site.

Threats: Habitat is threatened by spread of invasive non-native plants (tall fescue or orchard grass, rose, Scotch broom, thistle) as well as bracken fern and encroachment by shrubs (i.e., snowberry) and trees (i.e., Douglas-fir) into the meadow

4.1.0.1 Management Recommendations

Management priorities at this site should include enhancing existing meadow habitat. In addition to the general guidelines in Section 3, the following actions are recommended:

1. Remove Scotch broom (hand pulling or cutting, mowing, herbicide spray). Remove all hand pulled plant material from the meadow environment. Hand pulling of broom from the core Taylor's checkerspot area is recommended, but trampling must be minimized.
2. Reduce cover of invasive/tall grass and bracken fern component (burn & herbicide or mow, as appropriate and following parameters in Section 3). Do not impact core breeding areas.
3. Augment larval host and nectar plant populations within the meadow. Seeding or planting of young plants may be required.
4. The degraded meadow just upslope towards the road should be reclaimed as a Taylor's checkerspot is present there annually as nectaring adults.

4.1.1 Middle Meadow

4.1.1.0 Site Description

Taylor's checkerspot present? Yes, observed in 2008, and 2004-5.

Habitat: Butterflies observed to have preference for the least degraded portions of the site – the southern 1/3 and westward sloping (in the lee of prevailing winds) areas of this meadow. Those portions of the meadow appeared to contain the most remnant prairie habitat and included some plantain, with vegetation of relatively low stature overall. In 2007, tall grasses dominated the entire meadow and very little plantain was noted. Invasive shrubs (hawthorn, rose and scotch broom) and encroaching Douglas-fir present. Nectar species, including strawberry, appeared to be in low abundance.

Threats: A lack of larval host plants and adult nectar sources. Tall grasses (tall fescue and orchard grass) and invasive plants (hawthorn, rose, Scotch broom), tree encroachment (Douglas-fir) at the southern end of the meadow.

4.1.1.1 Specific Management Recommendations

To enable the natural re-colonization by Taylor's checkerspot butterfly from adjacent source populations, the following actions are recommended in addition to the general guidelines in Section 3.1:

1. Augment host (e.g., plantain) and nectar species (e.g., strawberry) within the meadow in areas of recent Taylor's checkerspot use. Seeding or planting of young plants may be required.
2. Work to reduce cover by tall stature grasses.
3. Monitor for the presence and establishment of Taylor's checkerspot and note areas of adult use.

4.1.2 Small Steep Double Meadows (south of the Middle Meadow)

4.1.2.0 Site Description

Taylor's checkerspot present? A few individuals have been recorded, but on-site breeding is doubtful.

Habitat: Openings as small, steep, shallow-soiled hillsides that serve as "stepping stones" for butterflies moving between adjacent areas of higher quality habitat. Larval and nectar resources have not been well assessed.

Threats: Encroachment by trees and shrubs and potential occupation by invasive plants that reduce the size of the opening or create habitat that consists of high-profile vegetation.

4.1.2.1 Specific Management Recommendations

In addition to the general recommendations in Section 3.1:

1. Better assess host and nectar resources.
2. Prioritize maintaining or expanding the meadow perimeters.

4.1.3 Summit Meadow

4.1.3.0 Site Description

Taylor's checkerspot present? Yes, as a moderate sized and reasonably stable colony.

Habitat: The meadow is relatively large, and the contiguous ridge area at the southern periphery has been opened up recently in an effort to reclaim oak savanna and adds an additional acre or two of potential Taylor's checkerspot habitat, some of which is occupied by Taylor's checkerspot. Also, about two acres of previously overlooked habitat on the southeast portion of the site was found to support moderate numbers of Taylor's checkerspot (2008). Originally, Taylor's checkerspot was thought to primarily utilize the upper 1/2-2/3 of the existing meadow, although reproduction appeared to be extremely localized within low stature vegetation hosting some plantain. One relatively small hand-mowed area along the summit ridge is heavily used by Taylor's checkerspot adults for nectaring. A large portion of the meadow contains tall grasses and there are sizeable patches of snowberry. Prairie plant species are present, but have not been well assessed. Typical nectar species such as strawberry are not abundant, and adults have been observed feeding at flowers of both Western buttercup and a dandelion species – two rarely used resources.

Threats: A lack of abundant larval host plants and adult nectar sources. Tall grasses (tall fescue and orchard grass) as well as shrub (snowberry) and tree encroachment (Douglas-fir) are potential threats.

4.1.3.1 Specific Management Recommendations

To support a larger population of Taylor's checkerspot at this site the following actions are recommended in addition to the general recommendations in Section 3.1:

1. Augment plantain, strawberry, and other nectar species within the meadow, especially within small areas where they currently exist. Seeding or planting of young plants may be required.
2. Better assess the presence and relative abundances of native and non-native species.

4.1.4 South Meadow

4.1.4.0 Site Description

Taylor's checkerspot present? Yes. The site currently (2007-2008) hosts the majority of the Bezell Taylor's checkerspot population.

Habitat: Reclaimed prairie/meadow within conifer forest. Taylor's checkerspot use is heaviest within the sloping portion of the site where plantain and strawberry densities are greatest and where tall grasses are least prevalent. The flatter portions of the upper and lower meadow support Taylor's checkerspot, but in much smaller numbers. Plantain and strawberry are generally abundant throughout the site. Bare patches of earth are also present, especially on the sloped portion. Small rose shrubs are present throughout and are heavily utilized as perch sites for adults.

Threats: While the sloped portion of the meadow hosts a few hundred butterflies at present, trailing blackberry, tall grasses and numerous small rose bushes, as well as encroaching Douglas-fir trees, are all potential threats to the site as a whole. A primary access trail (old road) runs across the lower portion of the site. An unofficial (deer) trail bisects the meadow from top to bottom. Pedestrian use of this trail could cause Taylor's checkerspot mortality.

4.1.4.1 Specific Management Recommendations

In addition to the general recommendations in Section 3.1, the following management actions are recommended to increase the availability of high quality habitat for Taylor's checkerspot that occur at the site. An increase in habitat quality at the site may encourage Taylor's checkerspot population growth.

1. The middle section of this meadow contains high quality habitat that should be maintained over time. Enhancement efforts should be focused on the upper and lower ends where habitat is of lower quality.
2. Remove trailing blackberry from the midslope area with minimal trampling or use of herbicides. For all other areas, use the most effective method available.
3. Maintain existing rose plants in the 2-4 foot tall range as long as they continue to be used by the butterflies for the perching and do not negatively affect other components of habitat quality.

4. Identify meadow edges where site enlargement could be conducted with greatest potential benefit. Increasing the size of the meadow gradually over time may benefit the Taylor's checkerspot population.
5. Discourage pedestrian use of the unsanctioned trail that bisects middle of meadow.

4.1.5 Caretaker's House Meadow

4.1.5.0 Site Description

Taylor's checkerspot present? Yes.

Habitat: A few Taylor's checkerspot show up at the site annually to nectar on the abundant strawberry flowers. Plantain is also plentiful, although the extent, if any, to which the site is used by females for egg laying is unknown. Frequent mowing has helped to keep the site suitable for Taylor's checkerspot use.

Threats: Various tall grasses and weedy plant species are present. Loss of plantain and strawberry may occur if annual mowing ceases. Encroachment into meadow by trees and shrubs from edges poses a continual threat. The small size of the site and the relative lack of connectivity to other area meadows with Taylor's checkerspot may limit Taylor's checkerspot use there. On-site breeding has not been witnessed.

4.1.5.1 Specific Management Recommendations

In addition to the general recommendations in Section 3.1, the following actions are suggested:

1. Annual mowing(s) to retain short stature vegetation and to encourage strawberry and plantain.
2. Monitor encroaching trees and shrubs, with removal every few years.
3. Maintain English plantain and strawberry, or other host plant and nectar plant abundance.
4. Refrain from using site as a parking area.

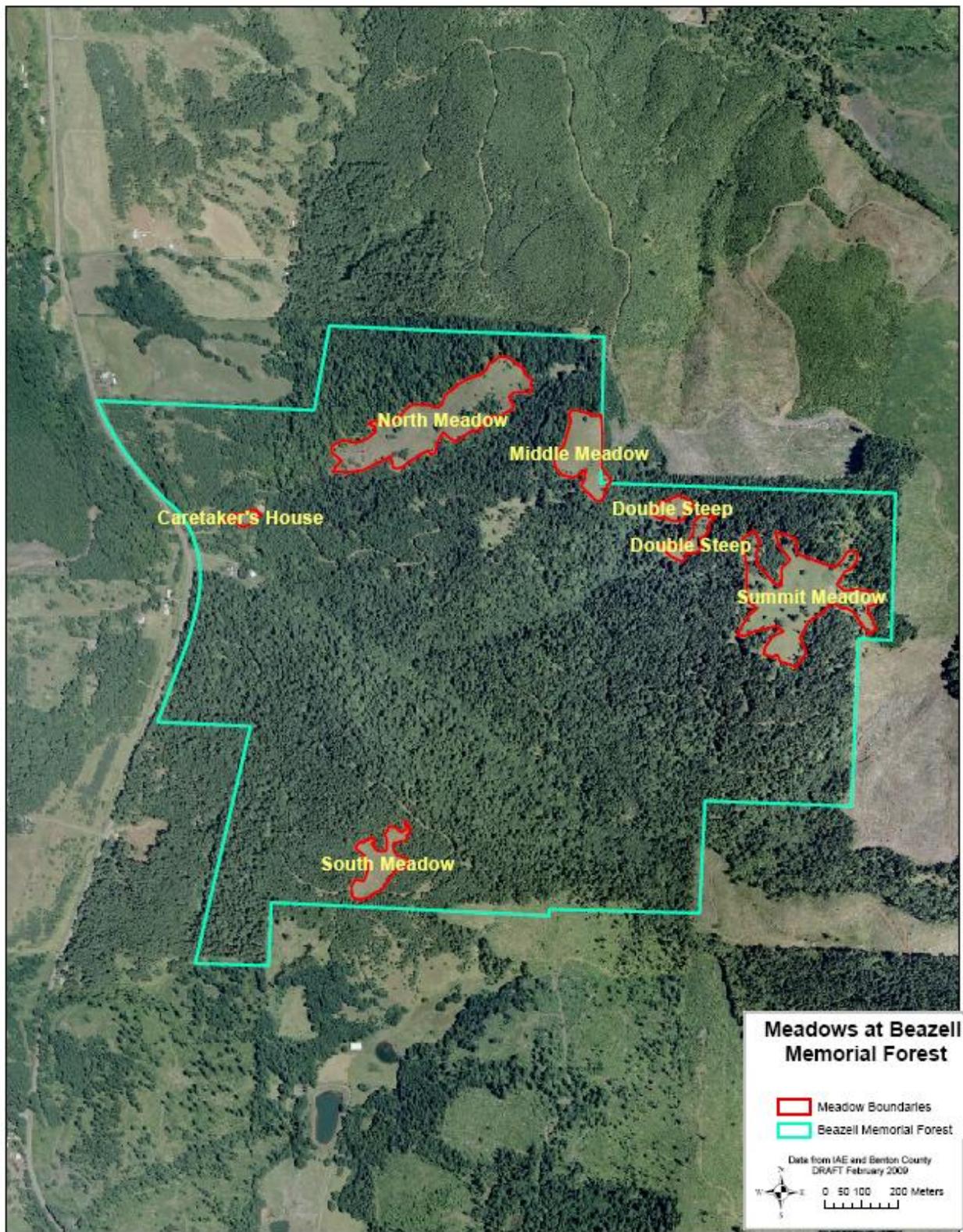


Figure 1. Meadow locations at Bezell Memorial Forest.

4.2 Fitton Green Natural Area

4.2.0 South Meadow

4.2.0.0 Site Description

Taylor's checkerspot present: Yes, as a few dispersing individuals. On-site breeding has not been recorded.

Habitat: A relatively large area of upland oak savanna/prairie habitat undergoing restoration (29 acres, west to southwest aspect, 700'-1060' elevation; Figure 2). Some high quality, short stature vegetation, dominated by native perennial grasses, and including English plantain and strawberry is present on the main hillside. Lower portions of the site contain meadows that have good physical characteristics for Taylor's checkerspot, but lack the desired plant community (short stature grasses and presence of larval host and nectar species) at present. The site is largely isolated from the core population, but Taylor's checkerspot is able to reach it via the connecting ridgeline and/or forest roads and openings. The site includes soil of the Dixonville-Gellatly Complex, 12-30 and 30-60% slopes.

Threats: The site largely lacks high quality, low stature habitat with sufficient larval and adult plant resources within areas that may be best suited to Taylor's checkerspot—namely, in a few smaller stepping stone meadow areas on the lower west-southwest portion of the site in the lee of prevailing winds. Tree and shrub encroachment and tall grasses are also threats. While the area is a popular destination for hikers, trampling should not be an issue if existing trails are used. Limited connectivity to the core population to the north may limit dispersal to this site.

4.2.0.1 Specific Management Recommendations

In addition to the general management guidelines in Section 3.1:

1. Restore select portions of lower meadows to high quality habitat in a stepping stone manner to attract dispersing Taylor's checkerspot and to encourage on-site breeding.
2. Identify, enlarge and restore openings along north/south road, and between Cardwell Hill Road and BPA power line easement to establish stepping stone dispersal opportunities.
3. Continue ongoing restoration of the site as a whole.
4. Monitor site annually for Taylor's checkerspot presence and document areas of primary use.

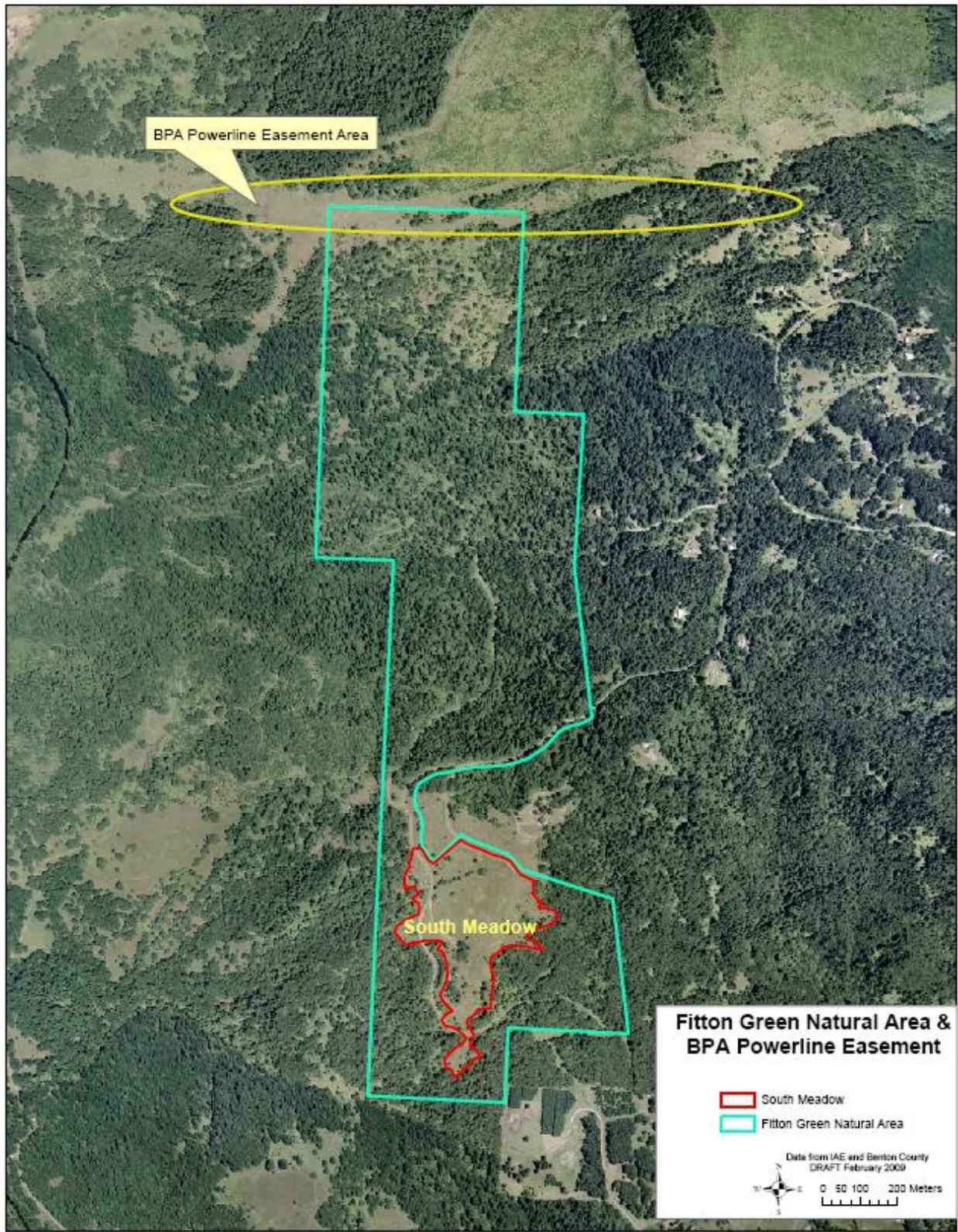


Figure 2. Fitton Green Natural Area adjacent to the BPA Powerline Easement.

5 Future Research

Research opportunities for this species abound. Effects of weather, aspect, plant communities, disease, site structure, dispersal patterns, herbicide interactions, predators, ideal habitat conditions, and successful restoration strategies on Taylor's checkerspot have yet to be fully understood.

As more research and study of Taylor's checkerspot takes place, new knowledge of nectar and host plant species may emerge. Such information will be incorporated into the management guidelines for this species on County owned and managed properties, under the advisement of species and resource specialists.

Future Taylor's checkerspot research should include studies of dispersal and recolonization by adults as well as more detailed studies of occupied sites and butterfly behavior there. The purposeful introduction of Taylor's checkerspot to an unoccupied site with the desired physical characteristics and high quality habitat should also be considered.

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