

Powell Butte Grassland Bird Surveys: 2019-2023

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Conservation InSight

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Why do we do this?

Conservation Genetics
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RESEARCH ARTICLE

Genetic analysis of federally endangered Cape Sable seaside sparrow subpopulations in the Greater Everglades, USA

Caitlin E. Beaver¹ · Thomas Virzi² · Margaret E. Hunter¹

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Abstract

The federally endangered Cape Sable seaside sparrow (*Ammospiza maritima mirabilis*) is endemic to the Greater Everglades ecosystem in southern Florida, inhabiting fragmented marl prairies in six individual subpopulations. The subspecies is threatened by loss of breeding habitat from fire and water management. Genetic information is severely limited for the subspecies but could help inform decisions regarding subpopulation protections and potential translocations for genetic rescue. To provide genetic data and inform management efforts, feather samples were collected across five subpopulations (designated A–E) and protocols were tested to optimize DNA extraction yields. We assessed four mitochondrial DNA markers (N = 36–69) and 12 nuclear microsatellite loci (N = 55) in 108 sparrows. Mitochondrial DNA sequences revealed low haplotype diversity, with NADH dehydrogenase-2 haplotypes matching to most other extant subspecies and to the Atlantic coast subspecies. Nuclear diversity was low compared to other subspecies, but similar across subpopulations. Samples grouped as one population when analyzed by Principal Component Analysis, Bayesian modelling and genetic distance metrics. Limited genetic emigration was detected from one putative migrant. Relatedness was significantly different for sparrows in the most geographically distant subpopulation (A), likely reflecting high self-recruitment and natal site fidelity ($P = 0.003$). The low to moderate effective population size ($N_e = 202.4$; $N_e/N_0 = 0.06$) and generation time estimates indicated that unique genetic variation could be lost quickly during stochastic events. The sample sizes were limited, which reduced the power to comprehensively address recent population size reductions and any subsequent loss of genetic diversity.

Keywords *Ammospiza maritima mirabilis* · Conservation genetics · Endangered species · Genetic diversity · Microsatellite DNA · Mitochondrial DNA

Introduction

The protection of endangered species from population threats, like habitat loss, is needed to effectively manage biological resources. To maintain population viability and evolutionary processes, a number of conservation units are used to delineate and manage demographically independent groups, such as distinct population segments (DPSs) under the United States Endangered Species Act, and evolutionary

distinct units (ESUs). Measurement of intraspecific genetic diversity, localized adaptation, and genetic or demographic resilience can be used to inform conservation efforts for imperiled or declining populations (Flanagan et al. 2018; Ottewill and Byrne 2022; Thompson et al. 2023). Mitochondrial and nuclear genetic studies can provide information on genetic variation, connectivity, population structure, relatedness, and inbreeding levels to inform conservation efforts.

The seaside sparrow (*Ammospiza maritima*) species complex is composed of seven subspecies found in marshes along the Atlantic and Gulf of Mexico coastlines of the United States (McDonald 1988). These seven subspecies were designated by feather plumage, song, and in some instances, mitochondrial DNA (mtDNA), but past and current taxonomic classifications and differentiations are still being finalized by comprehensive genetic and phenotypic analyses (Griscom 1944; Kale 1983; Robbins 1983; McDonald 1988; Mila et al. 2007; Remsen 2010; Winker 2010;

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Detectability of the endemic Cape Sable Seaside Sparrow in the Everglades ecosystem



Sean Murphy and Tom Virzi
Conservation InSight

Hydrologic impacts on mercury and breeding success of the Cape Sable seaside sparrow in the Florida Everglades

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CONTENTS

EXECUTIVE SUMMARY	3
1.0 DEMOGRAPHIC MONITORING	12
1.1 INTRODUCTION	12
1.2 SUBPOPULATION A	14
1.3 SUBPOPULATION B	20
1.4 SUBPOPULATION C	28
1.5 SUBPOPULATION D	31
1.6 SUBPOPULATION E	34
1.7 COMPARATIVE DATA	36
1.8 DISCUSSION	46
1.9 TABLES AND FIGURES	49
2.0 ESTIMATING POPULATION SIZE AND DETECTABILITY IN THE EVERGLADES NATIONAL PARK RANGEWIDE SURVEYS	66
2.1 INTRODUCTION	66
2.2 METHODS	67
2.3 RESULTS	70
2.4 DISCUSSION	72
2.5 TABLES AND FIGURES	76
3.0 UNDERSTANDING THE DETECTION PROCESS OF THE ENDEMIC CAPE SABLE SEASIDE SPARROW IN EVERGLADES NATIONAL PARK	100
3.1 INTRODUCTION	100
3.2 METHODS	103
3.3 RESULTS	109
3.4 DISCUSSION	112
3.5 TABLES AND FIGURES	117
4.0 METHYLMERCURY CONCENTRATIONS IN CAPE SABLE SEASIDE SPARROW FEATHER TISSUE SAMPLES	144
4.1 INTRODUCTION	144
4.2 METHODS	145
4.3 RESULTS AND DISCUSSION	146
4.4 TABLES AND FIGURES	151
5.0 LITERATURE CITED	163













Why do YOU do this?



Impact of Habitat Restoration on Bird Populations at Powell Butte Nature Park

- Reservoir 1
 - Pre-Restoration
(April 2021)

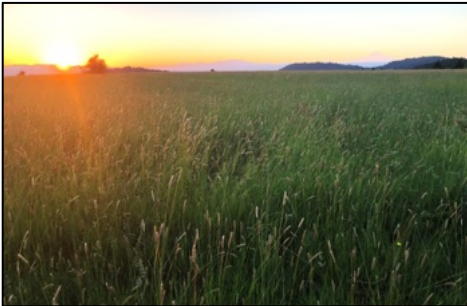


Grassland
Bird Nest



Impact of Habitat Restoration on Bird Populations at Powell Butte Nature Park

- Reservoir 1
 - Construction
(February 2022)



Impact of Habitat Restoration on Bird Populations at Powell Butte Nature Park

- Reservoir 1
 - Restoration
(Goal > 2023)



Impact of Habitat Restoration on Bird Populations at Powell Butte Nature Park

- Reservoir 1
 - Post-Restoration
(March 2023)



Impact of Habitat Restoration on Bird Populations at Powell Butte Nature Park

- Reservoir 1
 - Post-Restoration
(June 2023)



Impact of Habitat Restoration on Bird Populations at Powell Butte Nature Park



**Reservoir 2
(Restoration Goal)**



**Reservoir 1
(Pre-Restoration)**



**Reservoir 1
(Post-Restoration)**

Impact of Habitat Restoration on Bird Populations at Powell Butte Nature Park



Reservoir 1
(Post-Restoration - June 2023)

Impact of Habitat Restoration on Bird Populations at Powell Butte Nature Park

- Demographic Study

- Research goals:

- Assess grassland habitat quality at PBNP by studying indicator species breeding at the site.
 - Focal species = Savannah Sparrow (SAVS) + other grassland birds.
 - Determine status and distribution of SAVS and other grassland birds at PBNP.
 - Study breeding populations and compare demographic rates (e.g., nest success, survivorship, etc.) over time as restoration advances at the site.

- Community Science Surveys

- Research goals:

- Assess the impact of habitat restoration on bird populations at PBNP.
 - Collect data on entire bird community at PBNP (not just focal grassland species).
 - Collect additional data on focal species.
 - **Community participation in scientific research.**

Grassland Bird Monitoring Study Design 2019

- **Demographic Monitoring**

- Plot A

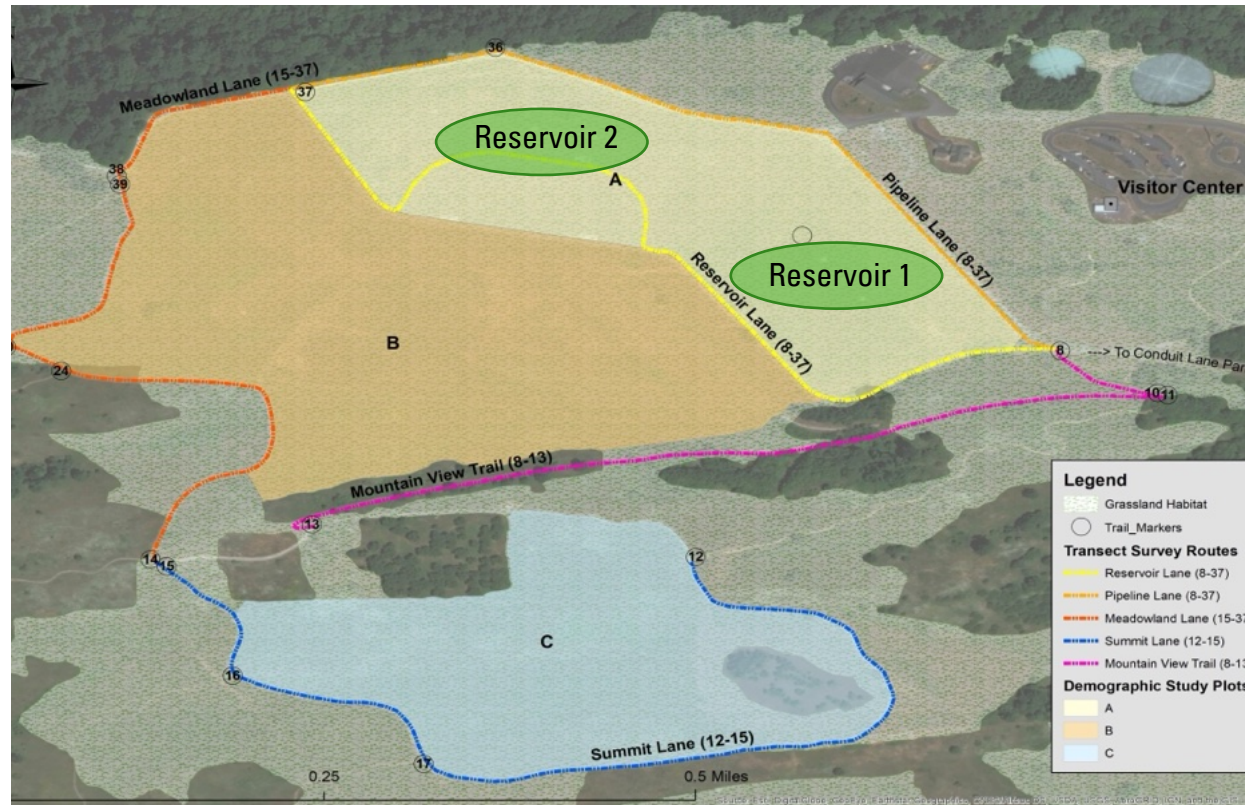
- Reservoir 1 – nonnative grasses
- Reservoir 2 – more native plants

- Plot B

- Adjacent grassland
- More woody vegetation

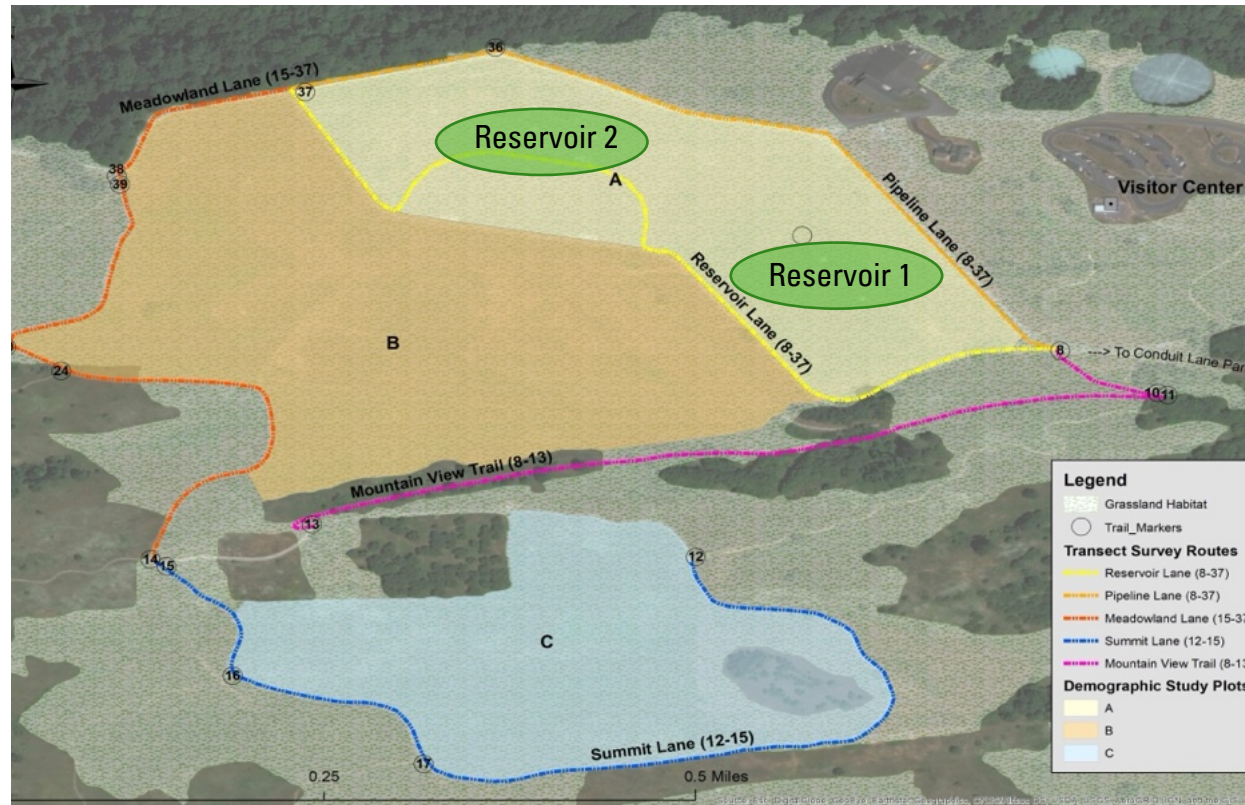
- Plot C

- Southern side of PBNP
- More invasive plants



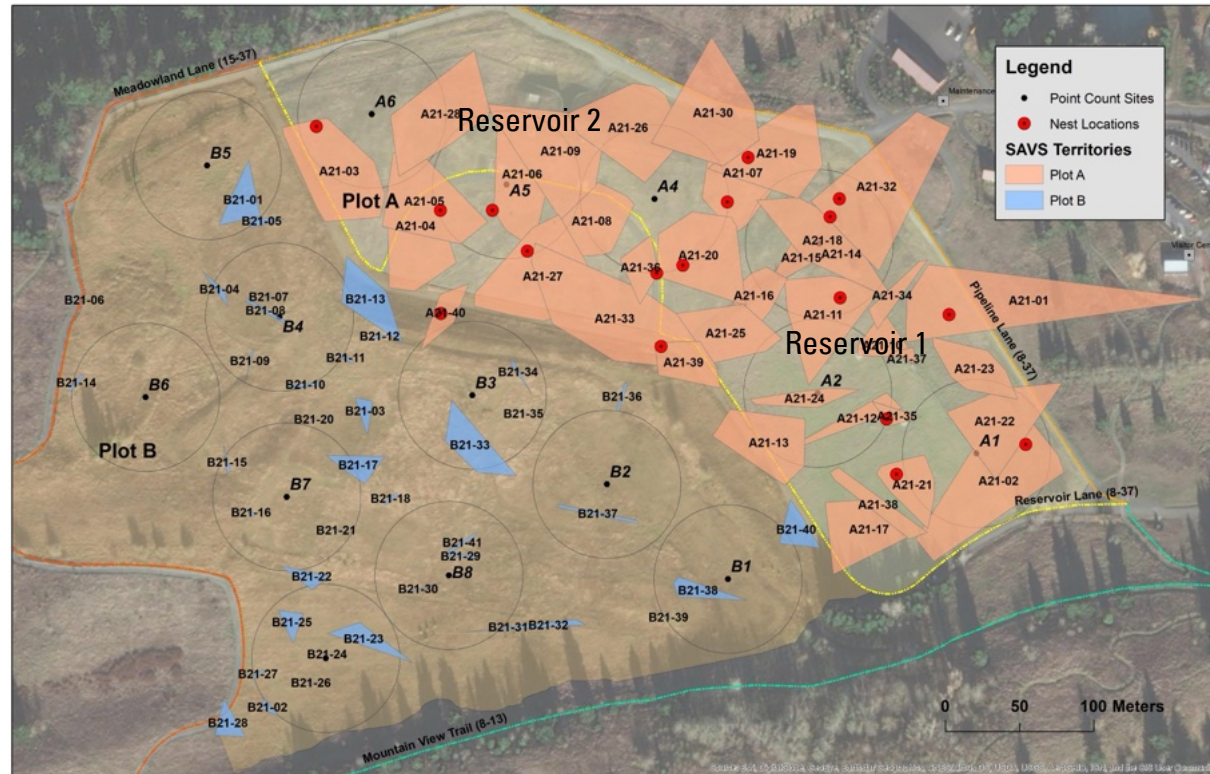
Grassland Bird Monitoring Study Design 2019

- **Community Science Surveys**
 - 5 survey routes
 - Survey area coincides with demographic study plots
 - Transect surveys
 - Duration: 30-45 min
 - Season: April-June
 - Count all birds detected (eBird)



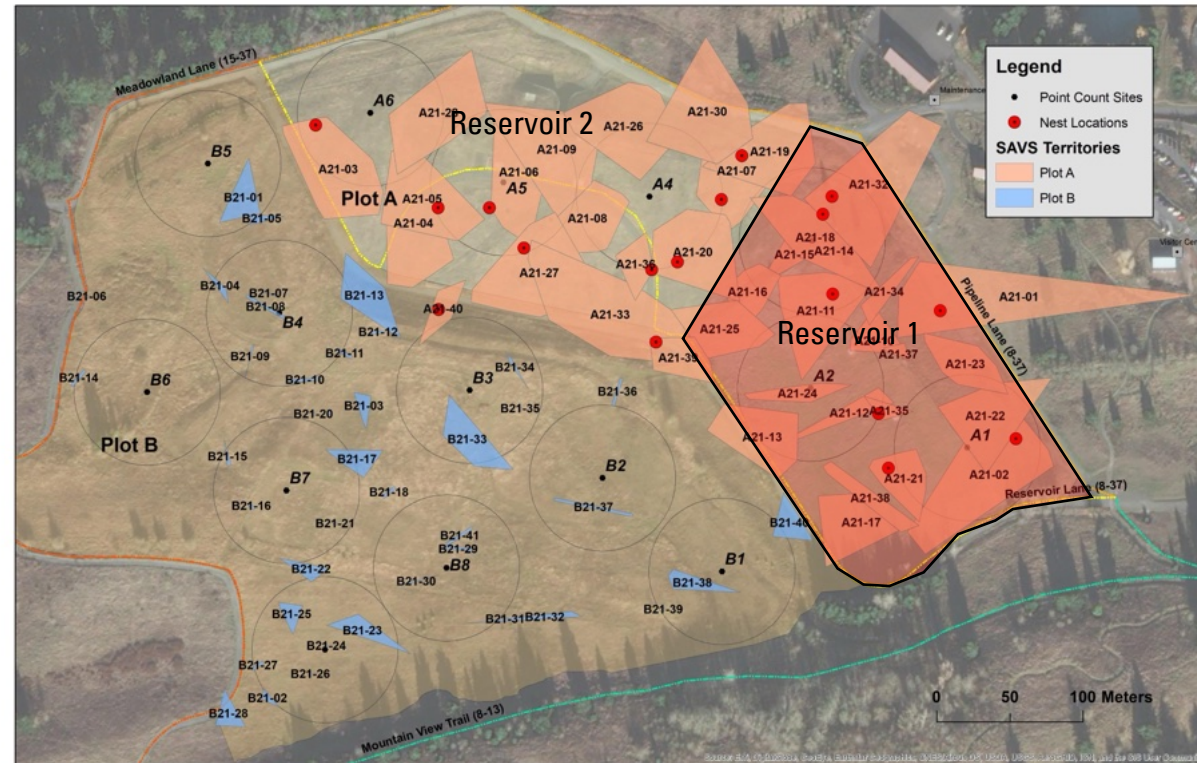
Demographic Study SAVS Territories 2021

- **Plot A**
 - SAVS breeding densely on Reservoirs 1 and 2
- **Plot B**
 - SAVS less dense in Plot B
 - Map does not depict total extent of SAVS territories (limited data)



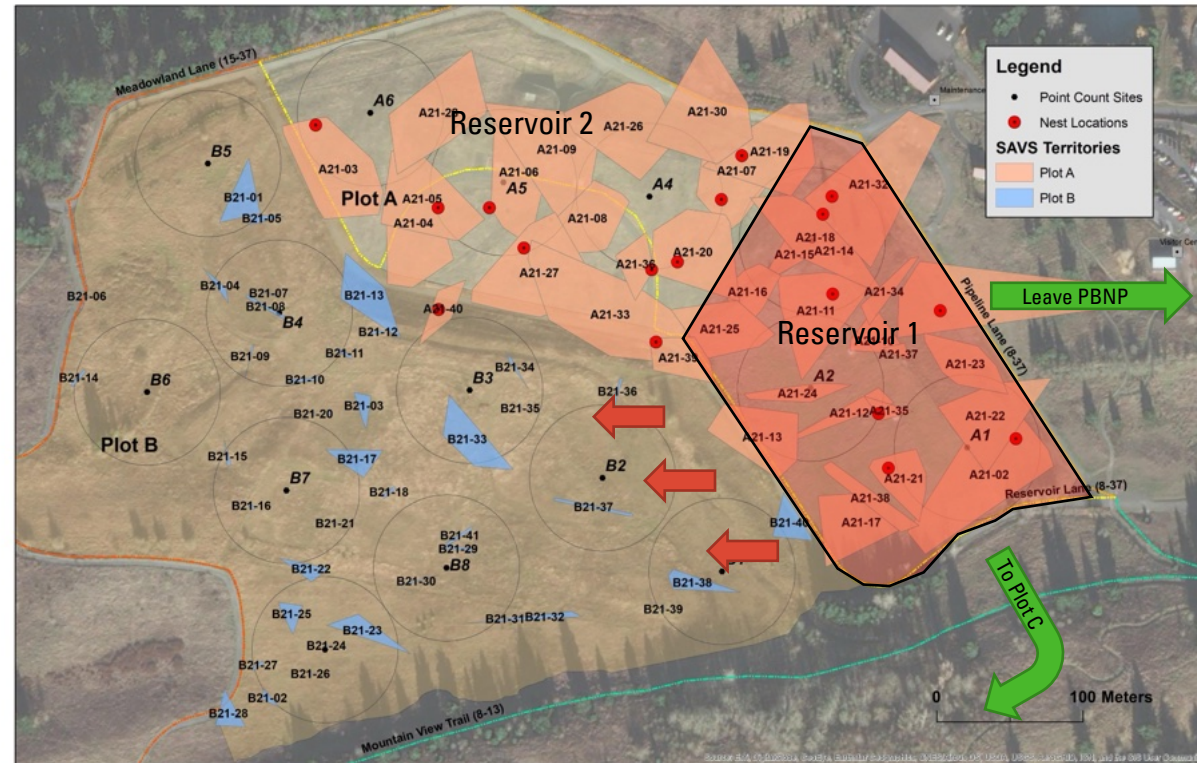
Demographic Study SAVS Response 2022-2023 (?)

- **Plot A**
 - Res 1 **unavailable** in 2022
 - Res 1 likely **unsuitable** in 2023
 - Res 2 likely at carrying capacity
- **Plot B**
 - Near carrying capacity in 2021
 - Habitat management potentially increased breeding habitat



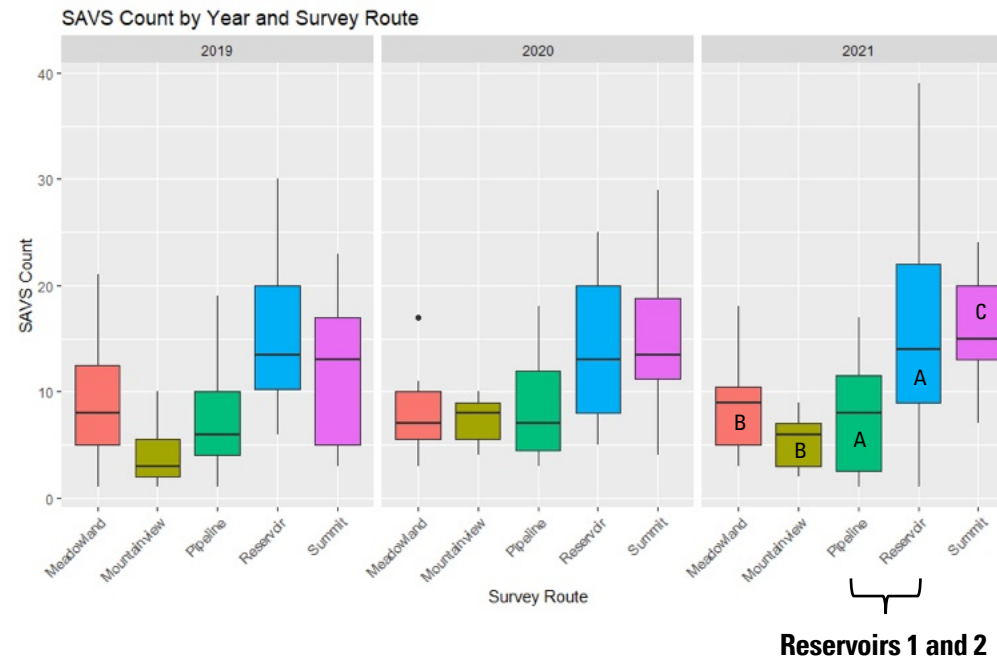
Demographic Study SAVS Response 2022-2023 (?)

- **SAVS Response**
 - Move to Plot B
 - Q – Is there enough suitable breeding habitat?
 - Move to other areas on Powell Butte (e.g., Plot C)
 - Leave Powell Butte entirely to breed elsewhere



SAVS Counted on Community Science Surveys 2019-2021

- Boxplots showing average SAVS count per survey – first 3 years of study
 - Reported by year and survey route
 - Consistent results across years
- **Q – What should we expect in 2022?**



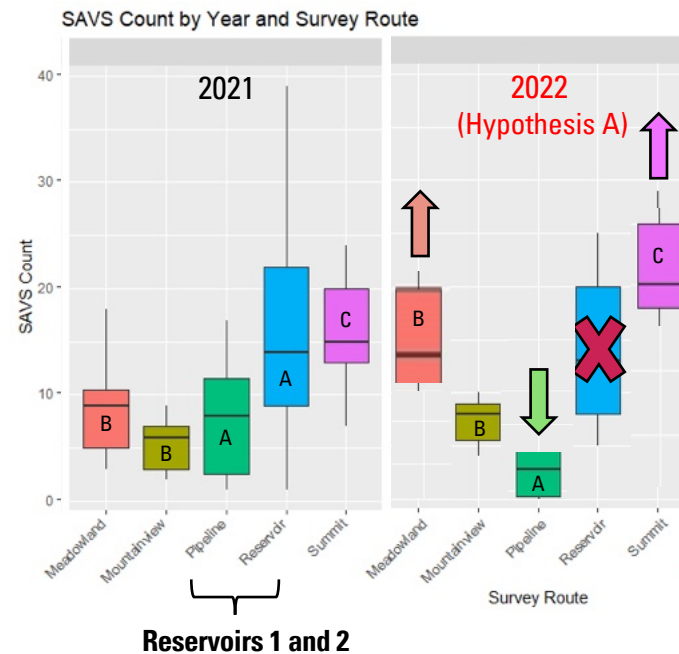
SAVS Counts 2022-2023 (?)

- **Hypothesis A**

- SAVS move to other areas on Powell Butte
- SAVS counts should increase in some areas and decline in others

- **Hypothesis B**

- SAVS from Reservoir 1 leave Powell Butte
- Overall SAVS counts should decline



2022
(Hypothesis B)

SAVS ↓

RESULTS 2022

- Demographic Study

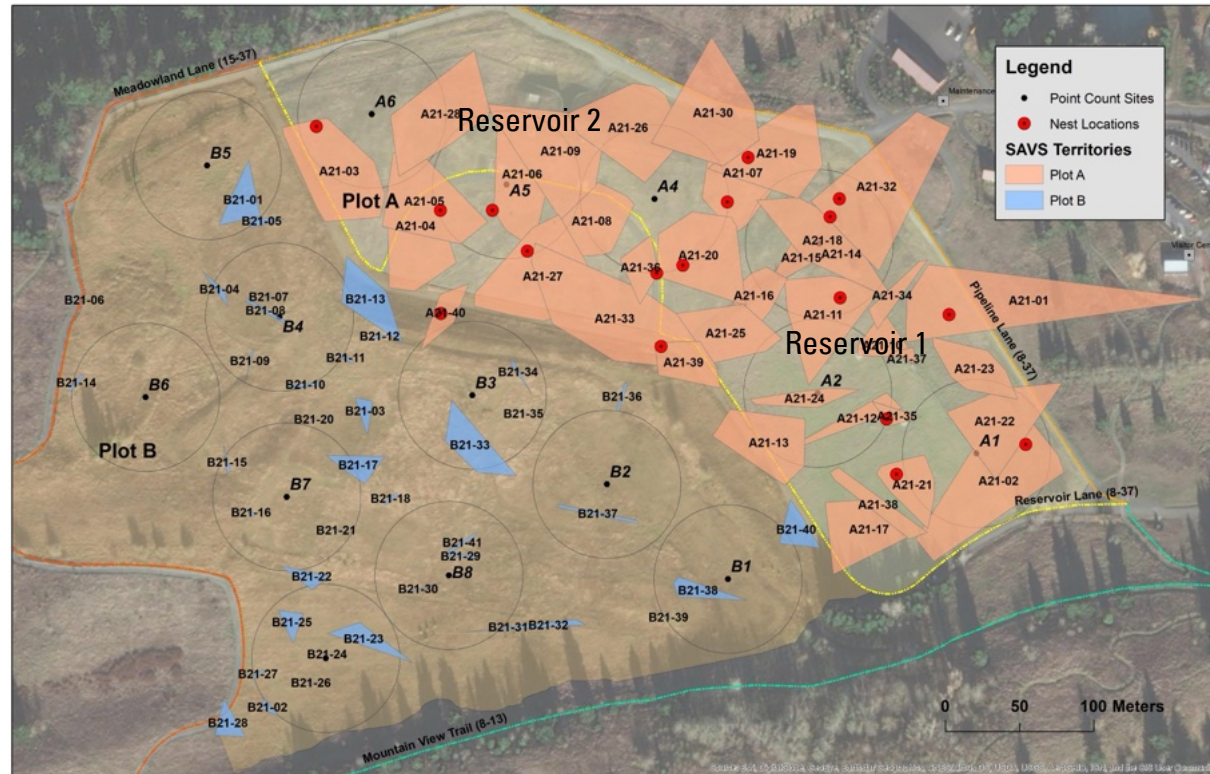


- Community Science Surveys



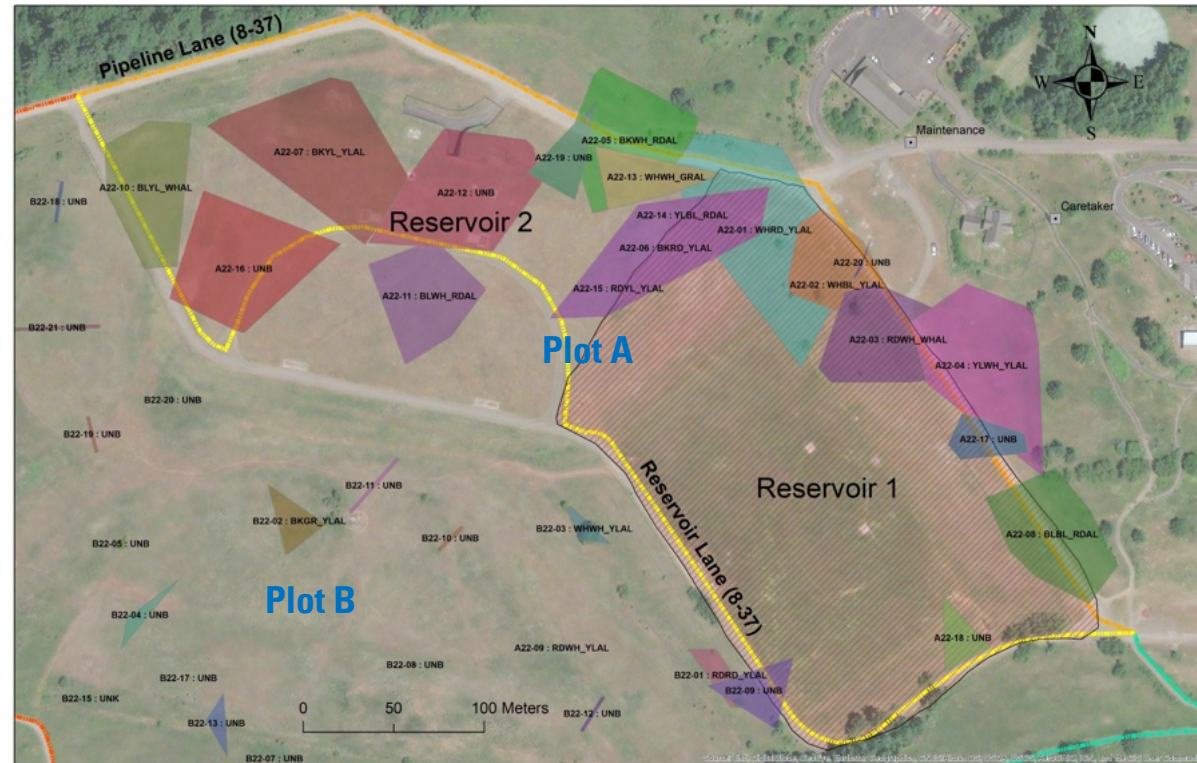
Demographic Study SAVS Territories 2021

- **Plot A**
 - 35 breeding pairs
 - Reservoir 1 = 18 pairs
 - Reservoir 2 = 17 pairs
- **Plot B**
 - 39 breeding pairs
 - Map does not depict total spatial extent of SAVS territories (limited data)



Demographic Study SAVS Territories 2022

- **SAVS Response**
- Plot A
 - 20 breeding pairs (↓43%)
 - Reservoir 1 = 8 pairs (↓56%)
 - Reservoir 2 = 12 pairs (↓29%)
- Plot B
 - 21 male territories (↓49%)
- Overall SAVS reproductive rates much lower in 2022 (everywhere)



Demographic Study SAVS Territories 2023

- **SAVS Response**

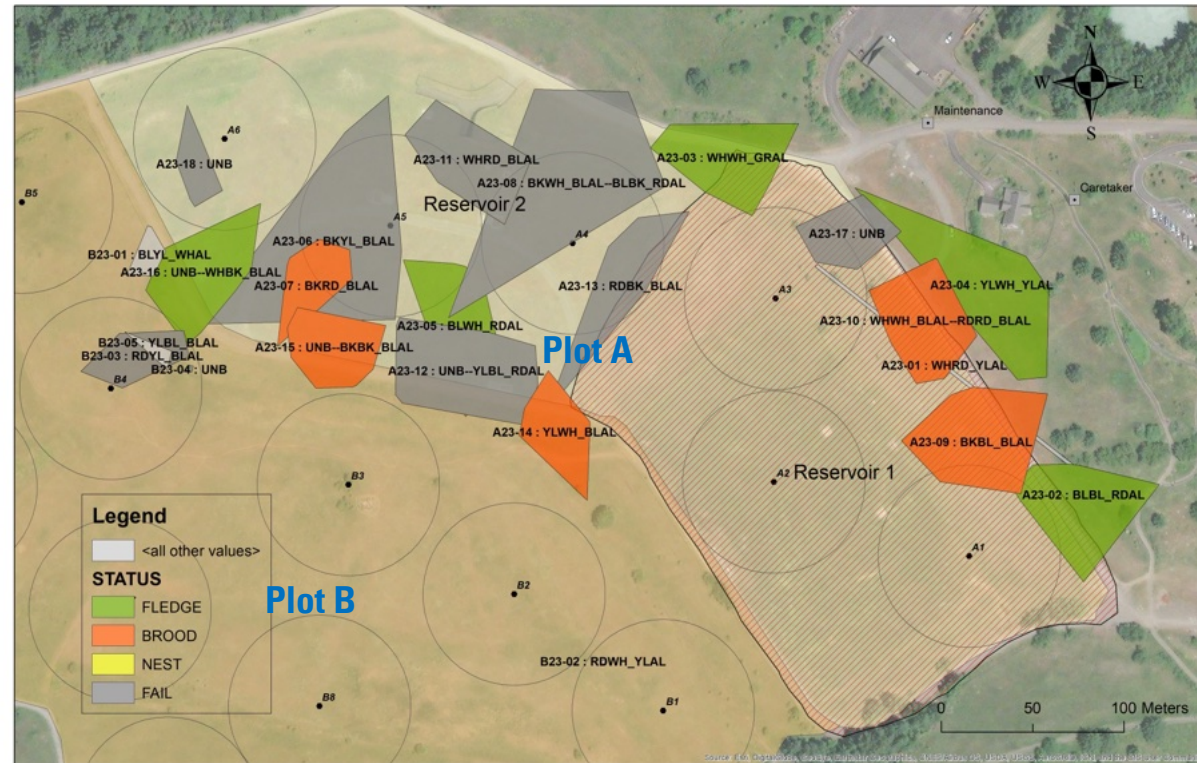
- Plot A

- 18 breeding pairs (↓10%)
 - Reservoir 1 = 6 pairs (↓25%)
 - Reservoir 2 = 12 pairs (no change)

- Plot B

- Not enough effort to calculate population size

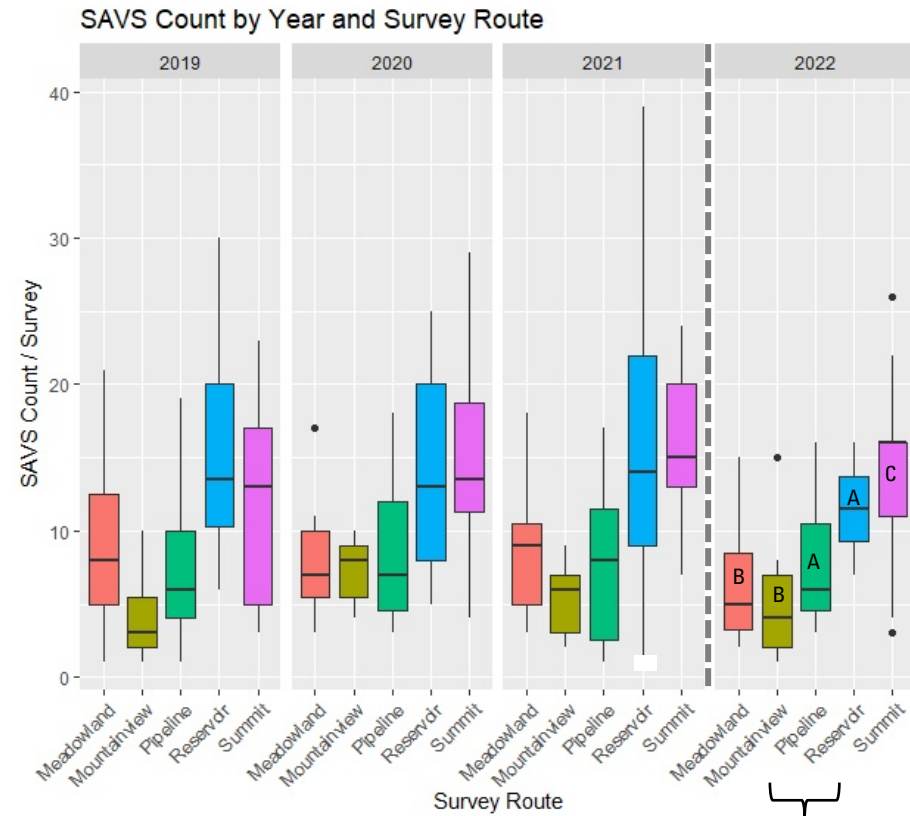
- Reproductive rates improve on Reservoir 1 ~ decline on Reservoir 2



Community Science Surveys

SAVS Counts 2022

- **SAVS Response**
- **Hypothesis A**
 - SAVS move to other areas on Powell Butte
 - SAVS counts should increase in some areas and decline in others
- **Hypothesis B**
 - SAVS from Reservoir 1 leave Powell Butte
 - Overall SAVS counts should decline



Reservoirs 1 and 2

Community Science Surveys

SAVS Count Data 2019-2023

SAVS Count Data	2019	2020	2021	2022	2023	Mean
Mean SAVS Counted Per Survey	9.1	10.9	10.4	6.9	8.1	9.0
Total SAVS Counted	841	631	675	457	748	670
# Surveys	92	58	65	66	92	75

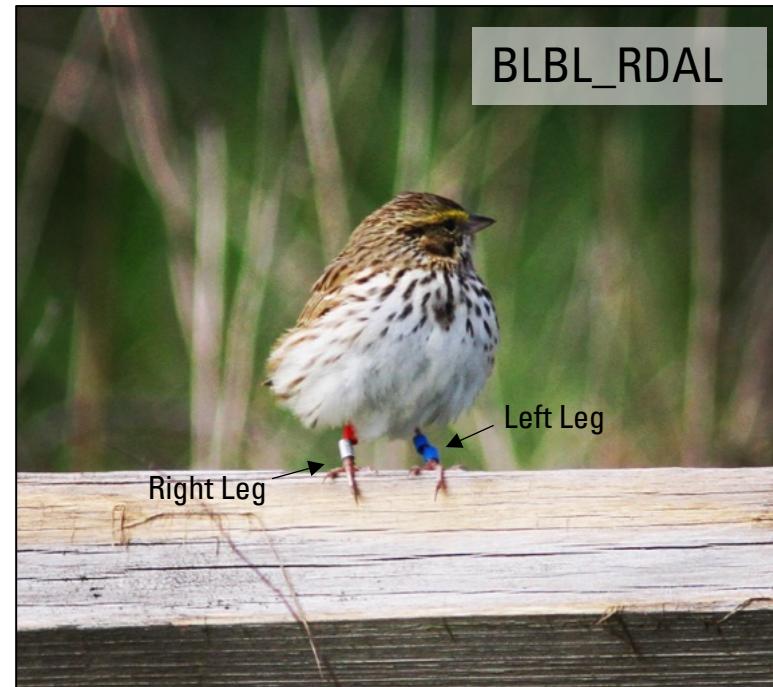
Community Science Surveys

SAVS Mean Counts 2019-2023

Survey Route	2019	2020	2021	2022	2023
Reservoir Lane	7.1	8.5	7.3	5.1	6.4
Pipeline Lane	15.2	14.2	16.2	11.5	8.6
Meadowland Lane	8.7	8.1	8.3	5.1	9.1
Summit Lane	12.4	15.2	16.0	13.3	14.3
Mountainview Trail	3.3	7.5	4.0	4.6	3.6

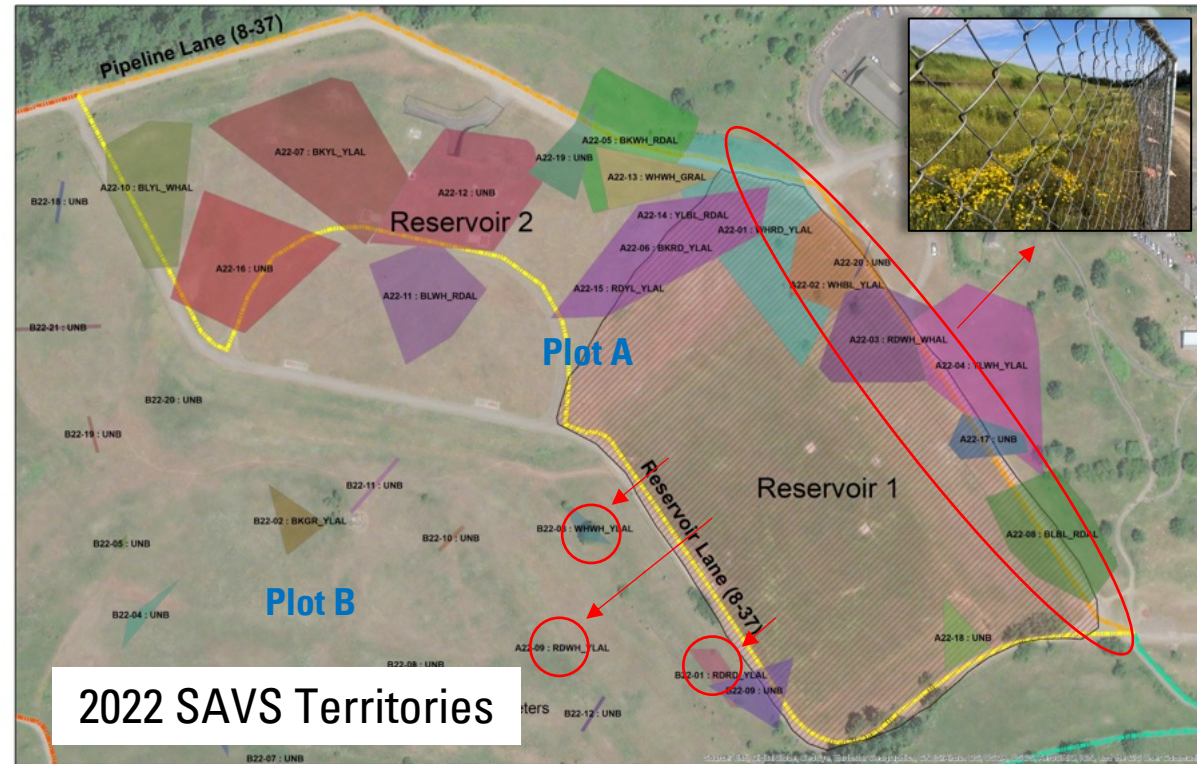
Tracking Individual Sparrows

- Color-banding allows us to track the response of individual birds
 - Estimate survivorship
 - Measure lifetime fecundity
 - Monitor dispersal and habitat selection
- 115 previously color-banded SAVS
 - Reservoir 1: 13 banded adult males in 2021 and 5 banded males in 2022



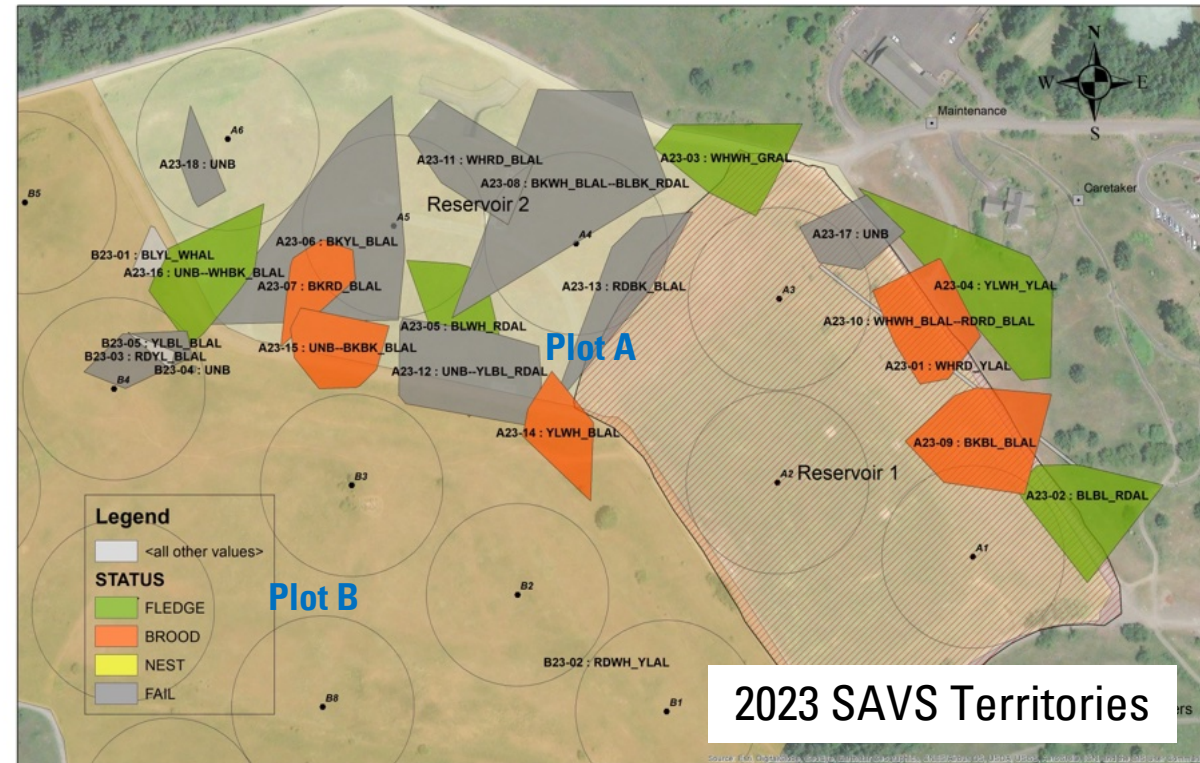
Savannah Sparrow Breeding Territories 2022-2023

- **Individual SAVS Response on Reservoir 1**
 - 2022 return rate = 0.62
 - 2023 return rate = 0.60
 - Banded males moved adjacent to construction zone or to Plot B (none move to Plot C or Reservoir 2)



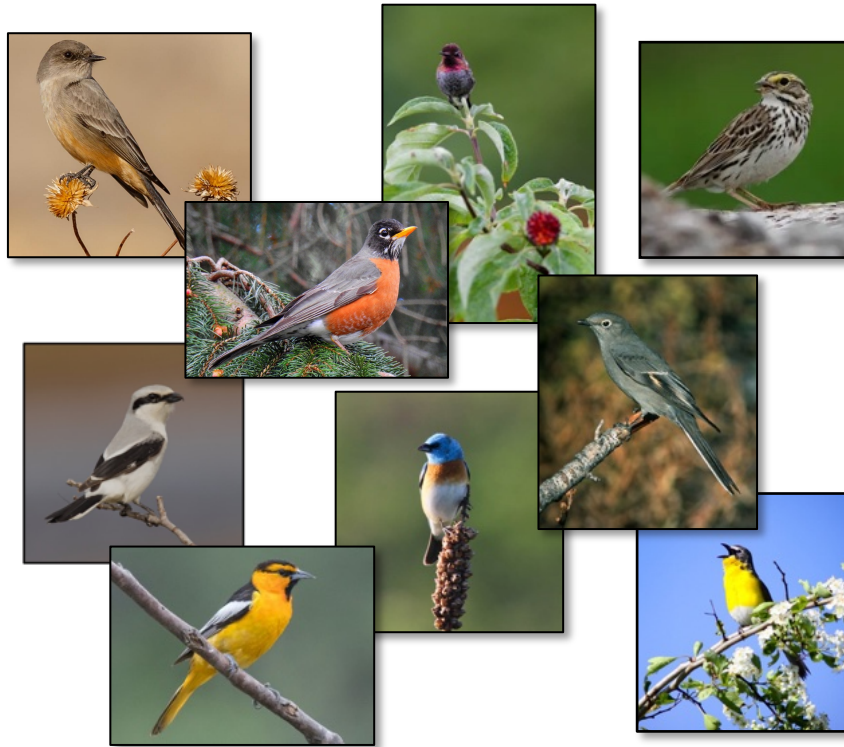
Savannah Sparrow Breeding Territories 2022-2023

- Individual SAVS Response on Reservoir 2
 - 2022 return rate = 0.44
 - 2023 return rate = 0.29
- SAVS population on Reservoir 2 had a very low reproductive rate in 2022 (nest success = 0.25)



Powell Butte Grassland Bird Surveys Results (2019-2023)

- Survey Effort
 - 42 Volunteers in 2023 – **THANK YOU!**
 - 373 Surveys over 5 years
 - 257 Hours of Surveys
 - 210 Miles of Trails Surveyed



Powell Butte Grassland Bird Surveys Results (2019-2023)

- Survey Data – by Year (5 survey routes)

	2019	2020	2021	2022	2023	Pooled
Species Detected	77	69	65	84	88	106
Birds Counted	4,221	2,491	2,951	3,988	5,499	19,150
# Surveys	92	58	65	66	92	373

For complete survey data visit:
www.conservationinsight.org

PBNP GRASSLAND BIRD SURVEYS: ANNUAL COUNT DATA						
Species	AOU Code	2019	2020	2021	2022	Pooled
American Crow	AMCR	137	45	42	244	468
American Goldfinch	AMGO	47	18	26	21	112
American Kestrel	AMKE	35	19	18	27	99
American Pipit	AMPI				2	2
American Robin	AMRO	519	290	355	553	1,717
Anna's Hummingbird	ANHU	137	68	88	169	462
Bald Eagle	BAEA	2	3		2	7
Barn Swallow	BARS	170	107	88	77	442
Black-capped Chickadee	BCCH	79	23	68	42	212
Bewick's Wren	BEWR	15	8	16	7	46
Brown-headed Cowbird	BHCO	20	7	4	3	34
Black-headed Grosbeak	BHGR	32	6	17	16	71
Brewer's Blackbird	BRBL	4		1		5
Brown Creeper	BRCR	1	1		5	7
Band-tailed Pigeon	BTPI	28	5	4	9	46
Black-throated Gray Warbler	BTYW	9	3		5	17
Bullock's Oriole	BUOR	1				1
Bushtit	BUSH	10	8	1	6	25
Cackling Goose	CACG				20	20
Canada Goose	CAGO	8	2	2	33	45
California Scrub-Jay	CASJ	27	12	10	7	56
Chestnut-backed Chickadee	CBCH	24	8	7	27	66
Cedar Waxwing	CEDW	78	37	108	81	304
Chipping Sparrow	CHSP				7	7
Cliff Swallow	CLSW	1		5		6
Cooper's Hawk	COHA	1	2	2		5
Common Raven	CORA				2	2
Common Yellowthroat	COYE	165	162	139	173	639
Double-crested Cormorant	DCCO		1			1
Dark-eyed Junco	DEJU	196	99	107	192	594
Downy Woodpecker	DOWO	5	2	6	6	19
Dusky Flycatcher	DUFL				1	1

Powell Butte Grassland Bird Surveys Results (2019-2023)

- Survey Data – by Route (2023)

	ML	MV	PL	RL	SL
Species Detected	63	51	61	68	73
Birds Counted	1,045	667	1,333	1,818	636
# Surveys	15	13	22	31	11

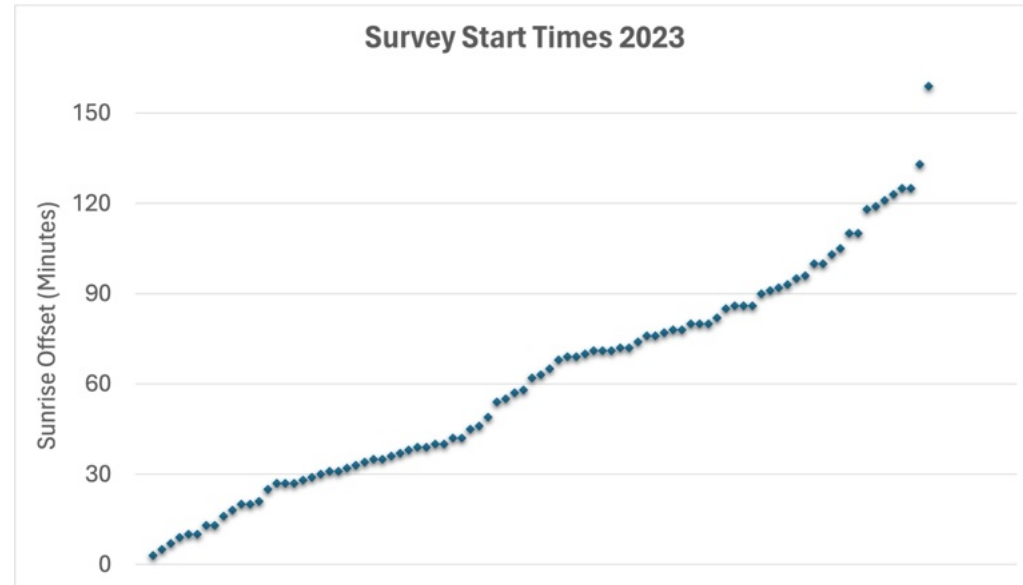
ML = Meadowland Lane
MV = Mountain View Trail
PL = Pipeline Lane

RL = Reservoir Lane
SL = Summit Lane

PBNP GRASSLAND BIRD SURVEYS: COUNT DATA BY SURVEY ROUTE (2019-2022)							
Species	AOU Code	Meadowland	Mountainview	Pipeline	Reservoir	Summit	Pooled
American Crow	AMCR	118	19	173	38	120	468
American Goldfinch	AMGO	10	47	8	37	10	112
American Kestrel	AMKE	10	9	25	13	42	99
American Pipit	AMPI	1				1	2
American Robin	AMRO	318	370	433	240	356	1,717
Anna's Hummingbird	ANHU	108	161	119	41	33	462
Bald Eagle	BAEA	1		4	2		7
Barn Swallow	BARS	33	18	256	101	34	442
Black-capped Chickadee	BCCH	29	83	61	24	15	212
Bewick's Wren	BEWR	17	7	12	8	2	46
Brown-headed Cowbird	BHCO	19	7	2	4	2	34
Black-headed Grosbeak	BHGR	31	13	13	7	7	71
Brewer's Blackbird	BRBL			1	1	3	5
Brown Creeper	BRCR	2	1	2	2		7
Band-tailed Pigeon	BTPI	31	5	8	2		46
Black-throated Gray Warbler	BTYW	4	5	5	2	1	17
Bullock's Oriole	BUOR		1				1
Bushtit	BUSH		15	5	3	2	25

Powell Butte Grassland Bird Surveys Results (2019-2023)

- Survey Start Times
 - Protocol
 - Complete surveys < 3 hrs after sunrise (start last survey < 2 hrs after sunrise)
 - Average start time
 - 105 min (1.75 hrs) post-sunrise (2019-2021)
 - **56 min (< 1 hr) post-sunrise in 2023!**



Powell Butte Grassland Bird Surveys Results (2019-2023)

**What were your favorite birds
observed during the 2023 surveys?**



Powell Butte Grassland Bird Surveys Results (2019-2023)

Species	2019	2020	2021	2022	2023
Savannah Sparrow	841	631	675	457	748
American Robin	519	291	355	553	616
Lesser Goldfinch	162	117	155	130	476
American Crow	137	45	42	244	397
Oregon Junco	196	99	107	192	308
Common Yellowthroat	165	162	139	173	254
Song Sparrow	217	163	153	262	235

Species	2019	2020	2021	2022	2023
Spotted Towhee	186	107	119	175	209
Northern Flicker	144	96	102	158	187
Anna’s Hummingbird	137	68	88	169	174
Lazuli Bunting	162	117	155	130	170
Cedar Waxwing	78	37	108	81	135
Barn Swallow	170	107	88	77	118
Stellar’s Jay	79	58	61	108	77

Most Abundant Birds (Total Counts 2019-2023)

Powell Butte Grassland Bird Surveys Results (2019-2023)

Species	2019	2020	2021	2022	2023
American Robin	84%	98%	61%	69%	98%
Savannah Sparrow	85%	100%	60%	56%	95%
Oregon Junco	59%	47%	42%	51%	89%
Song Sparrow	68%	84%	47%	62%	88%
Spotted Towhee	64%	83%	50%	58%	83%
Northern Flicker	66%	78%	48%	61%	79%
Anna’s Hummingbird	60%	53%	42%	58%	78%

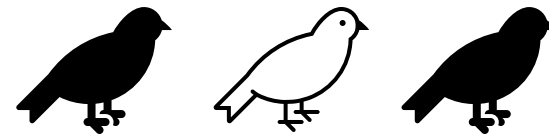
Species	2019	2020	2021	2022	2023
Common Yellowthroat	54%	79%	40%	47%	76%
Lesser Goldfinch	31%	34%	25%	31%	71%
American Crow	23%	29%	16%	34%	71%
House Finch	14%	2%	12%	22%	62%
Purple Finch	4%	3%	7%	38%	53%
Lazuli Bunting	45%	60%	36%	29%	49%
Stellar’s Jay	31%	53%	29%	43%	47%

Most Encountered Birds (% Surveys Detected 2019-2023)

Powell Butte Grassland Bird Surveys 2024 (Year 6!)

- Surveys planned again for 2024
 - Data from these surveys will help us understand the impacts of habitat restoration on bird populations at Powell Butte Nature Park
- Visit www.jcwc.org for information about signups and trainings

**We need
your help!**



Please visit our website to make a donation:
www.conservationinsight.org

Acknowledgements



- **Our Volunteers!**

- Daniel Newberry
- Sara Volk
- Marlee Eckman
- Christian Haaning
- Susan Hawes
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