North Monterey County
Amphibian Habitat Enhancement Project




Final Monitoring Report

June 2021

Central Coast Wetlands Group
at Moss Landing Marine Laboratories

Report prepared for the RCD of Santa Cruz County

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Contents

1. PROJECT DESCRIPTION

Introduction

This report discusses results and findings from monitoring efforts conducted as part of the North Monterey County Amphibian Habitat Enhancement Project (Project), which works towards the enhancement of wetland and upland habitat by creating a more contiguous migration corridor for Santa Cruz Long-toed Salamander (SCLTS) and California Tiger Salamander (CTS), improving breeding habitat within ponds, reducing erosion points at the project site, and installing approximately 1 mile of trail around the site to help minimize disturbance to the site and increase open space access. Monitoring results presented here include CRAM scores, vegetation surveys, bird surveys, aquatic dip netting surveys, and photo monitoring.

Project Location

The Project and study site is located on approximately 25 acres of land adjacent the north side of the North Monterey County High School (NMCHS)campus on Castroville Blvd near Castroville in unincorporated Monterey County (Figure 1). The site is owned by the North Monterey County Unified School District (School District).

The North Monterey County Land Use Plan designates the site location for the Project as Public/Quasi Public use. Land uses surrounding the project site include agricultural preservation (some unique farmland across Castroville Blvd), residential/medium and high density, and resource conservation designated land (wetlands). Immediately adjacent to the project site is NMCHS.

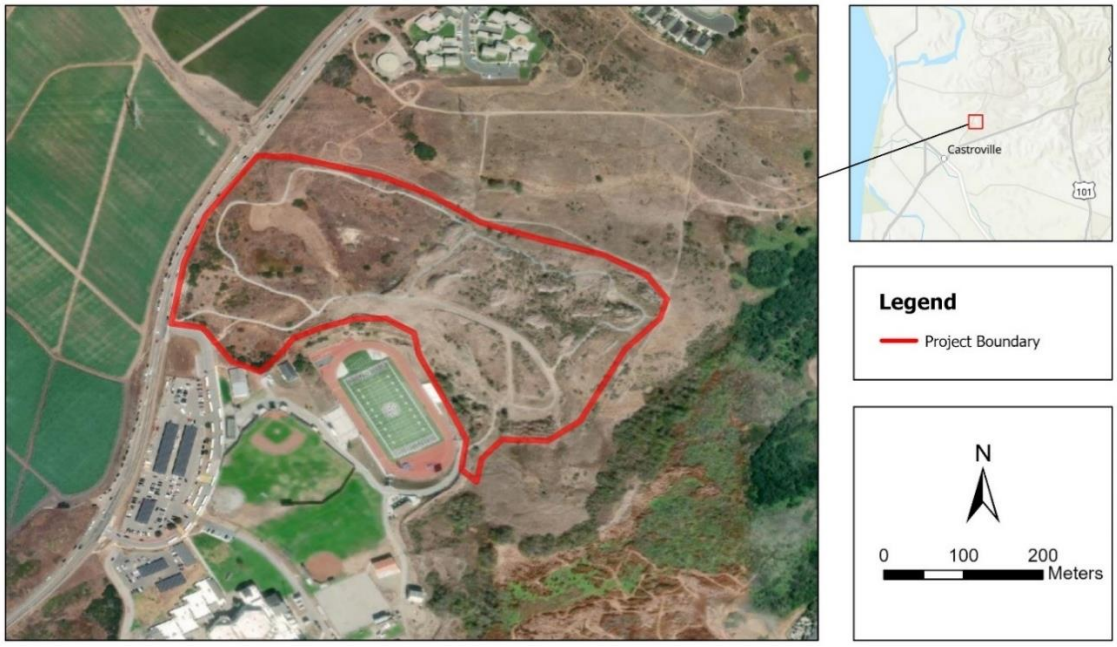


Figure 1. Project Location

Background

Historical aerial imagery indicates that the site was most likely used for grazing and that it did not originally support isolated seasonal wetlands. The NMCHS campus was established in 1978. In 2002, the School District identified the need for a new middle school and after the community approved a bond with the primary objective of building a new middle school, the property north of the NMCHS campus was selected. Extensive site grading occurred in winter 2005-06 until construction ceased due to incomplete permitting. A PG&E easement also precluded the construction of buildings or other structures on the property within the easement boundary. By 2007, the site was a mosaic of disturbed habitats dominated by dense stands of ruderal vegetation typified by mustard, radish and non-native grasses of various ages with small remnant islands of preexisting native vegetation. Remnant spoil piles remained in the upland area, creating unnatural topographic variability. Grading from 2005 also produced depressions that filled with water creating seasonal ponds and wetlands. The site includes three main seasonal ponds: South Pond, Central Pond, and North Pond, which provide an adequate hydroperiod to support amphibians. There is one additional pond, East Pond, on the south-east side of the restoration site. The three main ponds were overgrown with cattails (*Typha* sp) and bulrush (*Scheonoplectus* sp), limiting open water which is essential for SCLTS breeding habitat.

This region of north Monterey County has been known to support endemic amphibians, including the SCLTS, CTS and California Red-legged Frog (CRLF). Both SCLTS and CTS were documented 0.5 miles north of the project area in 2006 and 2007. In addition, CTS larvae were found 0.6 miles to the south in a small pond in 2006. CRLF were noted in that same pond during the 2006 sampling, as well as within migration distance to the east and west. At the project site, SCLTS and CTS were documented from a pit trap study conducted in 2007. Spring aquatic surveys in 2010 and 2015 did not document breeding by these species at the on-site ponds.

In 2014, the School District approached the Central Coast Wetlands Group (CCWG) to determine ways in which to better utilize the property. Several meetings were held that included staff from the School District, CCWG, the Elkhorn Slough Foundation, the Resources Conservation District of Monterey Country (RCDMC), the U.S Fish and Wildlife Service (USFWS), and the California Department of Fish and Wildlife (CDFW) to collaboratively discuss opportunities to restore the environmentally sensitive upland and wetland habitat north of the NMCHS campus for species recovery and educational purposes.

The Project design was funded by a grant awarded to the Resource Conservation District of Santa Cruz County (RCDSCC) by the State Coastal Conservancy and was facilitated by CCWG and developed in consultation with a Technical Advisory Committee that included staff from USFWS, CDFW and the RCDSCC and RCDMC. In 2017, Implementation funds were provided by the Wildlife Conservation Board and USFWS Partners and Coastal Programs to complete the Project.

Project Importance

Monterey County contains two SCLTS populations (McClusky and Elkhorn) consisting of seven known breeding sites. Two of the three sites within the McClusky metapopulation are presumed extirpated due to saltwater intrusion. Within the Elkhorn population, Moro Cojo Slough is also faced with the possibility of saltwater intrusion (along with other pressures) and potential extirpation of the SCLTS that utilize it. Moro Cojo Slough contains two of the four breeding sites within this population; and, the individuals that traverse the project site are solely dependent on Moro Cojo Slough to ensure their persistence. This project facilitates species breeding outside of the slough and significantly reduces the possibility of extirpation in this population. Little recovery work has been accomplished in Monterey County due to the inability to access and assist in management of breeding areas. This Project presents a unique opportunity to assist in the recovery of the species in this population.

As a species with very limited geographic distribution, the USFWS Draft Revised Recovery Plan for the SCLTS (1999) (Plan) outlines specific criteria for down listing and delisting. The Plan states that the SCLTS can be reclassified to threatened status when at least two functional breeding sites, as well as sufficient upland habitat to support self-sustaining populations are conserved within each complex (population). This project assists in that goal as there currently exists one breeding site with sufficient upland habitat within this population. The term metapopulation is used very loosely here, as interbreeding between these sites is not currently occurring due to habitat fragmentation. In addition, the Plan specifically recommends to "Implement management actions at Moro Cojo Slough by working with landowners, the Watershed Institute of CSUMB, Natural Resources Conservation Service, Monterey County Planning Department, and other parties as appropriate" and to "Investigate additional Moro Cojo Slough land protection."

Further, this project provides educational opportunities for NMCHS students and the local community through the installation of trails and interpretive signage. The Project supports the continued development of an environmental education curriculum which will emphasize the restoration efforts, local threatened and endangered species, and the importance of wetland and upland habitat conservation in the watershed. Students within the School District currently have very limited opportunities to engage in experiential science due to a lack of resources and family limitations. However, the students reside in an area rich with potential opportunities to engage in meaningful experiences with the outdoors. This site provides an ideal location for implementing a program where students can participate in hands-on restoration and monitoring activities to help foster a sense of environmental stewardship.

Habitat Enhancement Project Goals

The Project is intended to protect, create, and enhance upland and wetland habitat for the SCLTS, as well as CTS and CRLF and bird populations, at the 25-acre piece of land adjacent to the NMCHS campus.

Habitat enhancement objectives include:

- Enhance breeding pond habitat through the removal of select vegetation (specifically *Typha*) to increase open water and minimal earth moving to slightly enlarge the Central Pond and enhance water duration at East Pond through installation of an embankment.

- Increase terrestrial (riparian and upland) habitat cover and quality through strategic plant removal and revegetation with native riparian trees and shrubs, oak woodland species, and enhancing existing native grassland.

- Enhance ecosystem resilience to climatic and hydrologic change.

Other project objectives include:

- Install one-mile trail system to provide low impact recreational and educational opportunities to students and the public while protecting sensitive habitat. Interpretive signs along the trail will illustrate the need and benefits of wetlands and provide information about the life history of the SCLTS and the importance of different types of wetland and upland habitat. The trail system will have with three access points (two that connect to community trails and one connected to the high school campus).

- Monitor restoration success using the California Rapid Assessment Method for Wetlands (CRAM), vegetation surveys, amphibian presence/absence surveys, and bird surveys.

- Education and Outreach: This project provides an opportunity for teachers to incorporate lessons on environmental stewardship into their classes. This site will enable high school students to be involved in a habitat enhancement project through planting days, study of wetlands and uplands, and investigation of the roles these habitats play for endangered species.

Restoration Work Completed

Project partners, including Coastal Conservation and Research, California Conservation Corps, private contractors, and volunteers, completed the following restoration work throughout the project period:

Ground Engineering

- Installation of 4,900 feet of trail throughout the project site (2017, 2019).
- Extension of the southeast arm of the Central Pond by excavating 1-2 feet over approximately 1/10th of an acre (2017).
- Installation of a 3 feet high and 8 feet wide embankment at the outlet of the East Pond depression to create a deeper and larger wetland area (2017).

- Installation of a French drain across the flowpath in an erosion area near the East Pond, gathering runoff water into a pipeline and sending it to the flat area at the bottom of the gully (2017).
- Gully above East Pond was reshaped to decrease erosion issues and to allow vegetation to grow and naturally secure the soil (2017).
- Installation of salamander barrier behind South Pond (2021)

Native Plant Establishment

- Native seed spread along the entire length of the trail (2017, 2019).
- Native seed spread in areas cleared of vegetation during earth work (erosion control areas and Central Pond arm) (2017).
- In total, over 15,000 plants have been planted at the project site in both wetland and upland areas. (2017, 2018, 2019, 2020, 2021). A full list of species and numbers of each planted is found in Table 1.
- Mulch was added around newly installed native plants (2017, 2018, 2019, 2020).
- Watering of newly established plants occurred every 2 weeks during the dry season.
- Installation of cages around select shrubs and trees more prone to herbivory (2020, 2021)

Vegetation Management

- Removal of invasive species (primarily mustard and wild radish and bristly ox-tongue) at the site through methods such as weed whacking, mowing large areas along the trail, and hand pulling around native plants (2018, 2019, 2020, 2021).
- Removal of invasive locust tree stand (2018).
- Hand removal of bulrush with the Central Pond to increase open water habitat for salamander breeding (2018).
- Cutting/mowing of bulrush within the Central Pond to increase open water habitat for salamander breeding (2019, 2020).
- Removal of invasive pampas grass (2020)

Interpretive Signage

- Six interpretive signs were installed along the trail, including 2 welcome signs at each entrance and 4 signs that highlight the restoration process, endangered species, and the variety of habitats found within the site.

Trail Maintenance

- Mowing along trail edges to reduce weed overgrowth and encroachment on to the trail (2020, 2021)

- Application of herbicide (Roundup) on weeds within trail to reduce weed encroachment (2021)
- Scraping the trail with a tactor to level out areas (2021)
- Application of 25 tons of additional decomposed granite along select areas of trail (2021)

Interpretive signs installed along the trail highlight the restoration process and importance of wetland and upland habitats for native wildlife

Table 1. Plants planted at NMCHS project site 2017-2021

Scientific Name	Common Name	Planting Season				Total
		2017/2018	2018/2019	2019/2020	2020/2021	
Acer negundo	Box elder	0	9	25	0	34
Achillea millefolium	Yarrow	100	200	20	0	320
Aesculus californica	California buckeye	0	13	0	0	13
Arbutus menziesii	Madrone	0	21	15	0	36
Arctostaphylos hookeri	Hooker's manzanita	0	0	10	0	10
Arctostaphylos pajaroensis	Pajaro manzanita	8	0	7	0	15
Artemesia califonica	California sagebrush	320	196	200	103	819
Artemisia douglasiana	Mugwort	260	73	84	33	450
Baccharis glutinosa	Marsh baccharis	0	0	50	0	50
Baccharis pilularis	Coyote Bush	0	29	0	84	113
Bolboschoenus maritimus	Alkali bulrush	250	0	0	0	250
Carex barbarae	Santa Barbara sedge/carex	0	200	0	50	250
Ceanothus thyrsiflorus	Blue bossom	21	3	20	0	44
Cornus sericea	Creekside dogwood	33	156	50	21	260
Elymus glaucus	Blue Wild Rye	200	794	0	0	994
Elymus triticoides	Creeping wild rye	1,000	2,597	1270	20	4,887
Eriogonum fasciculatum	California buckwheat	0	0	0	40	40
Eriophyllum staechadifolium	Lizard Tail (non-dune)	0	0	0	73	73
Euthamnia occidentalis	Western goldenrod	0	50	28	82	160
Extriplex californica	California salt bush	0	0	0	0	0
Festuca califonica	California fescue	100	20	0	0	120
Frangula californica	Coffeeberry	4	166	100	200	470
Fremontodendron californicum	California flannelbush	8	21	20	0	49
Garrya elliptica	Silk tassel	10	13	5	0	28
Grindelia stricta	Gum	0	40	50	0	90

Scientific Name	Common Name	Planting Season				Total
		2017/2018	2018/2019	2019/2020	2020/2021	
Heteromeles arbutifolia	Toyon	44	2	0	0	46
Juncus effuses	Common rush	216	0	0	0	216
Juncus mexicanus	Mexican rush	20	259	50	0	329
Juncus patens	California grey rush	130	250	50	0	430
Juncus xiphioides	Irisleaf rush	200	0	0	0	200
Lupinus arboreus	Yellow bush lupine	200	84	35	165	484
Mimulus aurantiacus	Sticky monkey flower	20	49	230	18	317
Mimulus cardinalis	Scarlet monkey flower	0	109	0	0	109
Morella californica	Wax myrtle	40	0	5	0	45
Mulenbergia rigens	Deer grass	0	15	0	14	29
Oenothera elata	Hooker's evening primrose	0	176	0	0	176
Populus trichocarpa	Black cottonwood	19	55	20	10	104
Quercus agrifolia	Coast live oak	55	49	100	32	236
Ribes sanguineum	Red flowering currant	20	56	0	0	76
Rosa californica	California wild rose	0	11	3	24	38
Rubus ursinus	Blackberry	151	364	0	40	555
Salix laevigata	Red willow	0	8	0	0	8
Salix lasiolepsis	Arroyo willow	21	155	45	32	253
Salvia mellifera	Black sage	87	88	0	53	228
Sambucus mexicana	Blue elderberry	40	28	0	0	68
Scrophularia californica	Bee plant	100	250	150	92	592
Sisyrinchium bellum	Blue-eyed grass	0	3	0	0	3
Stipa pulchra	Purple Needlegrass	0	1,078	100	0	1,178
Symphoricarpos albus	Snowberry	5	120	0	0	125
Symphyotrichum chilense	California aster	0	65	34	26	125
	Total	**3,682**	**7,875**	**2,776**	**1,212**	**15,545**

Monitoring and Measurements of Restoration Success

To determine the success of upland, riparian, and pond enhancement efforts, the following success criteria were defined at the start of the project:

- Presence of SCLTS after three (3) to five (5) years and confirmed breeding success
- Plant establishment: 20% increase in native cover of plants in areas planted
- Plant establishment: 20% increase in woody vegetation cover in areas planted
- Plant establishment: 40% increase in diversity of plants in areas planted
- Improved Biotic Structure Score in CRAM (10 points)

To help determine if success criteria were being met, CCWG conducted biological monitoring for three years (in Spring of 2018, 2019, and 2021). Pre-restoration monitoring was conducted in Fall 2017 to establish the baseline of native cover and diversity at the site and CRAM score. Annual spring monitoring included vegetation surveys to determine increased plant cover and diversity using point intercept method along established transects within each vegetation zone, California Rapid Assessment Method (CRAM) assessments conducted at each of the four ponds, and photo documentation from established photo points. Although monitoring presence of SCLTS and CTS was out of CCWG's scope of work, CCWG staff did join annual dip netting surveys at the site. Seasonal bird surveys were also conducted throughout the project period.

Results of these monitoring efforts are discussed in the following chapters of this Report and can be used to assess whether success criteria are being met and help inform adaptive management of the site.

2. CALIFORNIA RAPID ASSESSMENT METHOD

Introduction

The California Rapid Assessment Method (CRAM) was used to characterize the condition of the ponds located at the site over the course of the restoration project. CCWG performed CRAM assessments at four ponds within the restoration project area. Assessments were conducted at each site before restoration initiation in Fall of 2017, and annually after restoration in Spring of 2018, 2019, and 2021.

Methods

The California Rapid Assessment Method for Wetlands (CRAM) was used to assess the habitat condition of ponds at the North Monterey County Amphibian Habitat Enhancement Project. This report reports CRAM scores from the project period of September 2017-May 2021. CRAM is a rapid habitat condition assessment. CRAM is a standardized tool for wetland monitoring, developed with support from EPA. It is based on the concept that the structure and complexity of a wetland is indicative of its capacity to provide a range of functions and services. It is designed for assessing ambient conditions within watersheds, regions, and throughout the State. It can also be used to assess the performance of restoration projects. CRAM requires a team of 2-3 trained practitioners less than 3 hours to assess a representative wetland area. CRAM evaluates wetland condition at specific sites within defined boundaries in what is termed the Assessment Area, or AA. There are specific guidelines for defining the AA for each CRAM module for different wetland types. For depressional wetlands the recommended size is no more than 2 hectares. In this study, each of the four ponds is under 2 hectares.

Each assessment area was evaluated according to the four universal attributes of CRAM (Table 1) using the current CRAM Depressional (Pond) field book (v 6.1):

- **Buffer and Landscape Context** - measured by assessing the quantity and condition of adjacent aquatic areas as well as extent and quality of the buffering environment adjacent to the AA.
- **Hydrology** - assesses the sources of water, the stream channel stability, and the hydrologic connectivity of rising flood waters in the stream.
- **Physical Structure** - measured by counting the number of patch types found within the AA and the topographic complexity of the marsh plain.
- **Biotic Structure** - assesses the site based on several factors including the number of plant vertical layers, the number of different species that are commonly found in the marsh, the percent of the common species that are invasive, and the horizontal and vertical heterogeneity of the plant communities.

These four attributes are consistent for all wetland modules of CRAM. Each of the four attribute categories is comprised of a number of metrics and submetrics that are evaluated

in the field and scored on a scale of D (3) to A (12). Each of the four attribute categories are then converted to a scale of 25 through 100, and the average of these four scores is the final CRAM index score, also ranging on a scale from 25 (lowest possible) to a maximum of 100.

The scale of condition categories presented in Table 1 is appropriate for the purposes of evenly distributing CRAM results into quartiles.

Table 2. CRAM condition categories and associated index scoring ranges.

Condition Category	Total CRAM Index Score Range
Excellent	82-100
Good	63-81
Fair	44-62
Poor	25-43

CCWG conducted CRAM at each of the 4 ponds (Central Pond, East Pond, South Pond, North Pond) in September of 2017, May of 2018, May of 2019, and late April of 2021 (Figure 2). The September 2017 CRAM was conducted pre-ground engineering, planting, and vegetation removal. Assessments conducted in May 2018, May 2019, and April 2021 represent post-ground engineering and planting.

Figure 2. CRAM assessment area (AA) boundaries at the North Monterey County Amphibian Habitat Enhancement Project.

Results from CRAM wetland condition assessments are uploaded to eCRAM, the Statewide CRAM database. This means that all the scientifically quantifiable outcomes of the project are available online to any interested groups.

Results and Discussion

Central Pond

During the pre-restoration CRAM, Central Pond received an overall index score of 76. After ground engineering was completed, the pond was assessed in May of 2018 and received an overall index score of 75, and was surveyed again in May of 2019 and received an overall index score of 78. The final assessment for the project was conducted in April of 2021 and scored a 74 overall. Results of these assessments are presented in Table 3 and Figure 3

During the May 2019 and April 2021 assessments the *Buffer and Landscape* attribute received a score of 49, which is 7 points higher than the previous CRAMs conducted in 2017 and 2018. This increase is due to the improvement in the *Buffer Condition* metric from a C to a B, due to weed management at the site. The *Hydrology* attribute score stayed the same throughout all 3 years. The *Physical Structure* attribute score increased between the 2018 and 2019 assessments (from an 88 to 100), due to receiving an improved score for the *Structural Patch Richness* metric. However, in the final assessment it dropped back down to an 88, as the *Structural Patch Richness* metric score went back down to a B. This metric tallies the number of patches at a site, and probably went down in 2021 due to the lack of water in a drought year. The *Biotic Structure* attribute score decreased from an 83 (October 2017) to a 78 (May 2018) to 69 (May 2019), to 67 (April 2021). This decrease in score is most likely due to both the seasonal timing of the assessment as well as the removal of bulrush from within the pond in 2018. The removal of the bulrush decreased the amount of vertical biotic structure within the pond. While this makes the pond score lower in CRAM, it is part of the management strategy for endangered salamanders, which need more open space habitat. The *Percent of Invasive Species* metric decreased (meaning higher percentage of invasive co-dominants) in May 2018. May 2019, and April 2021. This change in score is most likely because the 2018, 2019, and 2021 assessments were conducted during the spring explosion of invasive annuals, whereas the 2017 CRAM was conducted in Fall when more plants have senesced. During the spring season the invasive species may be more abundant and be included as co-dominants, while some of the native species that were planted are still not large enough to be counted as co-dominant species.

Central Pond, May 2019

Table 3. Central Pond CRAM metric, attribute and index scores over restoration project period October 2017-April 2021.

CRAM Attribute	CRAM Metrics and Submetrics	October 2018	May 2018	May 2019	April 2021
Buffer and Landscape Context	Aquatic Area Abundance	3	3	3	3
	% of AA with Buffer	12	12	12	12
	Average Buffer Width	6	6	6	6
	Buffer Condition	6	6	9	9
	Attribute Score	**42**	**42**	**49**	**49**
Hydrology	Water Source	12	12	12	12
	Hydroperiod	12	12	12	12
	Hydrologic Connectivity	9	9	9	9
	Attribute Score	**92**	**92**	**92**	**92**
Physical Structure	Structural Patch Richness	9	9	12	9
	Topographic Complexity	12	12	12	12
	Attribute Score	**88**	**88**	**100**	**88**
Biotic Structure	PC: No. of plant layers	12	12	12	9
	PC: No. of co-dominants	6	6	6	6
	PC: Percent Invasion	9	3	3	3
	Interspersion	9	9	9	9
	Vertical Biotic Structure	12	12	9	9
	Attribute Score	**83**	**78**	**69**	**67**
	Index Score	**76**	**75**	**78**	**74**

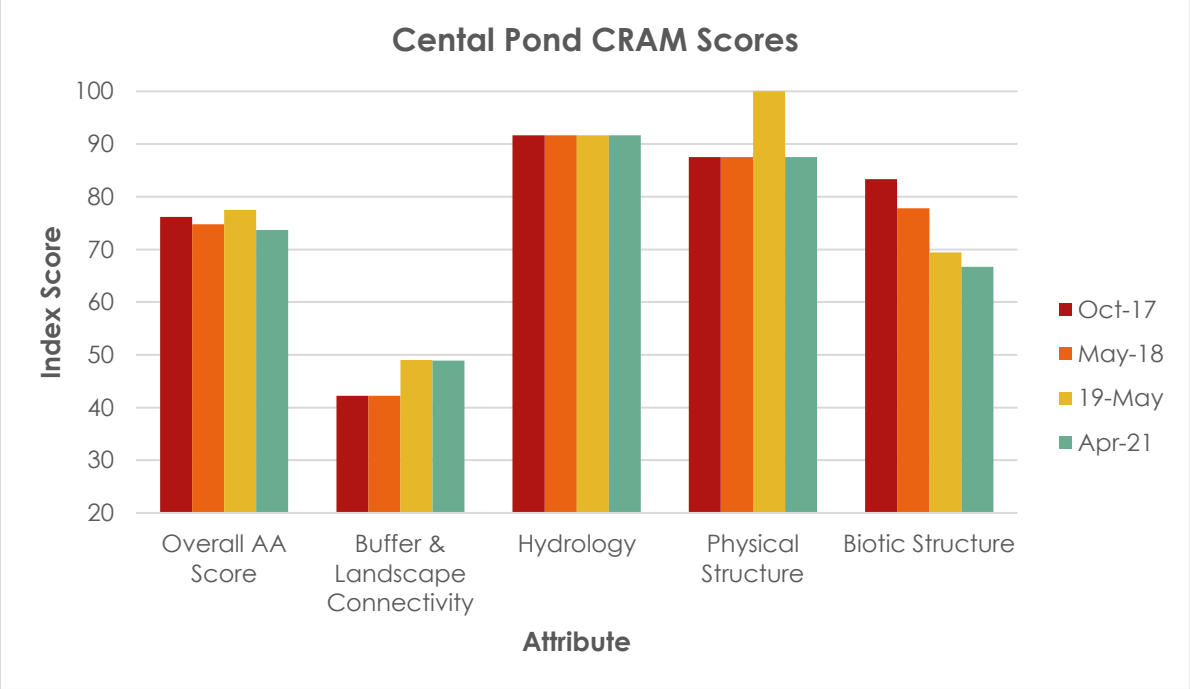


Figure 3. Central Pond CRAM index and attribute scores over restoration project period October 2017-April 2021.

South Pond

During the pre-restoration CRAM, the South Pond received an overall index score of 64. After ground engineering was completed, the pond was assessed in May of 2018 and received an overall index score of 65, in May of 2019 received an overall index score of 68, and was surveyed again in April 2021 with a score of 69. Results of these assessments are presented in Table 4 and Figure 5.

During the May 2019 and April 2021 assessments the *Buffer and Landscape* attribute received a score of 46, which is 5 points higher than the previous CRAMs conducted in 2017 and 2018. Although the *Percent of AA with Buffer* metric decreased from an A in 2017 and 2018 to a B in 2019 due to the installation of a new fence, the *Buffer Condition* metric increased from a C in 2017 and 2018 to a B in 2019 and 2021, due to weed management at the site. The *Hydrology* attribute score stayed the same throughout all 3 years. The *Physical Structure* attribute score increased between the 2018 and 2019 to 2021 assessments (from 63 to 75 to 88), due to receiving improved scores for the *Structural Patch Richness* metric. The *Biotic Structure* attribute score decreased from 69 in 2017 to 58 in 2021. This decrease in score is most likely due to the seasonal timing of the assessment. The *Percent Invasive Species* metric decreased (meaning higher percentage of invasive co-dominants) in May 2018 and May 2019, and went down again in April 2021. This change in score is most likely because the 2018, 2019, and 2021 assessments were conducted during the spring season, whereas the 2017 CRAM was conducted in Fall when the invasive annuals have died back. During the spring season the invasive species may be more abundant and be included as co-dominants, while some of the native species that were planted are still not large enough to be counted as co-dominant species. This also has to do with the proportion of co-dominant species changing due to a change in the overall number of co-dominant species. 2021 was a drought year and so the native wetland obligates were less vigorous, resulting in fewer co-dominant species, of which a higher percentage were invasive. However, during the 2018, 2019, and 2021 assessments, the pond received an improved *Vertical Biotic Structure* metric score, partly due to the more abundant vegetation (Including invasive species) during the spring season, and also due to management actions to improve overall cover. The *Horizontal Interspersion* metric score decreased from a B in 2017 and 2018 to a C in 2019 and 2021, due to interannual variations in vegetation structure, particularly drought impacts in 2021.

South Pond, April 2021

Table 4. South Pond CRAM metric, attribute and index scores over restoration project period October 2017-April 2021.

CRAM Attribute	CRAM Metrics and Submetrics	October 2017	May 2018	May 2019	April 2021
Buffer and Landscape Context	Aquatic Area Abundance	3	3	3	3
	% of AA with Buffer	12	12	9	9
	Average Buffer Width	6	6	6	6
	Buffer Condition	6	6	9	9
	Attribute Score	**42**	**42**	**46**	**46**
Hydrology	Water Source	9	9	9	9
	Hydroperiod	12	12	12	12
	Hydrologic Connectivity	9	9	9	9
	Attribute Score	**83**	**83**	**83**	**83**
Physical Structure	Structural Patch Richness	6	6	9	12
	Topographic Complexity	9	9	9	9
	Attribute Score	**63**	**63**	**75**	**88**
Biotic Structure	PC: No. of plant layers	12	9	12	9
	PC: No. of co-dominants	9	9	9	6
	PC: Percent Invasion	9	6	6	3
	Interspersion	9	9	6	6
	Vertical Biotic Structure	6	9	9	9
	Attribute Score	**69**	**72**	**67**	**58**
	Index Score	**64**	**65**	**68**	**69**

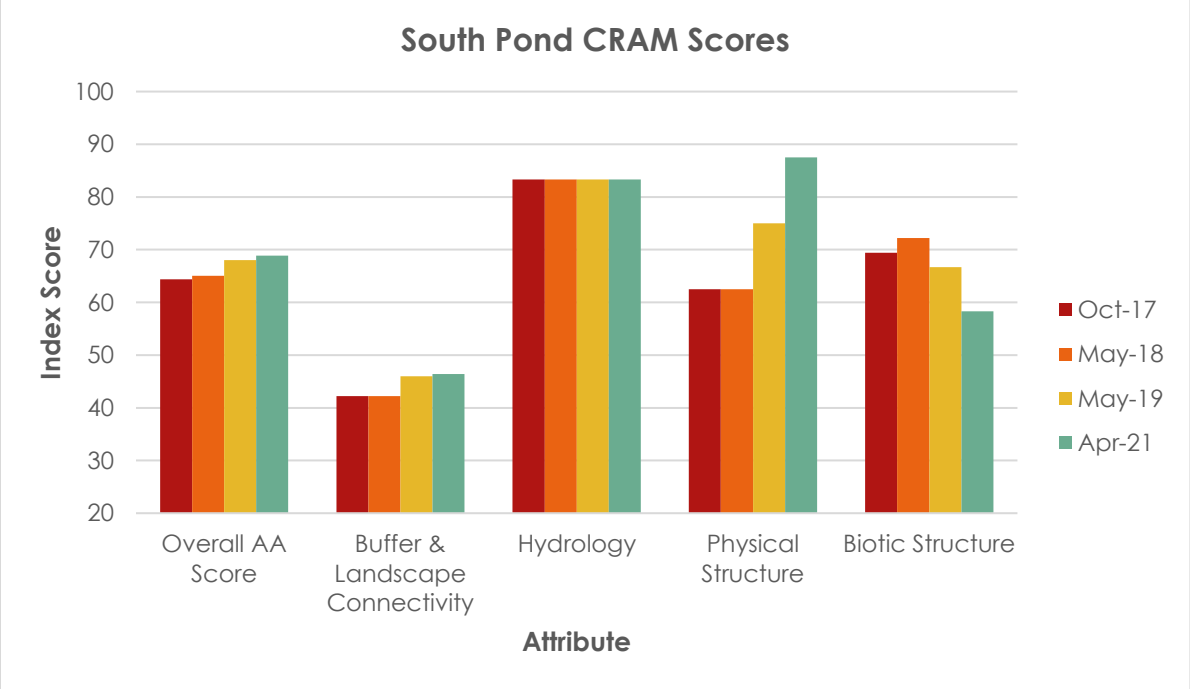


Figure 4. South Pond CRAM index and attribute scores over restoration project period October 2017-April 2021.

North Pond

During the pre-restoration CRAM, the North Pond received an overall index score of 60. After ground engineering was completed, the pond was assessed in May of 2018 and received the same overall index score of 60, again in May of 2019 with an overall index score of 71, and finally in April 2021 the overall index score increased to 72. Results of these assessments are presented in Table 5 and Figure 6. All attribute scores, except for *Hydrology*, increased between October 2017 and April 2021, and the *Hydrology* attribute score remained the same. In the *Buffer and Landscape* attribute, the site received an improved score for the *Buffer Condition* metric (from a C in 2017 and 2018 to a B in 2019 and 2021), due to weed management actions. In the *Physical Structure* attribute, the pond received an improved score in both the *Structural Patch Richness* metric (from a D in 2017 and 2018 to a B in 2019 and 2021) and *Topographic Complexity* metric (from a C in 2017 and 2018 to a B in 2019 and 2021). The *Biotic Structure* attribute score increased from 67 in 2017 and 2018, to 69 in 2019, to 72 in 2021. However, the metric and sub-metric scores within this attribute fluctuate between the five years the CRAMs were conducted, making it difficult to interpret what may be the driving factors of increases or decreases in scores. Interannual and seasonal variations in vegetation structure likely led to the slight fluctuations in metric and sub-metric scores. The *Vertical Biotic Structure* metric steadily improved through the project period due to management to increase overall cover, while the *Plant Community* sub-metrics fluctuated over time and season. The score for *Percent Invasion* increased over time due to weed management actions.

North Pond, April 2021

Table 5. North Pond CRAM metric, attribute and index scores over restoration project period October 2017-April 2021.

CRAM Attribute	CRAM Metrics and Submetrics	October 2018	May 2018	May 2019	April 2021
Buffer and Landscape Context	Aquatic Area Abundance	3	3	3	3
	% of AA with Buffer	12	12	12	12
	Average Buffer Width	6	6	6	6
	Buffer Condition	6	6	9	9
	Attribute Score	**42**	**42**	**49**	**49**
Hydrology	Water Source	12	12	12	12
	Hydroperiod	12	12	12	12
	Hydrologic Connectivity	9	9	9	9
	Attribute Score	**92**	**92**	**92**	**92**
Physical Structure	Structural Patch Richness	3	3	9	9
	Topographic Complexity	6	6	9	9
	Attribute Score	**38**	**38**	**75**	**75**
Biotic Structure	PC: No. of plant layers	12	9	12	9
	PC: No. of co-dominants	6	6	3	3
	PC: Percent Invasion	9	3	6	12
	Interspersion	6	9	6	6
	Vertical Biotic Structure	9	9	12	12
	Attribute Score	**67**	**67**	**69**	**72**
	Index Score	**60**	**60**	**71**	**72**

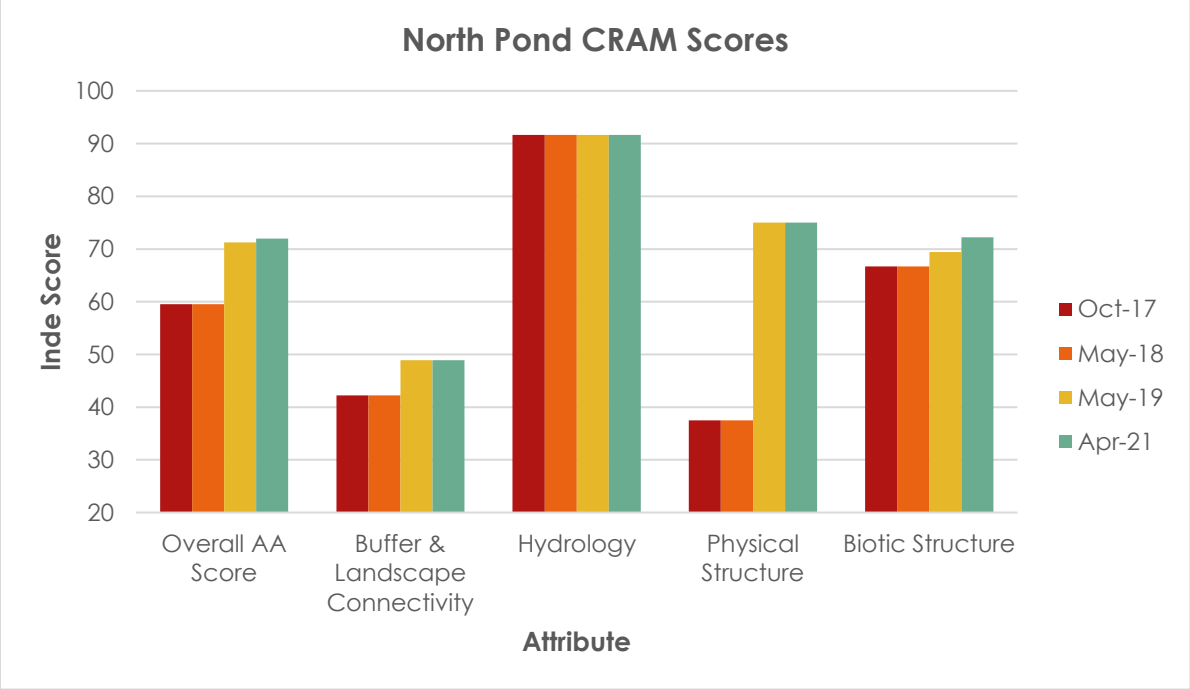


Figure 5. North Pond CRAM index and attribute scores over restoration project period October 2017-April 2021.

East Pond

During the pre-restoration CRAM, the East Pond received an overall index score of 52. After ground engineering was completed, the pond was assessed in May of 2018 and received an index score of 54, again in May of 2019 with an index score of 56, and in April 2021 the score increased to a 57. Results of these assessments are presented in Table 6 and Figure 6. During the May 2019 and April 2021 assessments the *Buffer and Landscape* attribute received a score of 50, which is 8 points higher than the previous CRAMs conducted in 2017 and 2018. Although the *Percent of AA with Buffer* metric decreased from an A in 2017 and 2018 to a B in 2019 and 2021, due to the installation of a fence around the perimeter of the high school, the *Buffer Condition* metric and the *Buffer Width* metric both increased from a C in 2017 and 2018 to a B in 2019 and 2021. The *Hydrology* attribute decreased in score between 2017 and 2018 because the *Hydroperiod* metric decreased from an A to a B as a berm was installed in October of 2017 to help hold water in the pond for a longer period of time. No further changes between 2018 and 2021 were identified. While this management action results in a lower CRAM score for this metric, it is aimed at the overall goal of improving habitat for endangered amphibians. The *Physical Structure* attribute score remained the same at the beginning and end of the project, with a dip in the middle due to a lower *Structural Patch Richness* score. The *Biotic Structure* attribute score increased from 33 in 2017 to 53 in 2021. The number of plant layers improved over time due to longer water retention fostering growth of hydrophytes in the understory (Eleocharis species), which also contributed to an improvement in *Vertical Biotic Structure*. Weed management opened space for native cover on the slopes next to the pond, which improved the score for *Number of Co-dominant Species, Percent Invasion,* and *Interspersion.*

East Pond, April 2021

Table 6. East Pond CRAM metric, attribute and index scores over restoration project period October 2017-April 2021.

CRAM Attribute	CRAM Metrics and Submetrics	October 2017	May 2018	May 2019	April 2021
Buffer and Landscape Context	Aquatic Area Abundance	3	3	3	3
	% of AA with Buffer	9	9	9	9
	Average Buffer Width	9	9	9	9
	Buffer Condition	6	6	9	9
	Attribute Score	**42**	**42**	**50**	**50**
Hydrology	Water Source	12	12	12	12
	Hydroperiod	12	9	9	9
	Hydrologic Connectivity	3	3	3	3
	Attribute Score	**83**	**75**	**75**	**75**
Physical Structure	Structural Patch Richness	6	3	6	6
	Topographic Complexity	6	6	6	6
	Attribute Score	**50**	**38**	**50**	**50**
Biotic Structure	PC: No. of plant layers	3	12	9	12
	PC: No. of co-dominants	3	6	6	6
	PC: Percent Invasion	12	3	3	3
	Interspersion	3	6	6	6
	Vertical Biotic Structure	3	9	6	6
	Attribute Score	**33**	**61**	**50**	**53**
	Index Score	**52**	**54**	**56**	**57**

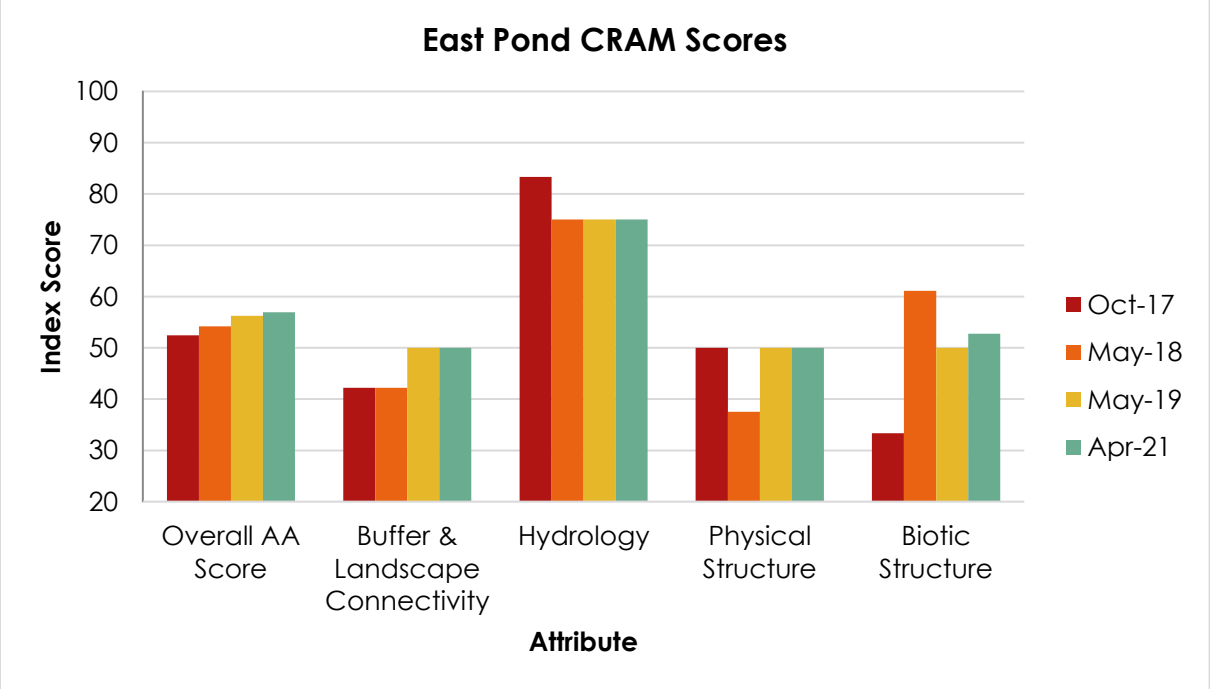


Figure 6. East Pond CRAM index and attribute scores over restoration project period October 2017-April 2021.

Stressors

Several stressors were identified at the sites during the assessments. While not factored into the CRAM scores, stressors can provide more detailed insight about what may be adversely affecting the ecological condition of ponds. Stressors that were consistently observed on the site include:

- Urban residential areas
- Transportation Corridor
- Sports fields
- Vector control
- Passive recreation
- Active recreation
- Intensive row-crop agriculture

Conclusion

CRAM Index scores for each of the four ponds at the North Monterey County Amphibian Habitat Enhancement Project site have increased since pre-restoration, except for the Central Pond, which decreased slightly. The North Pond improved significantly with an increase in overall index score of 12 points. The East Pond and South Pond improved slightly but not significantly. However, the surveys show that the restoration efforts conducted during late fall of 2017 and 2018 to 2021, which included minimal ground engineering, planting of native plants, and invasive vegetation management, has yet to show a significant increase in CRAM scores for most of the ponds. Minimal restoration work is occurring within the pond habitat, except for the Central Pond where vegetation was removed from the ponded area to facilitate endangered salamander habitat. While this management action is beneficial for the species of concern, it does reduce vegetation complexity and thus CRAM scores. Therefore, CRAM scores throughout the entire project may only change minimally. This is to be expected. However, we do expect that as the native vegetation becomes more established over the site and invasive species are further managed, the *Biotic Structure* attribute will continue to increase in score. The CRAM results also show that the restoration and invasive management efforts throughout the project site have already helped to improve the buffer condition around each of the ponds, which increases the *Buffer and Landscape* attribute score.

The following summarizes CRAM metric score improvements or reductions for each of the ponds:

Buffer condition increased across the board, from a C to a B for each pond. Plant Community scores fluctuated due to seasonal and interannual variations, particularly drought conditions in the last year of the project.

- Central Pond (16 point reduction in Biotic Structure Score, 2 point decrease overall)

    - Plant layers score reduced- removal of bulrush reduced numbers of layers present
    - Plant vertical biotic score reduced- removal of bulrush reduced density of pond vegetation
    - Plant percent invasion score reduced-spring annuals gone during initial CRAM, what was left was native perennials, latter CRAMs done during Spring
- South Pond (11 point decrease in Biotic Structure Score, 5 point increase overall)
    - South pond buffer width score was reduced with the installation of the chain link fence around the school campus
    - structural patch richness score improved
    - Plant layers score fluctuated
    - Plant co-dominants score reduced
    - Plant percent invasion score reduced
- North Pond (5 point increase in Biotic Structure Score, 12 point increase overall)
    - Structural patch richness score improved
    - Topographic complexity score improved
    - Plant layers score fluctuated
    - Plant codominant score was reduced
    - Plant percent invasion score improved
- East Pond (20 point increase in Biotic Structure Score, 5 point increase overall)
    - Plant layers score fluctuated and increased
    - Plant percent invasion score reduced
    - Plant interspersion and vertical biotic score increased

The following CRAM related success criteria have been met (Table 7):

Table 7. CRAM Success Criteria

Success Criteria	Met?	Comments
Improved Biotic Structure Score in CRAM (10 points)	Partially	North Pond met success criteria

3. VEGETATION SURVEYS

Introduction

To determine the success of upland, wetland, and riparian habitat establishment, vegetation monitoring was conducted each spring. Surveys using point intercept method along established transects helped document the increase in native plant cover and richness within each vegetation zone. Results from these surveys can be used to assess whether plant establishment success criteria are being met.

Method

Vegetation monitoring at the project site included annual spring surveys (2018, 2019, 2021) and one pre restoration survey (Fall 2017) using the Point Intercept Method to estimate cover of specific species as well as native versus non-native cover. The method is conducted by placing a 'pin' along the transect at regular intervals and determining the proportion of points that "hit" (or intercept) vegetation. Cover is measured by point intercept based on the number of 'hits' on the species present out of the total number of points measured. Specific methods for this project are detailed below:

CCWG staff conducting a point-intercept vegetation survey along a transect.

1. Vegetation transects were established throughout the project area in 2017 focusing on areas planned for restoration and native planting (Figure 7). In 2018 several more transects were established to capture new areas planned for planting during the 2018/2019, 2019/2021, and 2020/2021 planting seasons. Transects vary in length from 25-50 meters.
2. Transects were laid out using a 50 meter transect tape. Coordinates were recorded at the start and end of each transect. Transects were numbered based on the order in which they were conducted.
3. Point intercept data was recorded at 0.5m intervals along each transect. At each pre-determined interval along the transect the point intercept pin was placed on the ground; and the tallest plant species that directly intercepted the pin was recorded.
4. Species were recorded with genus and species name. Abiotic features such as; bare ground, litter, and water were also recorded.
5. After all data was entered, each species was recorded with type of vegetation/growth form (tree, shrub, forb, etc.) and noted as native or non-native.
6. Change in native and non-native cover, growth form, and species composition was analyzed for each transect between Fall 2017 and Spring 2021.

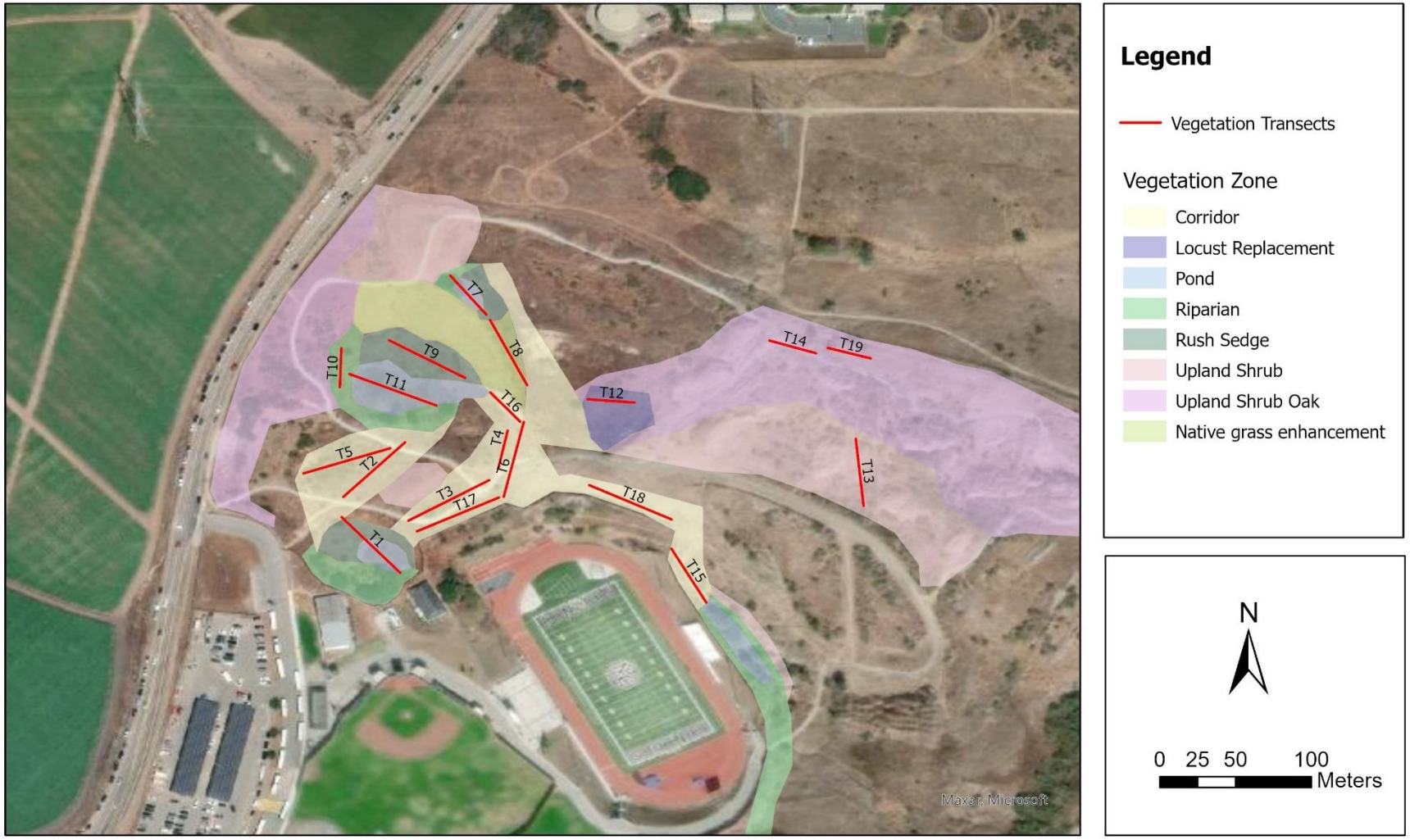


Figure 7. Vegetation zones and vegetation transect locations

Results

Change of native and non-native cover between Fall 2017 and Spring 2019 is shown for each transect in Figure 8. Transects 1, 2, 3, 4, 5, 6, 7, 9, 12, 15, 16, 17, 18, and 19 each show a positive increase in native cover, with transect 3, 5, and 12 showing the largest increases. Transect 11shows the largest decrease in native cover, most likely with the removal of the bulrush to create more open water habitat. Transects 1, 2, 3, 5, 6, 7, 9, 12, 13, 15, 16, 17, 18, and 19 all show a decrease in non-native cover, with transect 15, and 12 showing the largest decrease in cover. Transect 11 shows the largest increase in non-native cover.

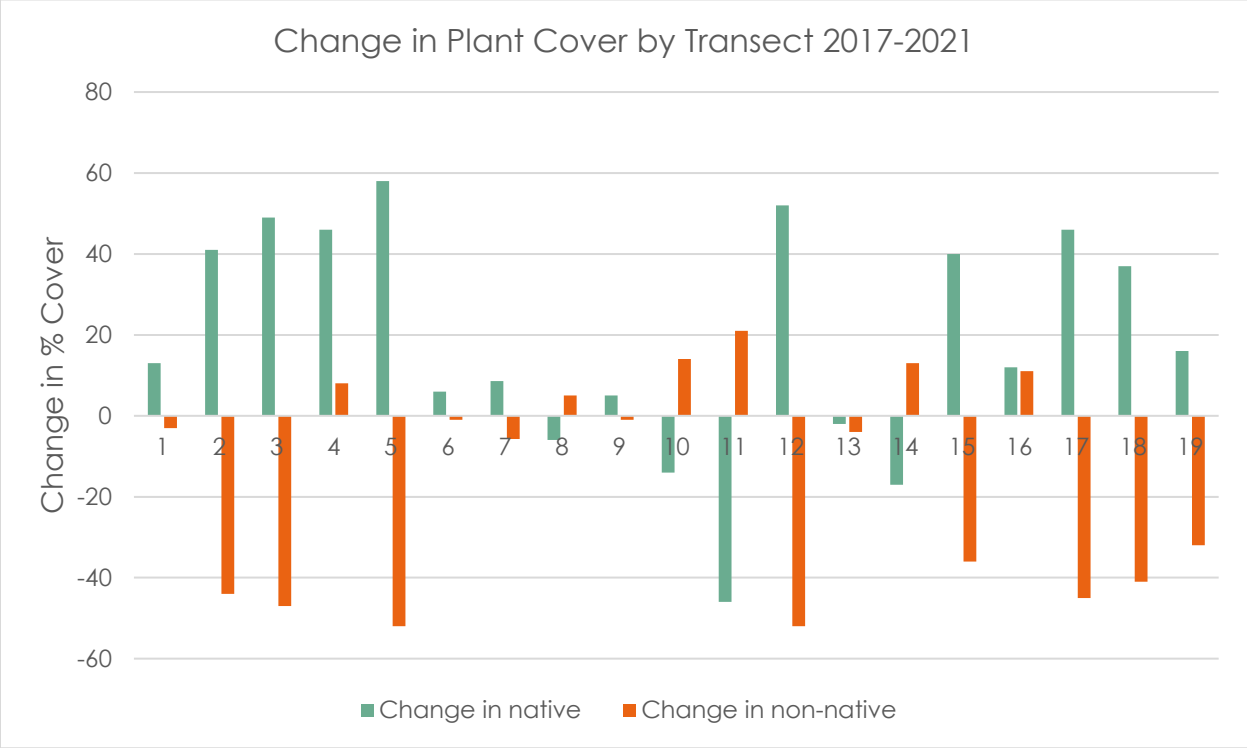


Figure 8. Change in percent cover of native and non-native vegetation between Fall 2017 and Spring 2021 for each transect. Note: Change data shown for transects 16-19 is for 2018-2021.

The vegetation survey data shows that site-wide there is a slight increase in native plant cover between Fall 2017 and Spring 2021, from 37% to 43%. There is also a slight decrease in non-native plant cover between Fall 2017 and Spring 2021, from 54% to 49%. Although abiotic cover shows a steady decrease between 2017 and 2019, from 10% to 5%, in 2021 abiotic cover increased slightly to 8%. (Figure 9Figure 9).

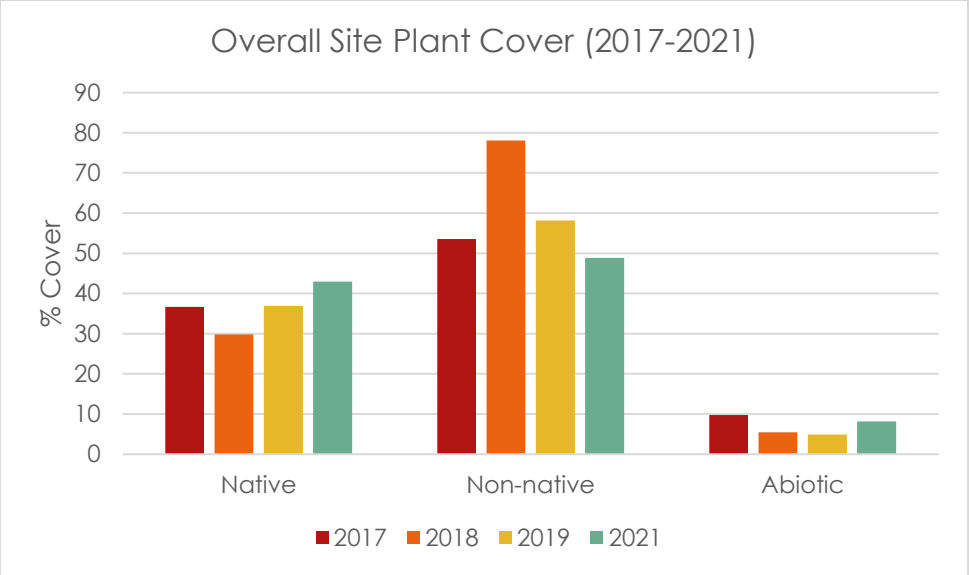


Figure 9. Percent cover of native plants, non-native plants, and abiotic features in 2017-2021.

Site-wide, vegetation survey results document that native species richness increased from 13 species to 30 species in areas surveyed and non-native species richness decreased from 29 to 23 species (Figure 10).

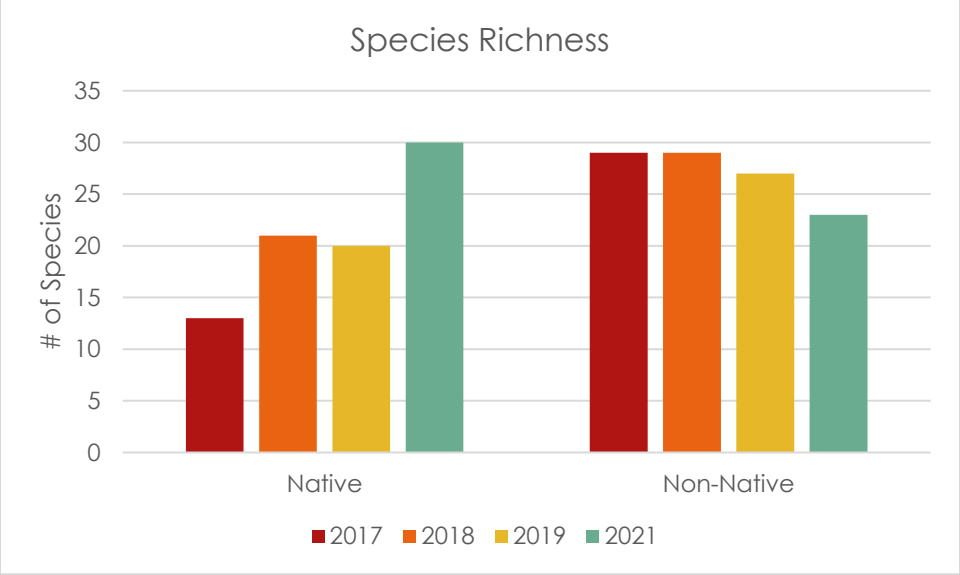


Figure 10. Site-wide species richness along vegetation transects

California blue-eyed grass (left) and Hooker's manzanita (right)

Site-wide there was a slight increase in native shrub cover (3.5% to 6.2%) and tree cover (1.8% to 3.5%) (Figure 11).

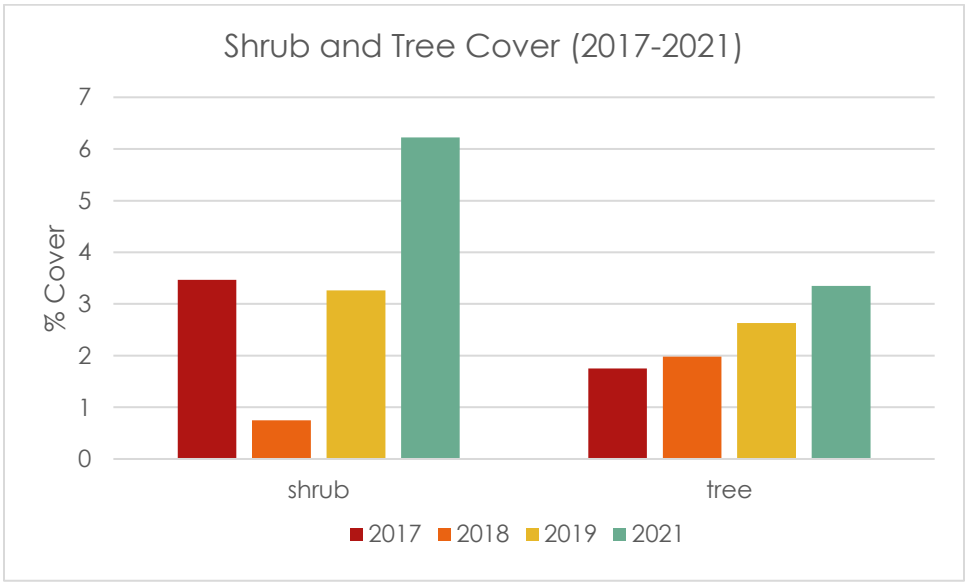


Figure 11. Site-wide increase in native shrub and tree cover along vegetation transects.

Surveys along transects that fell within the corridor zone (Transects 2-6 and 15-18), which is where the most effort went into native planting, document a significant increase in native cover from 9% in 2017 to 47% in 2021. Furthermore, non-native vegetation shows a significant decrease in plant cover from 73% in 2017 to 45% in 2021. Abiotic cover decreased from 18% in 2018 to 8% in 2021 (Figure 12).

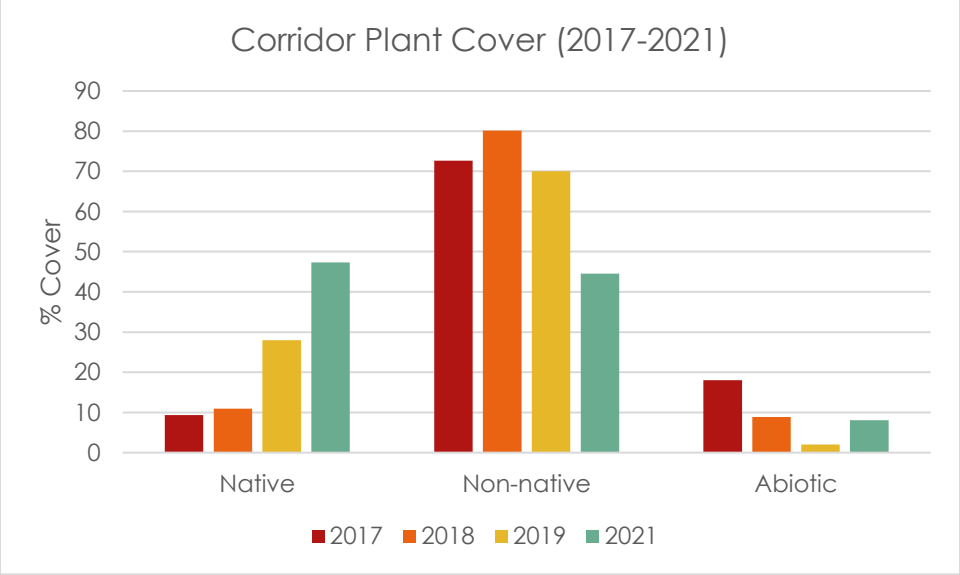


Figure 12. Percent cover of native and non-native vegetation, and abiotic features in 2017-2021 within the corridor planting zone.

Yellow bush lupine (left) and chick lupine (right)

Discussion and Conclusion

An overall increase in native vegetation cover and diversity and a decline in non-native cover and diversity indicates that habitat enhancement efforts are progressing. Although there was an initial decrease in native plant cover and an increase in non-native plant cover between 2017 and 2018, results then show an increase in native plant cover and decrease in non-native cover between 2018 and 2021. This is typical of restoration projects where after ground-engineering is conducted, non-natives are the first to become established in disturbed areas and newly planted native plants may not be abundant enough to be captured within surveys.

The greatest increase in native cover is seen within the corridor zone, which is to be expected as this is where the most effort in native planting was conducted. The increase in native cover along the corridor sections is encouraging. Improving movement corridors for seasonal salamander migration is a primary goal of this project, and an increase in native cover facilitates this habitat function.

The greatest decrease in native cover is seen in transect 11. This is the transect that runs through the Central Pond where bulrush was removed to create more open water habitat, which is beneficial for salamander breeding.

Two factors may have an influence on some of the survey results presented here. First, the initial baseline survey was conducted in Fall before any planting occurred, but also when many plants are dormant. Although Fall is not an ideal time to conduct vegetation surveys, we wanted to collect vegetation data prior to any restoration work occurring. The project did not begin until Fall, thus leaving only a small window to conduct plant surveys prior to any restoration efforts beginning. The subsequent vegetation surveys were conducted in Spring of 2018, 2019, and 2021, which is a more appropriate season for collecting vegetation data, but makes it harder to compare initial survey results to final results given the seasonality differences in expression of native and non-native plants between a Fall and Spring survey. Second, the most recent 2021 vegetation survey occurred during the present drought year. The drought has most likely impacted establishment of the more recently established native plants as well as the wetland and riparian vegetation within the site. Vegetation survey results from 2021 may be underrepresenting native cover that would otherwise be more abundant in a typical rain year.

The following vegetation related success criteria have been met either site-wide or in certain plant zones such as the "corridor" zone (Table 8).

Table 8. Vegetation success criteria

Success Criteria	Met?	Comments
Plant establishment: 20% increase in native cover of plants in areas planted	Partially	In the corridor zone this has been met.
Plant establishment: 20% increase in woody vegetation cover in areas planted	Yes	Site-wide this has been met
Plant establishment: 40% increase in diversity of plants in areas planted	Yes	Site-wide this has been met: An increase from 13 to 30 species

4. BIRD SURVEYS

Introduction

Birds have long been used as indicators of habitat quality and bird surveys are a useful tool to document the changes in species composition and abundance at restoration sites. Bird surveys detect variation in species composition among habitat types and time (seasonal and yearly). Birds may also be better suited than some animals to reflect vegetation changes because they have a multi-year lifespan and a tendency to return to the same breeding sites each year. Although multiple factors influence various bird species populations, and their presence or absence alone does not define the quality of the habitat, birds can serve as one indicator of the successfulness of a habitat restoration project. Their presence indicates that the basic habitat needs of the species have been met.

Methods

Bird surveys were conducted throughout the project period by Rick Fournier, a local bird expert, and include the following methodology:

1. Conduct a general count of five plots (plot 1-5) walking the perimeter of the study area listening and watching for bird activity recording sightings on individual survey plot sheets. For the remainder of the study area, the data will be compiled on one sheet labeled "General Population."

2. Spend at least a minimum of 10 minutes or more at each site. Record the time.

3. With the balance of the study area, follow the fence line near the housing project (starting at plot #3) around the back side of the campus finishing up at plot #5, the drainage pond behind the Football Field. In the process, serpentine in and out to the center of the study area observing and recording any avian activity.

The schedule* of surveys over the project period are shown in Table 9.

Table 9. Bird Survey Schedule 2017-2021

Year	Number of Surveys and Season
2017	2 Fall surveys (October and November)
2018	1 Winter survey (February), 2 Spring surveys (April and June)
2020	1 Winter survey (February), 2 Fall surveys (October and November)
2021	2 Spring surveys (April and May)

**Note survey dates were modified from initial schedule, due to Covid-19 restrictions.*

Results

Results of bird surveys between 2017 and 2021 are presented in Table 10 and Figure 13 and Figure 14.

Table 10. Bird surveys results (2017-2021)

Species	Fall 2017		Winter 2018	Spring 2018		Winter 2020	Fall 2020		Spring 2021		Frequency of Annual Encounter
	3-Oct-17	9-Nov-17	21-Feb-18	25-Apr-18	6-Jun-18	15-Feb-20	24-Oct-20	28-Nov-20	24-April-21	25-May-21	
American crow	6	2	1	2	1	4	5	1	0	3	C
American goldfinch	9	17	3	10	3	7	1	1	17	4	C
American kestrel	0	1	0	0	0	0	1	1	0	0	C/U
Anna's hummingbird	0	0	0	0	0	0	0	1	0	0	C
Barn swallow	0	0	0	1	3	0	0	0	0	2	X/C
Bewick's wren	9	4	2	1	0	5	3	2	2	0	C
Black phoebe	5	2	0	3	1	2	3	4	1	1	C
Black headed grosbeak	0	0	0	0	1	0	0	0	0	0	X/U
Blue-gray gnatcatcher	0	0	1	0	0	0	0	3	0	0	R
Brewer's blackbird	15	0	0	0	0	0	0	1	0	0	C
Brown headed cowbird	0	0	0	7	4	0	0	0	18	1	U
Bushtit	21	0	0	0	8	15	0	13	3	3	C
California gull	0	0	2	0	0	0	5	0	0	0	C/U
California quail	2	0	0	0	0	2	0	0	0	0	C
California scrub-jay	1	3	4	2	2	4	3	5	1	2	C
California thrasher	0	0	1	1	0	0	0	0	0	0	U
California towhee	0	1	1	1	7	6	7	2	6	6	C
Chestnut-backed chickadee	0	0	0	0	1	0	0	0	0	0	C
Cliff swallow	0	0	0	1,200	67	0	0	0	0	40	U/C
Common raven	0	0	0	0	2	0	0	0	1	0	U
Common yellowthroat	3	0	0	1	0	1	1	0	3	1	C
Downy woodpecker	1	1	0	0	0	1	0	0	0	0	U
Eurasian collared-dove	1	0	0	2	1	1	0	0	0	4	C

Species	Fall 2017		Winter 2018	Spring 2018		Winter 2020	Fall 2020		Spring 2021		Frequency of Annual Encounter
	3-Oct-17	9-Nov-17	21-Feb-18	25-Apr-18	6-Jun-18	15-Feb-20	24-Oct-20	28-Nov-20	24-April-21	25-May-21	
European starling	0	0	2	1	1	0	0	0	0	1	C
Fox sparrow	0	0	0	0	0	0	0	2	0	0	U
Gadwall	0	0	0	0	0	0	0	0	0	1	C
Golden-crowned sparrow	1	0	10	0	0	1	1	5	3	0	X/C
Great blue heron	0	0	0	0	0	1	0	0	0	0	C
Great egret	0	0	0	0	1	0	0	0	0	0	C
Great-tailed grackle	0	0	1	1	0	1	0	0	0	0	U
Greater white-fronted goose	11	0	0	0	0	0	0	0	0	0	U
Hermit thrush	0	1	0	0	0	0	0	1	0	0	X/U
House finch	38	40	16	4	31	35	51	46	30	5	C
House sparrow	0	0	0	0	2	0	0	0	0	0	C
House wren	2	0	0	0	0	0	0	0	0	1	C
Hummingbird sp.	0	0	0	0	1	0	0	0	0	0	C
Killdeer	14	2	7	1	0	0	1	2	1	3	C
Lesser goldfinch	0	4	0	0	0	0	0	2	0	0	C
Lincoln's sparrow	4	3	5	1	0	1	9	5	0	0	X/U
Mallard	0	0	0	6	0	10	1	0	0	0	C
Merlin	0	0	0	0	0	1	0	0	0	0	O/R
Mew gull	0	0	0	0	0	4	0	0	0	0	U/O
Mourning dove	0	0	0	0	0	0	0	0	0	2	C
Northern flicker	0	1	0	0	0	0	0	0	0	0	U/C
Northern harrier	0	0	1	0	0	0	0	1	0	0	U/O
Peregrine falcon	0	0	0	0	0	0	0	1	0	0	O
Purple finch	0	0	2	0	0	0	0	0	0	0	C
Red shouldered hawk	0	0	0	0	0	1	1	1	0	0	U
Red-tailed hawk	0	1	2	0	0	4	1	1	1	0	C
Red-winged blackbird	1	0	8	25	92	36	0	5	48	49	C

Species	Fall 2017		Winter 2018	Spring 2018		Winter 2020	Fall 2020		Spring 2021		Frequency of Annual Encounter
	3-Oct-17	9-Nov-17	21-Feb-18	25-Apr-18	6-Jun-18	15-Feb-20	24-Oct-20	28-Nov-20	24-April-21	25-May-21	
Ring-billed gull	0	0	1	0	1	0	0	0	0	0	C/U
Rock pigeon	0	0	1	0	0	0	0	0	0	1	C
Ruby crowned kinglet	0	0	0	0	0	4	7	10	0	0	C
Savannah sparrow	0	2	0	0	0	0	4	0	0	0	C/U
Say's phoebe	2	2	2	0	0	0	1	0	0	0	U/R
Sharp-shinned hawk	0	0	0	0	0	1	0	0	0	0	U
Song sparrow	14	8	8	26	35	12	2	2	11	22	C
Spotted towhee	0	0	0	0	0	2	0	1	0	4	C
Swainson's thrush	1	0	0	0	2	0	0	0	0	0	C/U/R
Tree swallow	0	0	0	9	0	0	0	0	0	0	R/C
Turkey vulture	1	0	0	0	0	1	0	0	0	1	O/C
Western meadowlark	2	2	2	0	0	0	0	0	0	0	U/C
White-crowned sparrow	39	85	10	0	0	7	40	13	1	0	C
White-tailed kite	1	0	0	0	0	1	2	1	1	2	U
Wilson's snipe	0	0	0	1	0	1	0	0	1	0	X/U
Wrentit	1	4	2	1	1	2	0	1	0	2	C
Yellow warbler	1	0	0	0	0	0	0	0	0	0	X/O/U/C
Yellow-rumped warbler	2	7	2	1	0	1	19	11	1	0	X/C
Total Species	**28**	**22**	**26**	**25**	**22**	**32**	**23**	**30**	**19**	**24**	
Total Individuals	**208**	**193**	**97**	**1,308**	**268**	**174**	**169**	**145**	**150**	**161**	

Frequency of Annual Encounter

- C: common: almost certain to be seen in suitable habitat.
- U: uncommon: present but not certain to be seen.
- O: occasional: seen only a few times during a season
- R: rare: not present every year.
- X: extraordinary: one or two records.

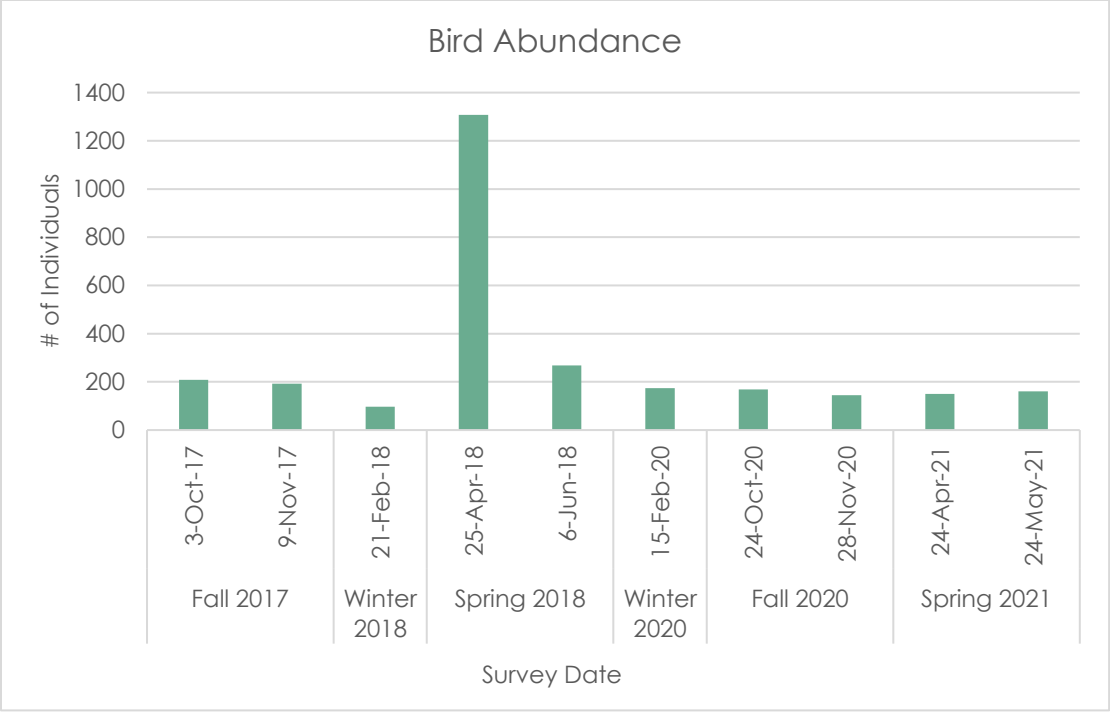


Figure 13. Total number of individuals for each survey date

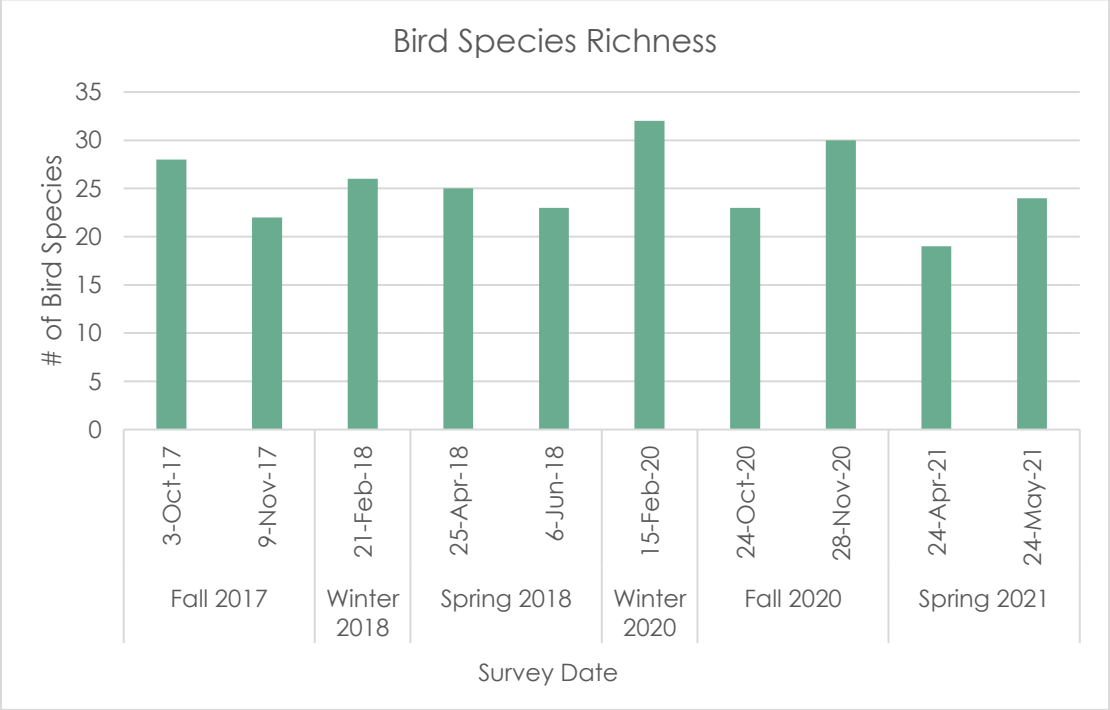


Figure 14. Total number of species for each survey date.

Discussion and Conclusion

No measurable changes or trends are seen over the three year period of the bird monitoring study. However, the data does suggest the site is holding species consistent with chaparral type biomes intermixed with patches of wetland and grassland habitats. The wetland that does exist is seasonal and given the limited amount of rainfall through the fourth quarter of 2017, first quarter of 2018, and first quarter of 2021, the holding capacity of the site was variable, or likely supported fewer birds than might otherwise be expected with a more abundant rainfall year.

The sporadic fluctuations in numbers essentially represent migrant and breeding activity. Of particular interest was the sizable feeding flock of migrant Cliff Swallows over the plot in April 2018, indicating there must have been a huge insect bloom to hold the flock in place for several hours during the duration of the survey period. It is not clear if the insect bloom was generated at the site or a carry-over from the adjacent Oak Hills Sewage Ponds, but it speaks well for the insectivores using the study area.

Spotted towhee (top) and Ruby crowned Kinglet (bottom)
Photos © Rick Fournier, May 2021

Since the scope of the monitoring is at best a sampling of the avian activity, species occurrence has also been recorded using the checklist of the Birds of Elkhorn Slough as a guideline. Because of the limited number of surveys conducted during the project period, it would be impractical to obtain enough data to establish one ourselves for the project site. Technically the study area falls within the boundaries of the Elkhorn Slough checklist and consequently is a good standard to use in understanding bird diversity and abundance.

Although bird survey results did not yield significant findings of bird species responding to restoration efforts, this lack of change is not surprising at this time. Ecological response to restoration takes time. Open water and emergent vegetation can appear rapidly after restoration, but herbaceous vegetation may take a few years to fully respond, and changes in the abundance and composition of riparian shrubs may take even longer. Furthermore, the lack of rain during early 2021, and the drying down of the seasonal ponds earlier than normal, most likely has an influence on bird species richness and abundance.

Recommendations to improve habitat use include having a couple year-round water stations; one adjacent to the South Pond and the other near the Central Pond. The additional water stations would increase overall diversity as well as stability providing a more comprehensive depiction of species using the study area.

5. AMPHIBIAN DIP NET SURVEYS

Introduction

Annual spring aquatic dip net surveys were conducted within known and potential amphibian breeding ponds throughout northern Monterey County. The project site ponds were included in this survey effort. The survey team was composed of members from Elkhorn Slough NERR, Elkhorn Slough Foundation, USFWS, CDFW, RCDSCC, and local biologists. Although aquatic surveys were out of the CCWG's monitoring scope of work, CCWG staff voluntarily participated in surveys in 2018 and 2019.

Results

In 2019 presence of SCLTS larvae (6) were detected at Central Pond at the project site. No larvae were detected in 2020, however due to Covid-19 restrictions the survey team was much smaller which may have influenced detection potential.

SCLTS larvae found within Central Pond in April 2019.
Photo by Suzanne Fork

The following success criteria have been met (Table 11):

Table 11. SCLTS presence related success criteria

Success Criteria	Met?	Comments
Presence of SCLTS after three (3) to five (5) years and confirmed breeding success	Yes	SCLTS larvae found in 2019

6. PHOTO MONITORING

Introduction

Simple photographic monitoring is a practical and cost-effective method of monitoring a restoration project. Photographic monitoring visually documents change in a site as restoration progresses.

Methods

Photo monitoring of the project site was conducted in August 2017 (pre-restoration), November 2017 (post-ground engineering work), June 2018, May 2019, and April 2021. A photo monitoring map of the restoration area was generated by walking the perimeter with a geographic positioning system (GPS) unit and selecting sites from which the restoration work could be visually covered. Thirteen locations were chosen to use for photo point monitoring (Figure 15). At each point, photos were taken looking in a variety of directions to best capture restoration efforts. Photos from a subset of those points are presented in this report. Google earth imagery pre- and post- earth moving is also presented here to capture the trail system which was installed in October 2017.

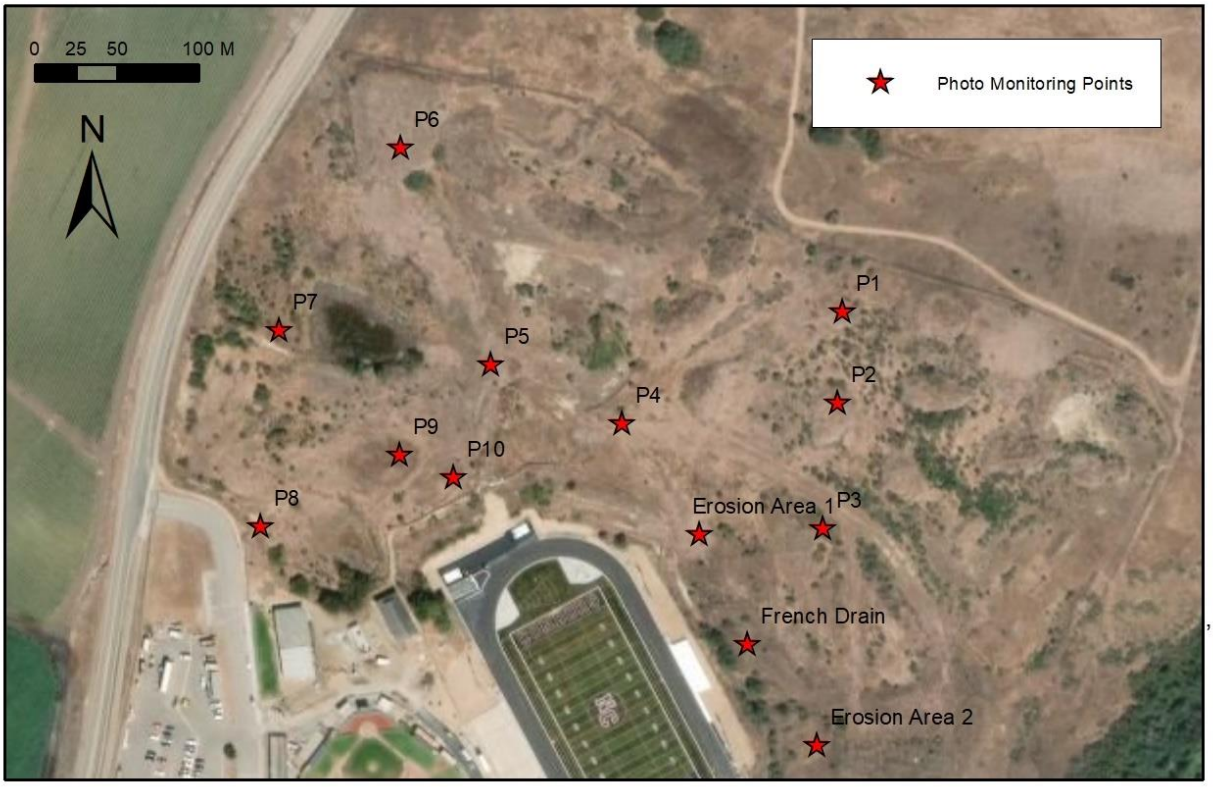
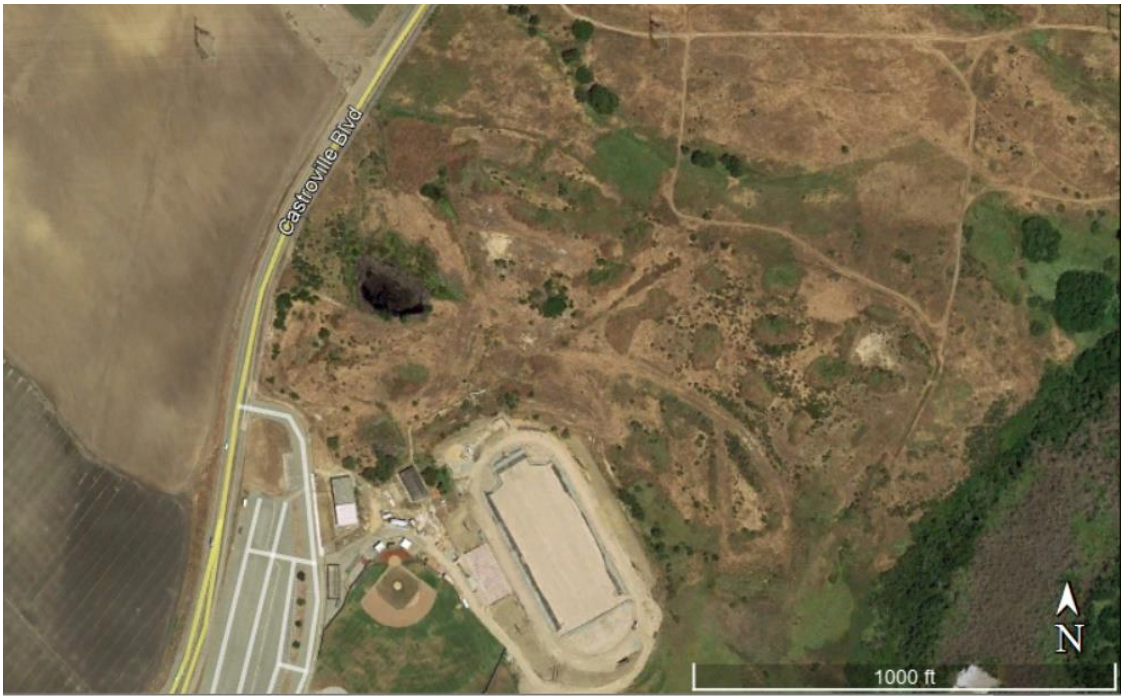


Figure 15. Photo monitoring locations

Results

Aerial Imagery

June 2017 (source: Google Earth)



February 2021 (source: Google Earth)

Point 1

Aug 2017

May 2018

April 2021

Point 4-A

Aug 2017

Nov 2017

April 2021

Point 4-B

Aug 2017

May 2018

April 2021

Point 5

Aug 2017

May 2018

April 2021

Point 7

Aug 2017

May 2018

April 2021

Point 8

Aug 2017

May 2018

April 2021

Point 9

Nov 2017

May 2018

April 2021

French Drain

Nov 2017

May 2018

April 2021

Erosion Area 1a

Nov 2017

May 2018

April 2021

Erosion Area 1b

August 2017

April 2021

Erosion Area 2

Nov 2017

May 2018

April 2021

7. CONCLUSION

Monitoring results discussed within this report show overall improvements in habitat condition, including increased native cover, reduced non-native cover, increased native vegetation richness, and reduced non-native richness. Each of the four ponds, except the Central Pond show an overall increase in CRAM score, however improvements in individual attributes and metrics differs between the ponds. Final CRAM scores may be impacted by the lack of water during the 2021 drought year. Although, bird monitoring results showed no measurable changes or trends in abundance or richness over the three year period, it is expected that bird species response to habitat enhancement efforts may be seen once native vegetation becomes better established and cover increases. Perhaps most importantly, the presence of SCLTS larvae found during aquatic dip net surveys in 2019 shows that the site is being used as a breeding site and that habitat enhancement efforts will continue to be beneficial to the species.

The following success criteria that were established at the beginning of the project have been met, or partially met (Table 12):

Table 12. Success criteria results

Success Criteria	Met?	Comments
Plant establishment: 20% increase in native cover of plants in areas planted	Partially	In the corridor zone this has been met.
Plant establishment: 20% increase in woody vegetation cover in areas planted	Yes	Site-wide this has been met
Plant establishment: 40% increase in diversity of plants in areas planted	Yes	Site-wide this has been met: An increase from 13 to 30 species
Improved Biotic Structure Score in CRAM (10 points)	Partially	North Pond met success criteria
Presence of SCLTS after three (3) to five (5) years and confirmed breeding success	Yes	SCLTS larvae found in 2019

Ongoing monitoring will be beneficial to continue to track condition of wetland, riparian, and upland condition, presence of SCLTS, and help inform adaptive management of the site. Furthermore the following recommendations are suggested for continued site enhancement and management moving forward (funding dependent):

- Continue to manage non-native vegetation
- Continue to plant natives to increase riparian and upland habitat cover
- Continue to manage emergent vegetation (bulrush and cattail) within ponds to increase open water for potential amphibian breeding habitat
- Enhance North and South Ponds by installing liner or excavate deeper to increase water holding potential

- Install salamander barrier along Castroville Blvd
- Install a couple year-round bird water stations; one adjacent to the South Pond and the other near the Central Pond to increase overall bird diversity as well as stability
- Maintenance of trails to provide safe access for students and public education.