

A photograph of a grassy field with various wildflowers, including purple and yellow ones, under a clear blue sky. The field is filled with tall green grasses and some dried, brownish plant matter. The background shows a distant horizon with some trees and a clear sky.

Thatch Management Using Mowing and Grazing to Benefit the Behren's Endangered Butterfly (*Speyeria zerene behrensii*), Manchester, California, USA

NCB 2023

*Terra Fuller, Senior Environmental Scientist (Specialist),
Sonoma-Mendocino Coast District, California State Parks*

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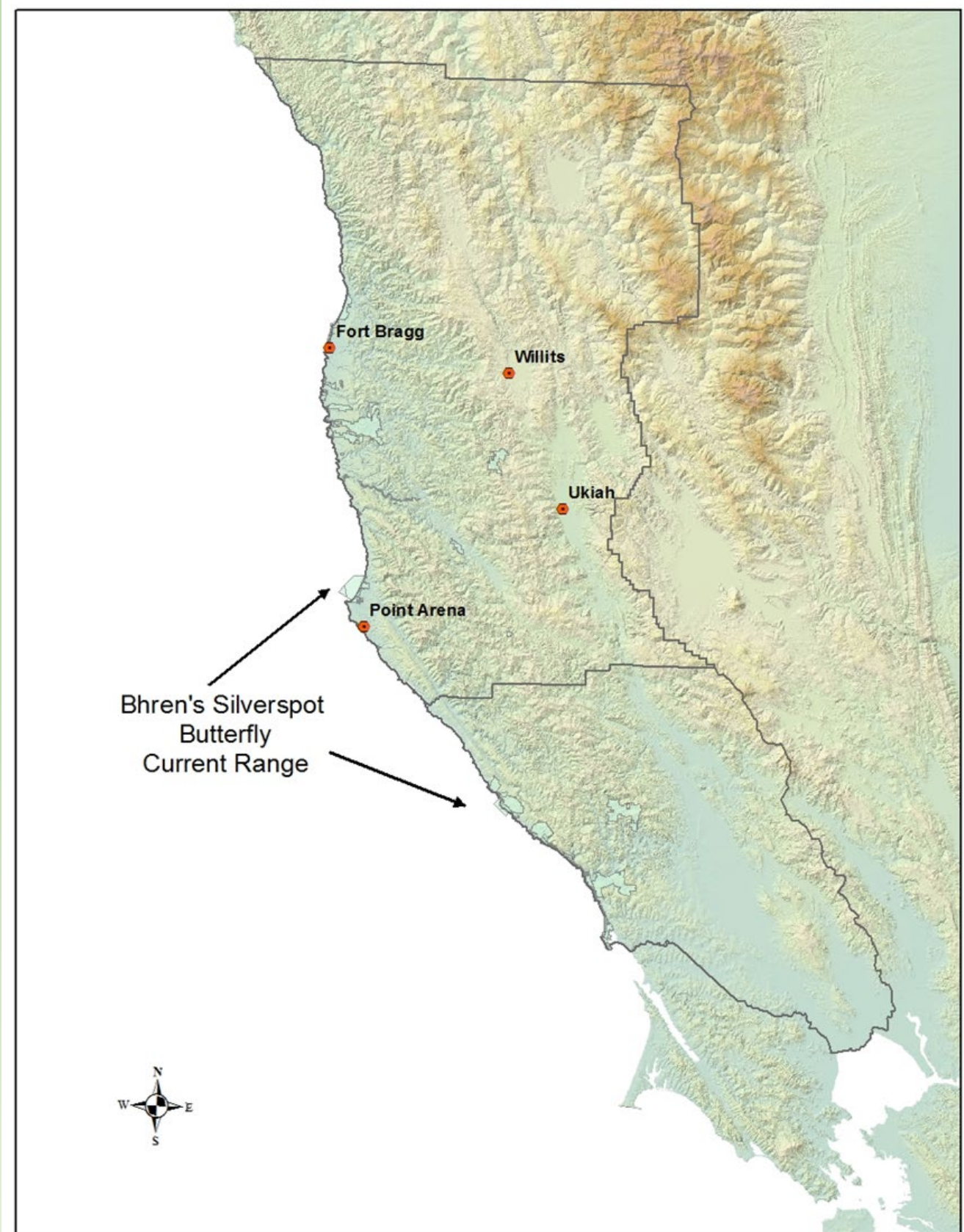
Behren's Silverspot Butterfly (*Speyeria zerene behrensi*)

Listed by USFWS as Endangered in 1997

Historic Range- City of Mendocino to
South of Salt Point

Current Range- Manchester State
Park to Salt Point

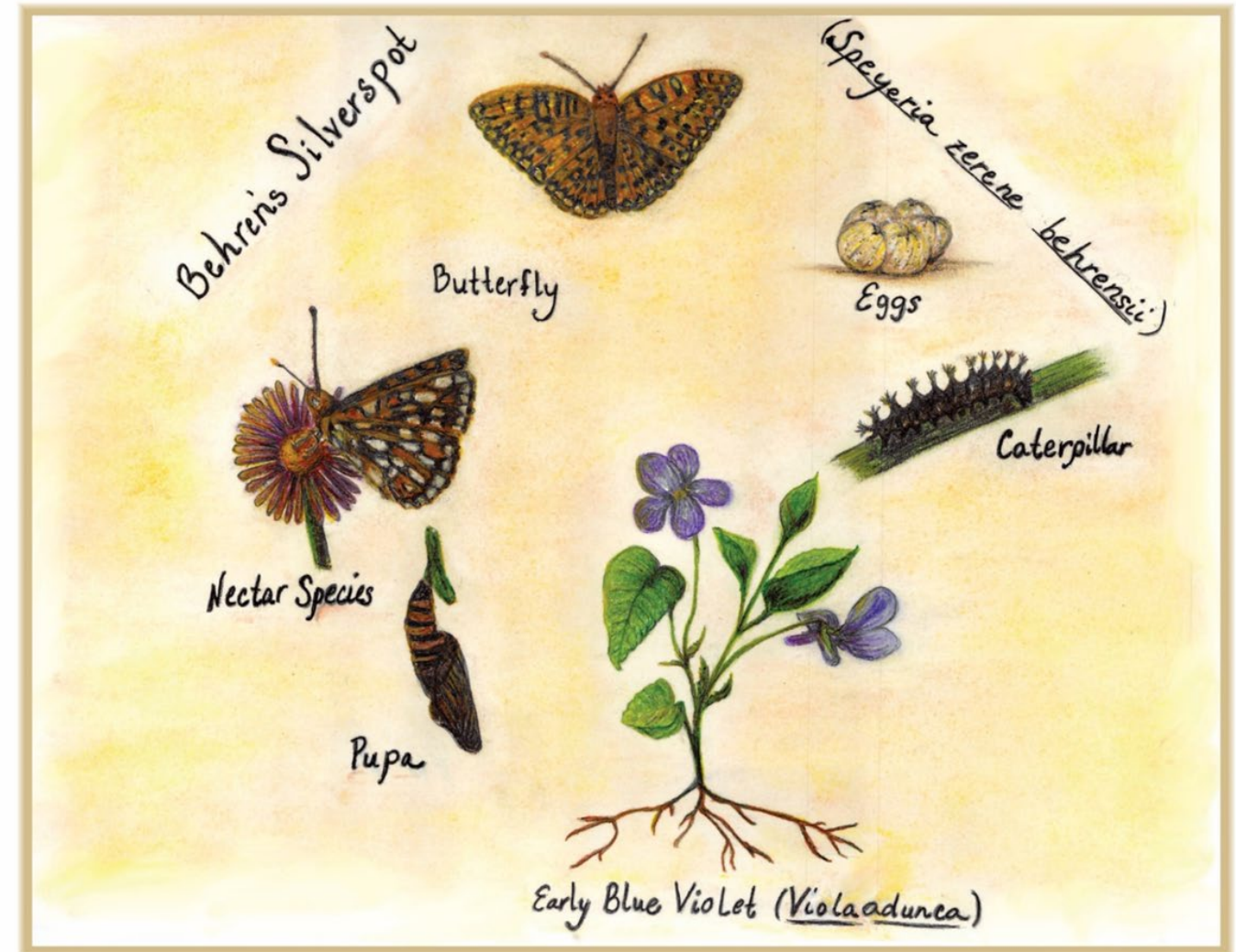
Similar silverspot subspecies: Myrtle's (*Speyeria zerene myrtleae*) and Oregon (*Speyeria zerene hippolyta*)



Behren's Silverspot

Life History

- Emerges from pupation early/mid summer,
- Nectar plants important for energy and egg development
- Mate's immediately
- Ovaries take about a month to mature.
- Eggs laid on early blue violets late summer-September (12 days to hatch)
- Larvae overwinter without feeding
- Larvae go through 6 molts, during the spring feeding on *Viola*
- In pupal case for 2-3 weeks, eclose from pupa





Viola adunca

- Only larval food for Behren's, with 200 leaves needed for each caterpillar (Oregon zoo captive rearing procedures 2009); 25 plants/m²
- Perennial herb
- Spreads by woody rhizome and seed
- Locally occupies vernal moist meadows, prairies, stream banks and meadow edges in conifer forests

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Viola adunca subsp. adunca
WESTERN DOG VIOLET, EARLY BLUE VIOLET

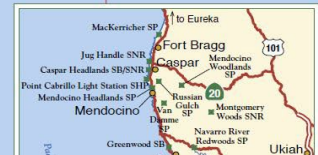
Higher Taxonomy
Family: **Violaceae** [View Description](#)
Genus: **Viola** [View Description](#) [Dichotomous Key](#)

Viola adunca Sm. subsp. *adunca*
NATIVE
Habit: Perennial herb 3.5–30(35) cm, glabrous to pubescent. Stems prostrate to erect, generally many, often woody at base in age, generally some much elongated by end of season, clustered on 1–several caudexes generally at ground level, from woody rhizome. Leaf: simple, basal 1–4 per caudex, glabrous to hairy, petiole 0.5–13.5 cm, blade 0.5–6.5 cm, 3.4–4.8 cm wide, ovate to ovate-triangular, entire to crenate, base cordate, truncate, or long-tapered, tip acute to obtuse; cauline petiole 0.5–12.1 cm, blade 0.6–4.2 cm, 0.4–4.4 cm wide, – like basal. Inflorescence: axillary, peduncle 1–10.3 cm. Flower: sepals inconspicuous, not ribbed; petals light to deep violet, lower 3 white basally, veined dark violet, lateral 2 bearded with ciliate hairs, lower 7–21 mm, upper 3–7 mm, generally elongate, concavo-ovate, straight or tip hooked. Fruit: 5–11 mm, short siliqua, glabrous. Seed: 1.5–2 mm, dark brown to olive-black. Chromosomes: 2n=20,30,40.
Ecology: Vernal moist meadows, deep meadows, meadow edges in conifer forest, generally shade. Elevation: < 3570 m. **Microgeographical Distribution:** CA-FR (gen. n. det. to D in text).
Wing: **Distribution Outside California:** to Alaska, Yukon Territory, eastern North America, New Mexico. **Flowering Time:** Apr–Aug. **Note:** Polymorphic, with many named varieties. Often confused with *Viola nephrolepis* (L.) O. S. L. Larval food plant for 3 federally endangered or threatened butterflies.
Synonymy: *Viola adunca* subsp. *adunca* M.S. Baker; *Viola adunca* var. *adunca* M.S. Baker; *Viola adunca* var. *californica* C.L. Hitchc.; *Viola adunca* var. *kirki* V.G. Darter; *Viola adunca* subsp. *oxycaerulea* (S. Watson) Piper; *Viola adunca* var. *undulata* (Greene) Applegate; *Viola californica* M.S. Baker; *Viola undulata* Greene; *Viola uncinata* Greene.
Unabridged Note: Listed as the larval food plant for federally endangered *Bahama's silverspot butterfly* (*Speyeria zerene bahamensis*) in Mendocino Co., *Myrtle's silverspot butterfly* (*Speyeria zerene myrticola*) in Marin and Sonoma cos., and the federal threatened Oregon silverspot butterfly (*Speyeria zerene applegatei*) in Del Norte Co.
eFlora Treatment Author: R. John Little
Unabridged Reference: Baker, M.S. 1949a. Studies in western violets. IV. Leaf. West. Bot. 5: 141–147; Baker, M.S. 1949b. Studies in western violets. VI; Madroño 10: 110–128; Baker, M.S. 1957. Brittonia 9: 217–230; Ballard, H.E. 1992. Systematics of Viola section Viola in North and north of Mexico. M.S. thesis, Central Michigan University, Mt. Pleasant, Michigan; Ballard, H.E. 1994. Violets of Michigan. Michigan Botanist 33: 131–199; Davidse, G. 1976. A study of some Intermountain violets (Viola Sect. Chamaemelolium). Madroño 23: 274–283; Fabijan et al. 1987. The taxonomy of the Viola nuttallii complex. Can. J. Bot. 65: 2562–2580; Gil-adi, N.L. 1995. Systematics and evolution of Viola L. subgenus *Revealii-Americanae* (W. Recker) Dickey. Ph.D. dissertation, Univ. of Michigan, Ann Arbor, Michigan; Gil-adi, N.L. 1997. Systematics of Viola subgenus *Revealii-Americanae*. Botanical Magazine 110: 1–130; Gil-adi, N.L. 1998. The micromorphologies of seed coats and petal trichomes of the taxa of Viola subsect. *Revealii-Americanae* (Violaceae) and their utility in discerning orthospecies from hybrids. Brittonia 50: 91–131; Hitchcock, C.L. 1961. Vasc. Pl. Pacific NorthW. Vol. 3; McMinney, L.E. 1992. A taxonomic revision of the acaulescent blue violets (Viola) of North Am. Sida Botanical Miscellany, 7: 1–59; McMinney, L.E. and R. Russell. 2002. Violeaceae of the Southeastern United States. Castanea 6: 369–379; Russell, N.H. 1965. Violets (Viola) of the central and eastern United States: an introductory survey. Sida 1: 1–113
Jepson Online Interchange

Viola adunca subsp. adunca
Violaceae
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Legend

- Major Road
- Paved Road
- Unpaved Road
- Hiking Trail
- Natural Preserve
- State Marine Reserve
- Accessible Feature
- Campfire Center
- Campground
- Drinking Water
- Environmental Campground
- Group Campground
- Hike/Bike Campground
- Information/Self-Registration
- Marsh Area
- Parking
- Restroom
- RV Sanitation Station
- Trailhead



This park receives support in part through

Manchester State Park

History

- Pre-contact Central Pomo Indians, recognized now as the Manchester Band of Pomo Indians
- Early settlers did cultivation and ranching
- 1930 State Park Commission set aside 295 acres along the coast for recreation
- In 1955 this area became Manchester State Beach
- Hoyt ranch added in 1961 James Biaggi
- 1977 the final pieces added to become a State Park in 1991



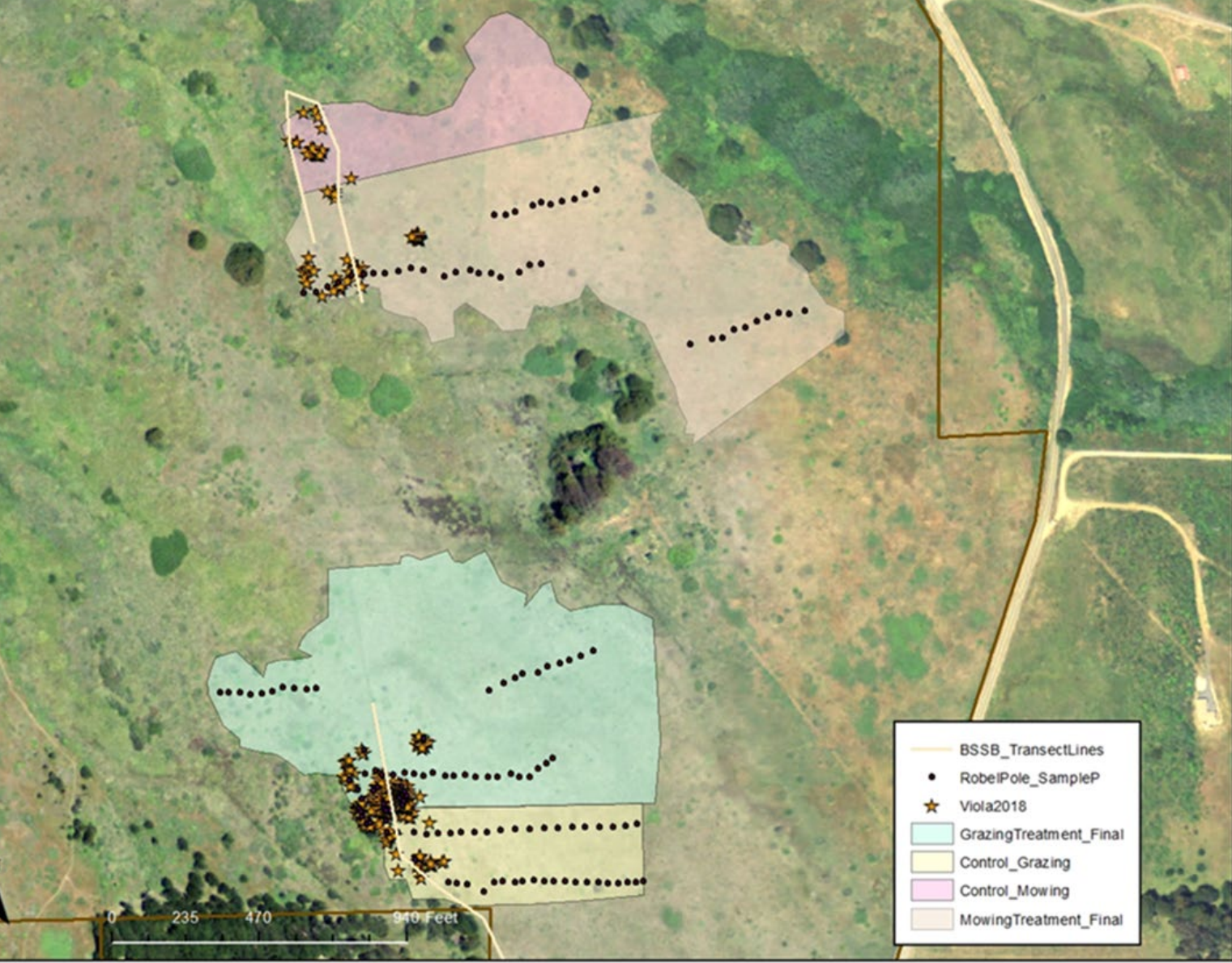
Why Restoration??



Sweet Vernal Grass (*Anthoxanthum odoratum*) & Velvet Grass (*Holcus lanatus*)



- Historic agricultural activities, loss of fire, loss of large grazers and introduction of non-native grasses have resulted in ecological changes to the native coastal prairie.
- Invasive perennial grasses compete for resources (space, sunlight and water) and through the dense accumulation of thatch.
- Behren's Silverspot butterflies are very low to absent at Manchester
- Only two locations at Manchester contain *Viola adunca*
- Mowing and grazing as tool to help control invasive grasses
- USFWS recovery funding in 2015 with additional funding through Disney Conservation Fund for treatments and monitoring



Question: does grazing or mowing reduce thatch and increase *Viola* numbers?

2015-2020 Implemented Treatments

- 20 acres mowed
- 20 acres of high intensity low duration grazing
- 10 acres of control
- Mowed and grazed during the spring-summer or fall-winter

		Months -Year					Months -Year					Months -Year					Months -Year											
		Apr-16	May-16	Jun-16	Oct-16	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Dec-17	Apr-18	May-18	Jun-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	May-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-19
Manchester	Grazing	Yellow						Yellow	Yellow				Yellow				Yellow	Yellow				Yellow	Yellow	Yellow	Yellow		Yellow	Yellow
	Mowing				Green						Green			Green														
	Robel Pole				Orange					Orange	Orange				Orange	Orange							Orange			Green		
	Viola Counts	Blue	Blue			Blue	Blue							Blue							Blue							

Grazing Area broken into the temporary paddocks used in phase one:



Daily Procedures - Conducted each day throughout the first grazing period:

1. Map the area to be fenced.
2. Erect electric fencing
3. Take notes and photographs of paddock before moving sheep in
4. Herd sheep into the new paddock
5. Take notes and photos of previous day's paddock after sheep have moved out
6. Move sheep around their new paddock with herding dog to increase the trampling impact on standing and thatched organic matter. This is done early while there is still dew on the grass.
7. Feed alfalfa (typically 3-4 flakes) on top of areas of significant thatch.
8. Provide water to the sheep with portable water trough
9. Repeat steps 5 and 6 one or two more times throughout the day.
10. Scare off nighttime predators with a spotlight

Monitoring

Pre-Project

Project Implementation

Controls vs. Treatments



Robel Pole



Robel pole techniques outlined by Smith 2008

Butterfly Surveys



Established transects since 2007

Viola Counts



Control Mowing



05.23.2019 11:51

Control

Mowing

04.28.2020 13:07

After Fall Mowing



Control Grazing



05.13.2019 17:01



Control

Grazed

04.21.2020 10:42

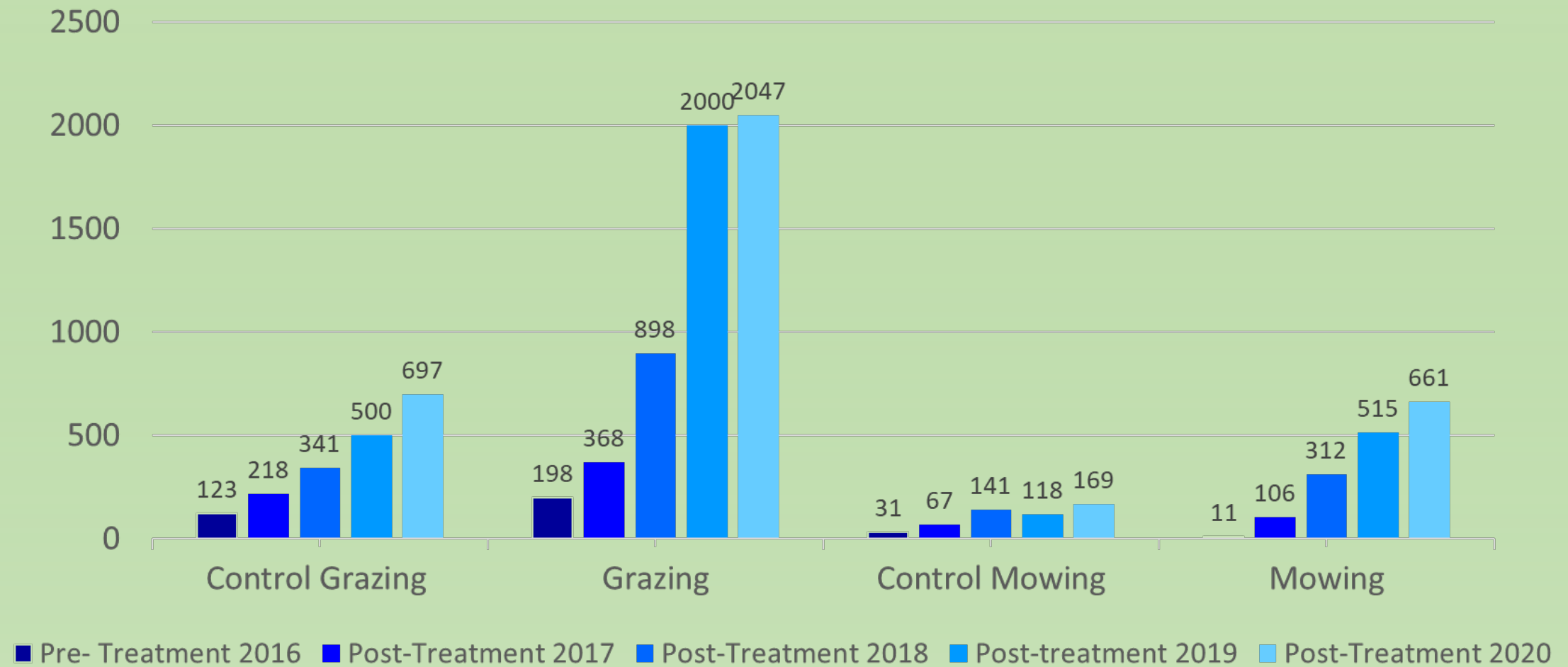
After Fall Grazing



Viola Counts

Absolute Change
($V_2 - V_1$).

Relative Percent
Change ($(V_2 - V_1) / V_1$
*100)



Treatments	2016-2017		2017-2018		2018-2019		2019-2020		Average	
	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute
Control Grazing	77%	95	56%	123	47%	159	39%	197	55%	144
Grazing	86%	170	144%	530	123%	1102	2%	47	89%	462
Control Mowing	116%	36	110%	74	-16%	-23	43%	51	63%	35
Mowing	864%	95	194%	206	65%	203	28%	146	289%	163



Optical Density Monitoring

(cm) corresponding to treatment season and years 2016-2020, Manchester State Park. Darkened cells illustrate a considerable reduction in optical grass density.



	Average Optical Density Pre-project (cm)	Fall Mow and Fall and Spring Grazing	No Grazing Fall and Spring Mow	Fall Mow and Summer Grazing	Fall Mow and Fall Grazing
Treatments					
Year	2016	2017	2018	2019	2020
Mowing	15	18	8	22	23
Grazing	24	11	24	13	22
Control	18	25	20	21	23

Grazing-Transect 4

Mowing-Transect 6



Fall &
Spring

Fall
only

Control- Transect 1



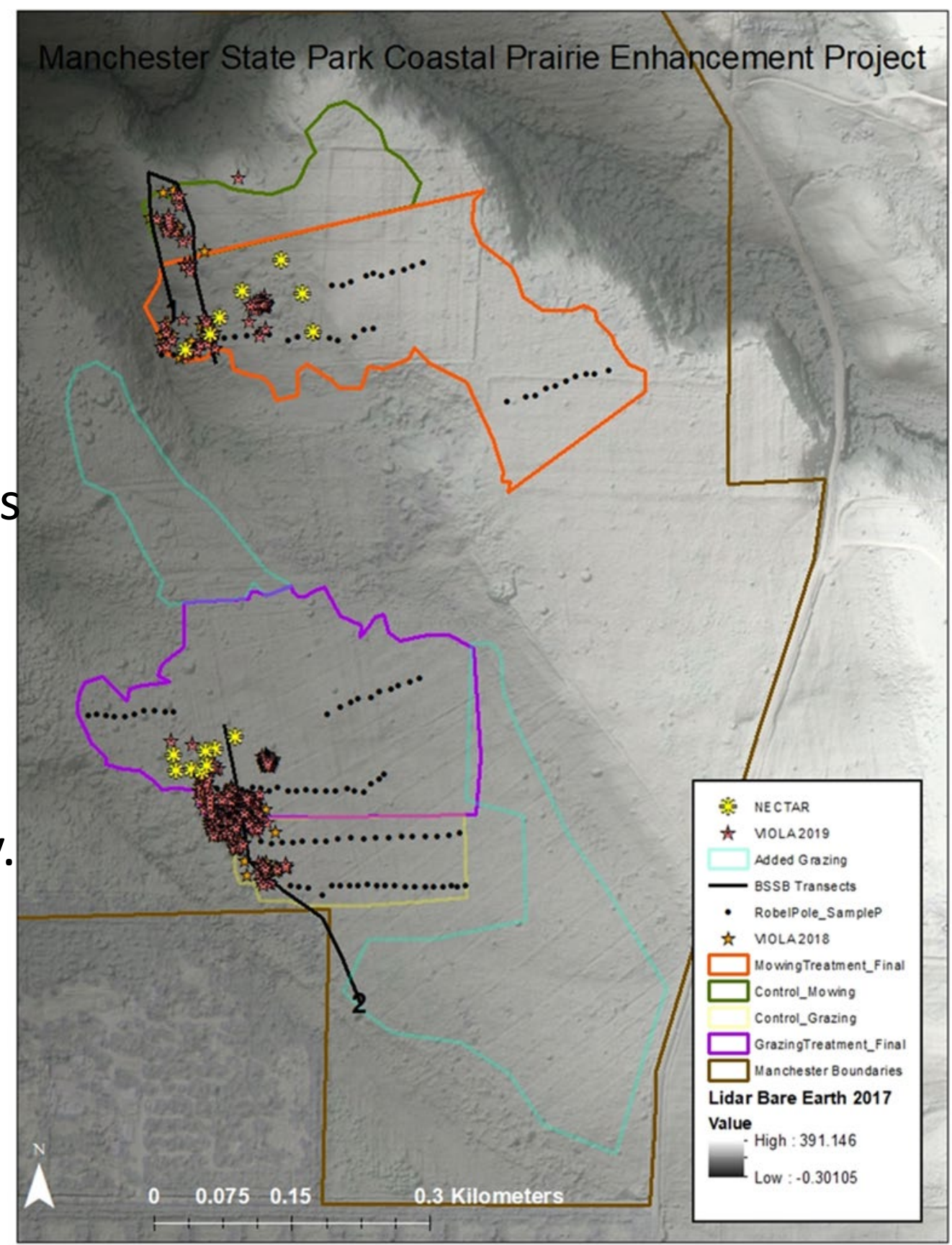
Monitoring Conclusions:

- Viola numbers increased with both grazing and mowing. Dead hatch was removed with annual treatments.
- Only spring/summer treatments reduce the density of grass during the Behren's flight season using the Robel pole method; however, observationally there appeared to be a carryover effect from repeated years with fall treatments.



Observations:

- Fall winter treatments reduced grass thatch through the spring and early summer and lasted *Viola* blooming season
- Native forbs and grasses showed a flowering response to treatments where the seed bank was present.
- Wet years and wet areas had more flowering native forbs than drier areas after treatment.
- Manchester native seed bank is low (tilling); thus, treatments alone will not increase diversity.
- Purple velvet grass appeared to be reduced by mowing and grazing; however bent grasses (*Agrostis stolonifera* or *capillaris*) did not and will be a long-term challenge.



Recommendations:

- Grazing and mowing are thatch reduction treatments and can improve the flowering of natives.
- For perennial grasslands, fall treatments will last until the spring/early summer blooming season. Fall treatments avoid the bird nesting season, don't impact spring forbs.
- Farmed/tilled grasslands will likely require the removal of non-native grasses. Active planting or seeding of forbs and native grasses may be needed to restore coastal prairie.

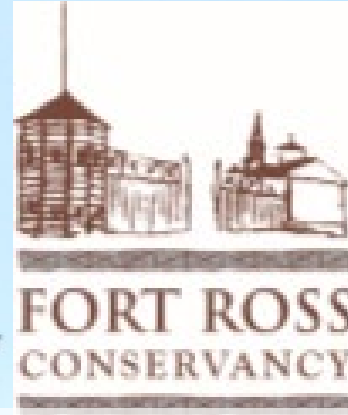




Leland Falk Sea
Ranch Sheep



Thank You!



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Consulting botanist: Peter Warner.

09.13.2018 10:24