

**The Endangered
Fender's Blue Butterfly**
(Icaricia icarioides fenderi)



By Melanie Goral



Presentation Outline

1. Physiology and Life History
2. Habitat, Distribution and Diet
3. Endangerment Status and Causes
4. Issues and Concerns
5. Research Studies and Common Methodology
6. Results and Observations
7. Major Conclusions
8. Conservation Methods



General Information

- Over the past 14 years, the prairie habitat of Fender's Blue Butterfly has declined to 0.5 % of its original size.

(Schultz and Crone 2005)

- This Fender's Blue Butterfly is exclusive to the Western edge of Oregon, US.

(Schultz and Hammond 2003)

- Was believed to be extinct from 1940-1980s and rediscovered with few numbers.

(BC Brochure)



Fender's Blue Butterfly

Taxonomy

Kingdom: Animalia

Phylum: Arthropoda

Class: Insecta

Order: Lepidoptera (Butterflies and Moths)

Superfamily: Papilionoidea

Family: Lycaenidae

Subfamily: Polyommatainae (Blues)

Genus: *Icaricia*

Species: *Icaricia icarioides fenderi*

(USFWS 2006)



Fender's Blue Butterfly (FBB)

- Small size
- Delicate, slender-bodied
- Brightly coloured
- Adults are rapid fliers
- Males front legs are shorter than females and lack tarsal claws
- Female is darker than the male



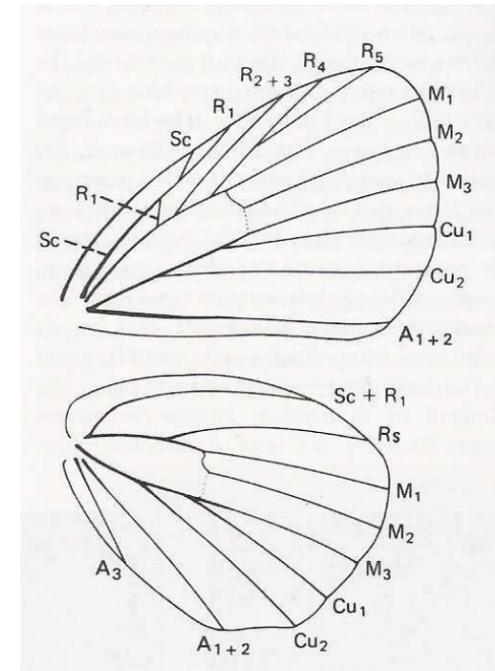
(Triplehorn and Johnson 2005)



Fender's Blue Butterfly

Wings

- Approx. 1-inch wingspan
- Upper wings
 - blue=male
 - brown=female
- Underside of wings
 - creamy tan with
 - 2 rows of black spots
 - white border
- Radius in front wing is 4-branched
- There is no humeral vein in hind wing
- Last branch of radius in front wing is forked

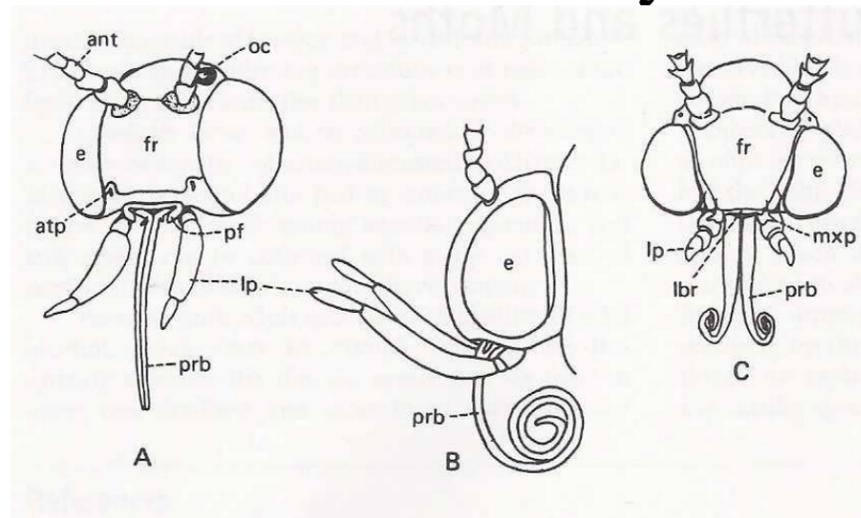


(Triplehorn and Johnson 2005)



Generalized Lepidopteran Head-parts

- Large compound eyes with many facets
- White scales encircle the eyes



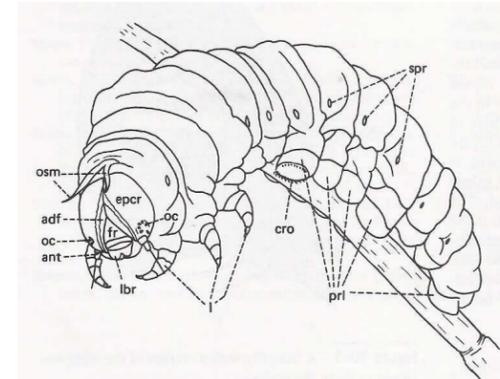
- Antennae are ringed with white
- Adults have sucking mouthparts with a long and coiled proboscis (for nectar).

(Triplehorn and Johnson 2005)



Life History – Larvae Stage

- Larvae have 2 stages (pre- and post-diapause)
- Pre-diapause larvae:
 - Hatch a few weeks after egg stage in May.
 - Feed on lupine leaves (host-plant) and go into diapause at the base of the host-plant until Feb./March
- Post-diapause larvae:
 - Emerge in February and feed on young lupine leaves and flowering stems (inflorescences)
 - Rapid growth and development, followed by the pupate stage in mid-April
- Larvae are flattened and slug-like
- They secrete honeydew, which attracts ants.

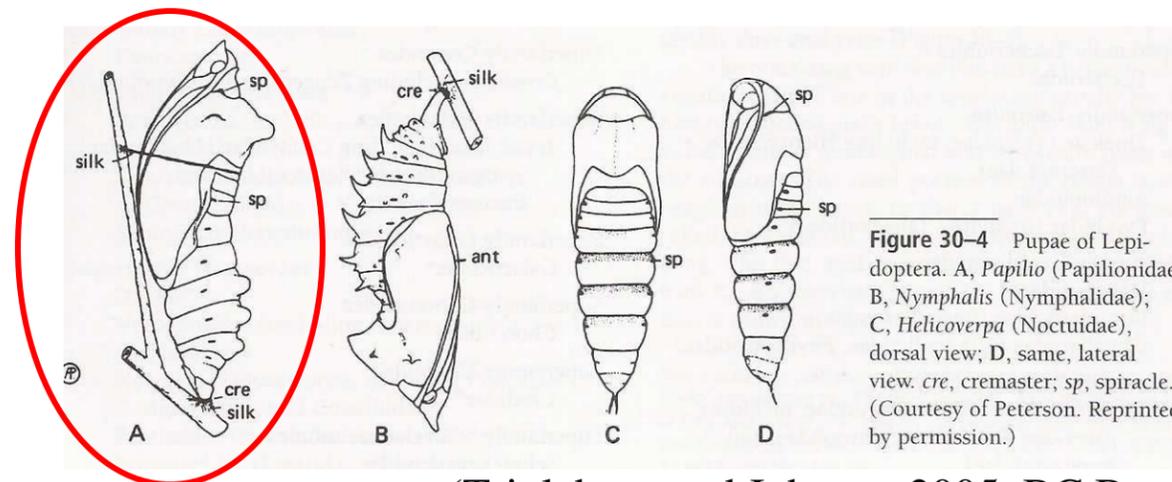


(Triplehorn and Johnson 2005, BC Brochure)



Life History – Pupate Stage

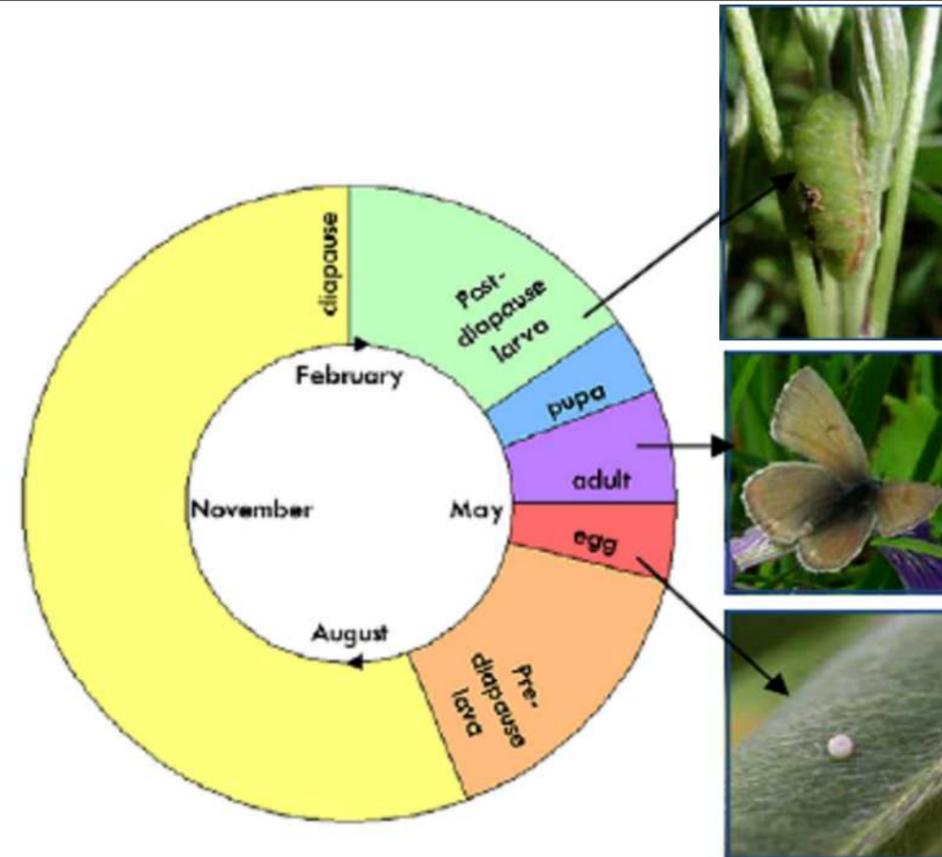
- Post-larvae pupate in mid-April and emerge in May as an adult
- The pupae are fairly smooth
- Attachment to the plant by silk at the cremaster (cre)



(Triplehorn and Johnson 2005, BC Brochure)



Life History – Adult Stage



- Adult emerges in early May
- The cycle continues when the female oviposits on the underside of the lupine leaves in May/June

(Triplehorn and Johnson 2005, BC Brochure)



Habitat

- FBB populations occupy prairie habitats (wet-, upland- and oak savanna-) at low elevations in valleys and foothills.
- This species prefers open grasslands with few trees and shrubs for flight and egg laying.
- Critical elements of habitat:
 - Larvae depend on host-plants for nutrients
 - Adults depend on nectar plants for nectar

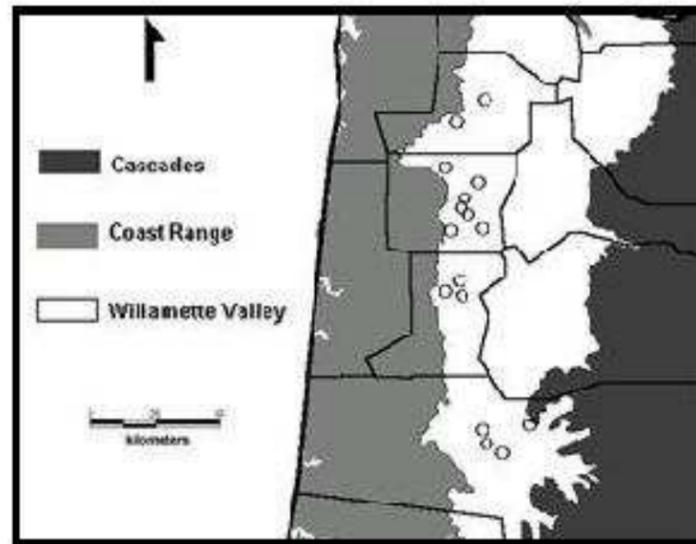


(BC Brochure)



FBB Distribution

- FBB is distributed along the upland prairies of Willamette Valley in Oregon, U.S.



- W. Valley consists of 4 counties:
 - Polk
 - Lane
 - Yamhill
 - Benton (refer to brochure)



(Severns 2002)



FBB Distribution cont.

- This species is endemic to W. Valley and is among the rarest of native species, dependent on its unique habitat type (BC Brochure).
- **HISTORICALLY**, FBB was widely distributed across Western Oregon and South Western Washington, but reduced in numbers following the European settlement in the 1850s (Severns 2002).
- **PRESENTLY**, <0.5 % of the original Oregon habitat exists in 12 isolated prairie patches (Schultz and Crone 2005).



Fender's Blue Butterfly

Diet

- Larval host-plants
 - Kincaid's lupine (primary)
 - Sickle-keeled lupine
 - Spur lupine
- Adults feed on nectar (sugary fluid) produced by flowering species
- Food source often defines FBB distribution



(Schultz and Dlugosch 1999)



Kincaid's Lupine (KL)

- Endemic species to W. Valley upland prairies
- Among the rarest of species in W. Valley
- Growth has been partially successful in greenhouse experimentation
- Most vulnerable life stages to mortality:
 - Germinant stage
 - First growing year



(Severns 2003)



KL Distribution

- KL co-occurs alongside FBB species in W. Valley, Oregon prairie locations.
- W. Valley is a mosaic of:
 - upland prairies
 - wetland prairies
 - lupine patches in varied proximity to each other
- **HISTORICALLY**, lupine patches were surveyed 0.5 km apart.
- **PRESENTLY**, they are isolated from each other ranging between 3-30 km apart, in 13 upland prairie patches.



(Schultz 1998)



Endangerment Status of FBB

- FBB is listed as an endangered species under the federal Endangered Species Act (ESA) in 2000 (Schultz and Crone 2005).
- Possible Cause:
 - Invasion by non-native plants into a habitat threatens required resources for the FBB (Schultz and Dlugosch 1999).
 - Fewer larval host-plants
 - Fewer adult nectar sources
 - Decline in FBB population





Threatened Status of KL

- KL is federally listed as a threatened species under the ESA.
- Possible Cause:
 - Habitat fragmentation may be causing KL colonies to display inbreeding depression (ie. low seed production).



(Severns 2002, Severns 2003)



Decline for FBB and KL

- Habitat loss
- Invasion by non-native weeds (reducing the diversity and abundance of species)
- Loss of larval host-plants and nectar sources
- Tree and shrub encroachment
- Elimination of natural disturbance



Encroachment of non-native shrubs into upland prairie habitat.

(BC Brochure)



Issues/Concerns



- Prairie domination by woody vegetation, while out-competing native plants like KL...
 - ...if natural disturbance (ie. fire) is suppressed
 - ...if anthropogenic disturbance (ie. mowing) is not actively used
- FBB decline...
 - ...if host plants and nectar resources decline

(BC Brochure, Schultz and Dlugosch 1999)



Cheryl Shultz - Main Researcher



- Cheryl B. Schultz is the main researcher studying Fender's Blue Butterfly.
- She is an assistant professor at Washington State University and focuses on conservation biology of plants and animals.



Conservation Studies: **FBB and/or KL Research Foci**

1. FBB behavioural patterns with respect to lupine patches.

(Schultz 1998, Schultz and Hammond 2003, McIntire *et al.* 2007)

2. FBB adult and larval resources over time.

(Schultz and Dlugosch 1999)

3. KL plant growth dynamics with varying natural disturbances.

(Schultz and Crone 1998, Schultz 2001)



Common Methodology

- Observe butterfly flight patterns and the amount of daily activity:
 - Within primary lupine habitats and boundaries between habitats.
- Mark-release-recapture (MRR) experiments:
 - Indicating FBB survivorship from year to year.
- Quantified movement behaviour of FBB as a function of distance from host-plant patches.



(Schultz 1998)



Common Methodology cont.

Mathematical simulations:

- Use fire as a tool to control plant growth
 - By burning prairies, observing the effect of natural disturbances and the success rate of FBB dependent on KL seed sets.



- Utilization of data from prior studies
 - To study degradation and quality of native prairies sufficient for long-term persistence of FBB and KL species.

(Schultz 1998, Schultz and Crone 1998, McIntire *et al.* 2007)



Common Methodology

cont.

- Soil treatments to restore habitat:
 - Planting and weeding treatments, replicated in 8 experimental blocks at sites.
- Population viability analysis:
 - To develop recovery criteria for FBB
 - Count of all observed butterflies during peak of emergence in May
 - MRR and walking transect methods during flight periods

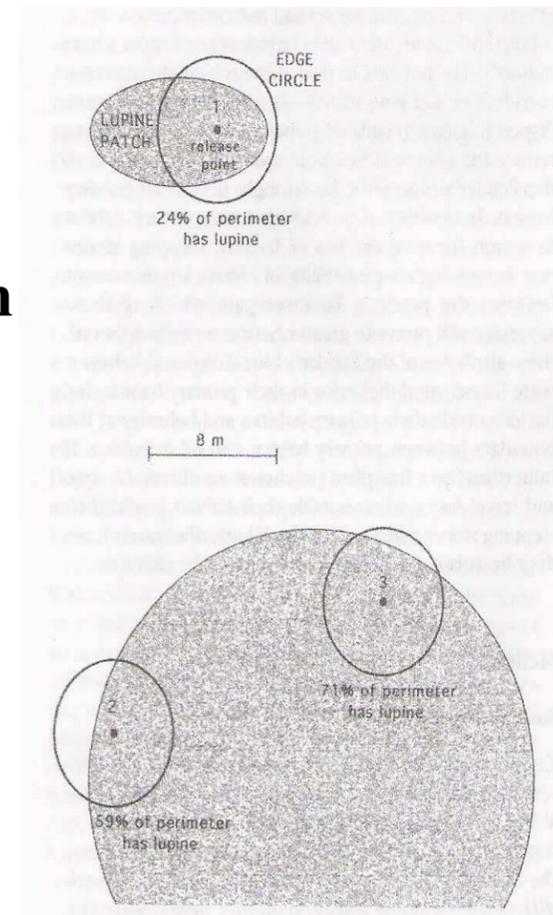


(Schultz 2001, Schultz and Hammond 2003)



FBB Behavioural Observations

- **Figure 1 shows the proximity of FBB in lupine patches**
 - Near habitat edges (leaving the habitat).
- **95% of the FBB population found between lupine patches**
 - 10-22m proximity of patches (effectiveness of a corridor?).
 - Increasing the distance between patches makes it unlikely that dispersing FBB find new patches when they leave their natal lupine patches.

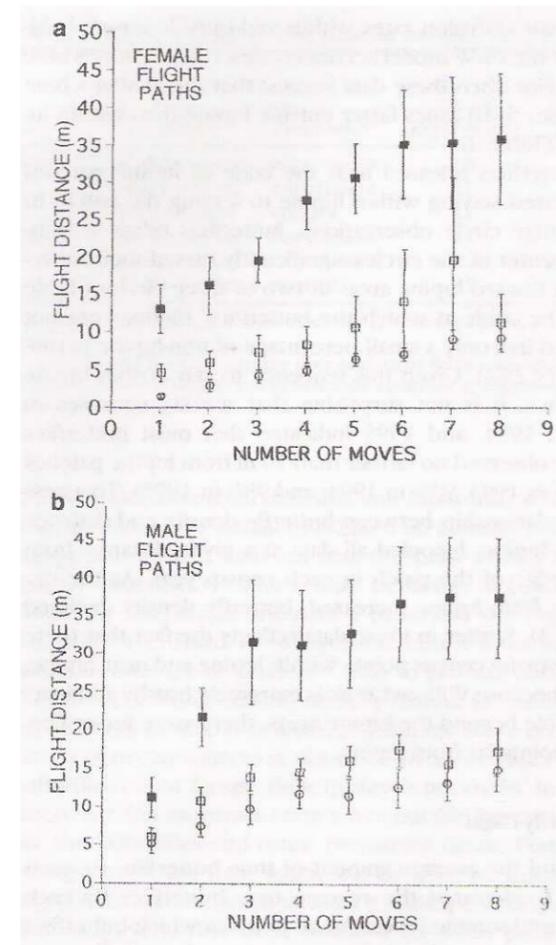


(Shultz 1998)



FBB Behavioural Observations

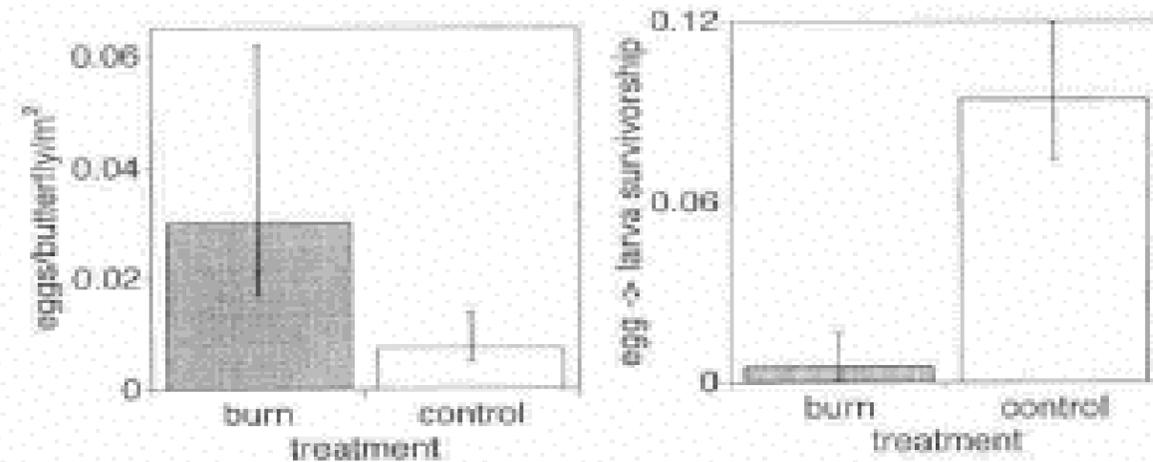
- **Figure 2 shows the positive correlation between FBB movements and distance traveled in and about lupine patches**
 - For both male and female, the flight pattern is dependent on the size of the lupine patch (based on experimental and control measures).
 - MRR data show that adult FBB live about 9.5 days and fly about 2.3 hours/day



(Schultz 1998)



KL Growth Dynamics



- **Figure 3 shows burning treatment advantage to FBB ovipositing and future larvae survivorship in the absence of burning treatment**
 - An increase in ovipositing when natural disturbances are not suppressed and able to control non-native plant competition.
 - Increases in ovipositing and FBB resources leads to higher survivorship of larvae.
- **Burning 1/3 of the habitat/year maximizes average annual population growth rate, led to 95% of simulated butterfly population persisting for 100 years (based on mathematical models).** (Schultz and Crone 1998)



KL Growth Dynamics

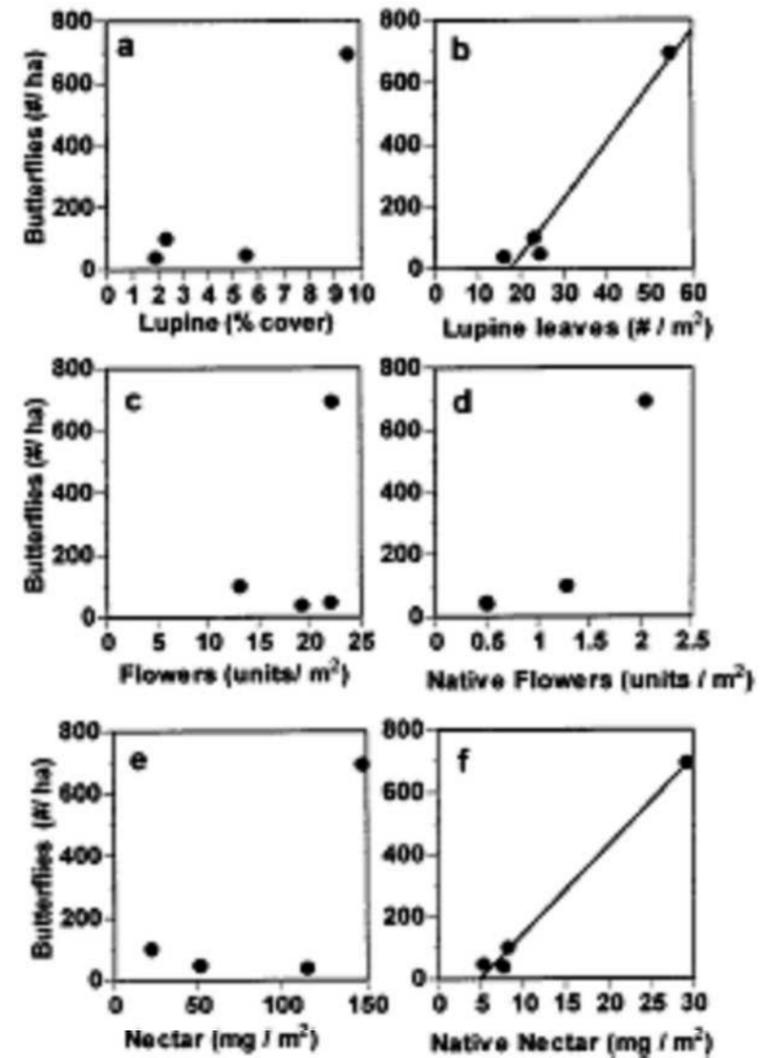
- **Open pollination and within colony breeding leads to less seed production**
 - Hands-on out-crossing between patches produced significantly larger seed sets.
 - Leads to more KL patches.
- **Restored patches should be <1km from existing habitat and at least 2 ha**
 - Based on FBB dispersal behaviour and demography from previous studies of FBB

(Severns 2002, McIntire *et al.* 2007)



KL Growth Dynamics

- **Figure 4 shows a positive correlation between KL resources and FBBs population density.**
 - An increase in KL patch resources, increases the amount of FBB population.
- **Linear regression line shows a statistical significance**
 - % cover of lupine leaves
 - **density of lupine leaves**
 - All available flowers
 - All native flowers
 - All available nectar
 - **All native nectar**



(Schultz and Dlugosch 1999)



Conclusions

- Need to understand dispersal behaviour of the FBB and KL.
- Need stepping stones between patches rather than corridors to help facilitate FBB movement.
- Designing strategies may involve tradeoffs with negative short-term impacts (ie. fire) to achieve long-term success.
- Important to connect restoration efforts to the life history features of FBB.



(Schultz 1998, Schultz and Crone 1998, Schultz 2001)



Conservation Management

- As of Sept. 22, 2006, only 36% FBB (=475) are protected by the U.S. within critical habitats.
- Unique analysis is needed to determine suitable lands to expand populations.
- Restore degraded habitat by enhancing adult and larval resources that play an important role in managing populations of FBB.

(USFWS 2006, Schultz and Dlugosch 1999)



Conservation Management

- Addition of new KL seeds to small patches, buffering against effects of inbreeding.
- Restore all currently degraded and potentially available habitat patches to high quality native prairies.

(Severns 2003, McIntire *et al.* 2007)



Management Plans

- In the spring of 2006, Benton County received a grant from the USFWS to develop a Habitat Conversation Plan (HCP) that will (refer to brochure):
 - Increase conservation and restoration opportunities
 - Provide long-term protection of sensitive species and habitats
 - Develop a more economical and ecological approach to species conservation and mitigation

(BC Brochure)



Management Plans cont.

- On November 30, 2006, the U.S. Fish and Wildlife Service (USFWS) began a critical habitat plan for FBB and KL.
 - 1218 ha for FBB in Benton, Lane, Polk and Yamhill counties, OR, U.S.
 - Consisting of 13 critical habitat units to function as larger connected metapopulation.
 - 237 ha for KL in Benton, Lane, Polk and Yamhill counties, OR, U.S.
 - Consisting of 13 critical habitat units to function as larger connected metapopulation

(USFWS 2006)



A FBB Critical Habitat

- Upland prairie, wet prairie, or oak savanna habitat with a mosaic of low-growing grasses and forbs.
- Absence of dense canopy vegetation, and undisturbed subsoils.
- Larval host-plants and adult nectar sources
- Stepping-stone habitat consisting of:
 - undeveloped open areas
 - appropriate support for the short-stature prairie plant communities
 - well-drained soils
 - within ~2 km of natal lupine patches.
- Does not include man-made structures
 - such as buildings, roads, and other paved areas

(USFWS 2006)



How Can We Help?

- The conservation of FBB and KL will require necessary measures to bring species to the point where measures are not necessary; for example:
 - Law enforcement
 - Habitat acquisition/propagation
 - Live trapping
- Education for:
 - Private landowners
 - States
 - Local governments
 - Public



(USFWS 2006)



Questions?