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BREEDING AND NON-BREEDING WATERBIRDS 11

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CHAPTER SUMMARY

Central Valley wetlands play a vital role for North American waterbirds and provide a multitude of benefits to people. Although less than 10% of the Central Valley's historical wetland acreage remains, this region still supports populations of a diverse array of waterbird species.

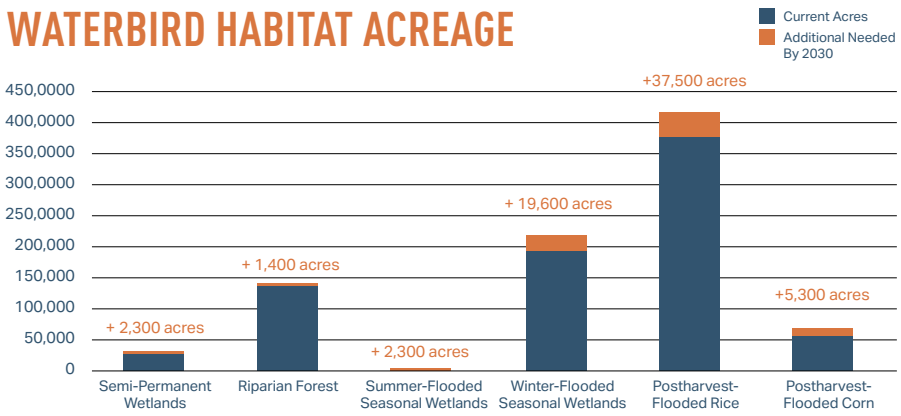
This chapter describes the conservation objectives for the restoration and enhancement of wetlands, flooded croplands, and adjacent riparian forest needed to support robust populations of waterbird species in the Central Valley. The goal is to reverse historical population declines of these species. The chapter uses population objectives for a group of 10 representative species to determine overall habitat needs for waterbirds.

The Conservation Delivery chapter in Section I integrates these habitat objectives with the habitat objectives for other bird groups in the Implementation Plan to present total habitat needs in the Central Valley. The chapter then describes conservation actions for achieving these integrated habitat objectives.

HABITAT TYPE

Waterbirds in the Central Valley use a wide variety of habitat types, but mainly semi-permanent and seasonally flooded wetlands, postharvest-flooded rice and corn fields, and adjacent riparian forests. Within these habitats, various bird species may respond differently to particular water depths, vegetation structure and extent, season of flooding, degree of human presence, and other factors.

WATERBIRD HABITAT ACREAGE



HABITAT SUCCESS STORIES

since the 2006 Implementation Plan

Stone Lakes National Wildlife Refuge provides important foraging and roosting habitat for greater and lesser sandhill cranes during their non-breeding season. Progress over the last decade includes:

- 240 acres of suitable crane habitat added to the refuge
- Habitat enhancement completed for 80 acres of wetlands
- Number of cranes has increased: from two cranes in 1999, to 710 in 2010, to more than 1000 roosting cranes in 2015

SHORT-TERM OBJECTIVE (CURRENT + ADDITIONAL):

869,300 ACRES OF HIGH-QUALITY WATERBIRD HABITAT

WHAT'S NEEDED?

68,300 ADDITIONAL ACRES

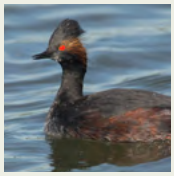
BIRD SPECIES INCLUDE:

Representative waterbird species in the Central Valley:

Snowy egret*

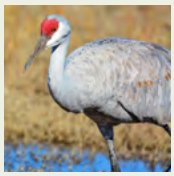
White-faced ibis*

Species of heightened conservation concern:

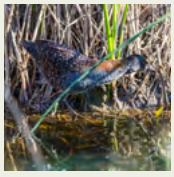


Eared grebe**

Forster's tern**



Sandhill crane***



Black rail****

*Image: Brian Gilmore **Image: Tom Grey ***Image: Steve J. McDonald ***Image: Philip Robertson

(1) Snowy egret - Tom Grey (2) Central Valley wetlands - Anders Ericsson and Lighthawk (3) Western grebe - Tom Grey

INTRODUCTION

Historically, the Central Valley supported a diverse and abundant community of wetland-dependent birds, including waterfowl, shorebirds, and a group referred to here as waterbirds. This group includes loons, grebes, pelicans, cormorants, herons, egrets, night-herons, rails, coots, cranes, gulls, and terns. Despite the loss of more than 90 percent of its historical wetlands (Frayer et al. 1989), the Central Valley remains of continental importance for waterbirds (Shuford 2014a; Shuford 2014b), many of which have special conservation status at either the state or federal level.

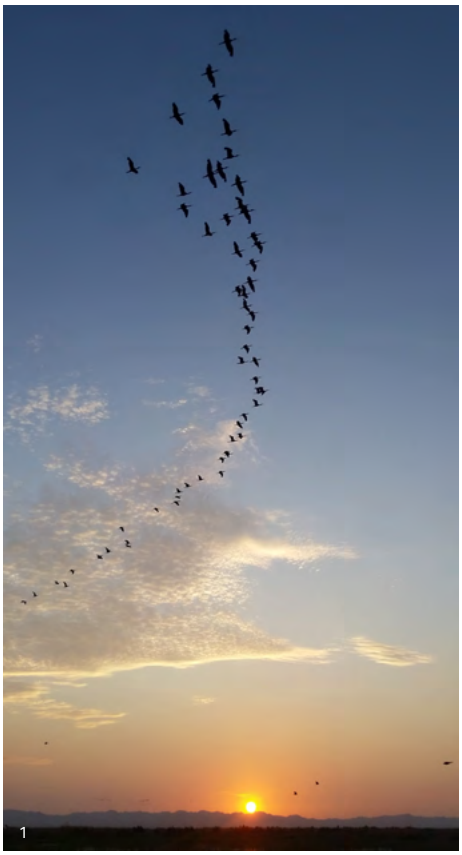
Waterbirds in the Central Valley use a wide variety of habitats, including managed and tidal wetlands, agricultural lands, riparian forest, and a range of water bodies. Protecting, restoring, and enhancing these habitats for waterbirds will also provide habitat for a broad suite of other animals and plants. These actions can also benefit people in surrounding communities by reducing flood risk, improving air and water quality, recharging groundwater, sequestering carbon, providing recreational opportunities, and attracting wildlife watchers who help support local economies.

In addition to facing habitat loss and degradation, waterbirds across North America are subject to a wide range of other threats, including contaminants, disease, and non-native predators. Sea-level rise and increasing prevalence of drought and other extreme weather patterns projected for the 21st century also threaten waterbirds (Kushlan et al. 2002; Shuford 2014a). The North American Waterbird Conservation Plan (Kushlan et al. 2002) provides a continental vision for the conservation of waterbirds. The Coastal California (BCR 32) Waterbird Conservation Plan, which encompasses the Central Valley in addition to central and southern coastal California (Shuford 2014a), provides regional conservation goals and objectives. These plans helped guide the development of the CVJV's conservation goals and objectives for breeding and non-breeding waterbirds.

The CVJV has established conservation objectives for habitat restoration and enhancement and for target population sizes of a representative suite of waterbird species. Improving and increasing habitat for these species will provide widespread benefits for waterbirds of all kinds in the region. This chapter explains these conservation objectives and how they can be applied to reach the conservation goals.

CONSERVATION GOAL

The Central Valley Joint Venture's long-term goals are to restore and enhance more waterbird habitat in the Central Valley and to reverse historical declines of waterbird populations in this region.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(1) White-faced ibis flock - Sara Miller (2) Sandhill cranes flying over wetlands - Tom Grey

WHICH SPECIES ARE INCLUDED?

The conservation objectives focus on 10 waterbird species that occur regularly in the Central Valley during either the breeding or non-breeding season (Table 11.1). These include eight species of heightened conservation concern and two additional species (snowy egret and white-faced ibis) chosen for additional representation of key habitat attributes. These focal species collectively represent the habitat needs of a broad range of waterbird species in this region. Managing habitat to support local populations of these species will likewise support diverse and healthy ecosystems (Chase and Geupel 2005).

American white pelican - Tom Grey

SPECIES (*SCIENTIFIC NAME*)	CONSERVATION STATUS[a]	HABITAT ASSOCIATIONS	
		BREEDING SEASON (MARCH – JULY)	NON-BREEDING SEASON
Eared grebe (*Podiceps nigricollis*)	WCP-32, NAWCP	Semi-permanent and summer-flooded seasonal wetlands	Semi-permanent and seasonal wetlands
Western grebe (*Aechmophorus occidentalis*)	WCP-32, NAWCP	Semi-permanent wetlands	Semi-permanent wetlands
California black rail (*Laterallus jamaicensus*)	ST, BCC, WCP-32, NAWCP	Semi-permanent wetlands	Semi-permanent wetlands
Sandhill crane (*Antigone canadensis*)	ST[b], BSSC[c], WCP-32	NA	Forages in postharvest dry and flooded corn and rice, other cereal grains, alfalfa, pasture, and seasonal wetlands. Nighttime roosts are in shallowly flooded seasonal wetlands and agricultural fields.
Black tern (*Chlidonias niger*)	BSSC, WCP-32, NAWCP	Rice and summer-flooded seasonal wetlands	NA
Forster's tern (*Sterna forsteri*)	WCP-32, NAWCP	Semi-permanent and summer-flooded seasonal wetlands	NA
American white pelican (*Pelecanus erythrorhynchos*)	BSSC, NAWCP	NA	Semi-permanent wetlands
Least bittern (*Ixobrychus exilis*)	BSSC, WCP-32, NAWCP	Semi-permanent wetlands	NA
Snowy egret (*Egretta thula*)	NAWCP	Nests in riparian forest (or residential trees); forages in semi-permanent and summer-flooded seasonal wetlands, rice, and other irrigated crops and pasture	Roosts in riparian forest; forages in semi-permanent and seasonal wetlands, postharvest-flooded rice, and other irrigated crops and pasture
White-faced ibis (*Plegadis chihi*)		Nests in semi-permanent wetlands; forages in semi-permanent and summer-flooded seasonal wetlands, rice, alfalfa, and other irrigated crops and pasture	Roosts in semi-permanent and seasonal wetlands; forages in semi-permanent and seasonal wetlands, postharvest-flooded rice, alfalfa and other irrigated or flooded crops and pasture

*[a] Conservation status designations: **ST**, state threatened species (**CDFW** 2016); **BSSC**, California Bird Species of Special Concern (Shuford and Gardali 2008); **BCC**, U.S. Fish and Wildlife's Birds of Conservation Concern (**USFWS** 2008); **WCP-32**, species ranked as of high or moderate concern in the Coastal California Waterbird Conservation Plan (Shuford 2014a); **NAWMP**, species ranked as of highest, high, or moderate concern by the North American Waterbird Conservation Plan (Kushlan et al. 2002).*
[b] State threatened status is for the greater sandhill crane (Antigone canadensis tabida).
[c] Bird species of special concern status is for the lesser sandhill crane (Antigone canadensis canadensis).
NA: Not Applicable

TABLE 11.1 Waterbird focal species: Conservation status and habitat associations during the breeding and non-breeding seasons.

WHICH GEOGRAPHIC AREAS ARE INCLUDED?

Conservation objectives were defined for each of the five planning regions in the CVJV's Primary Focus Area (Figure 11.1).

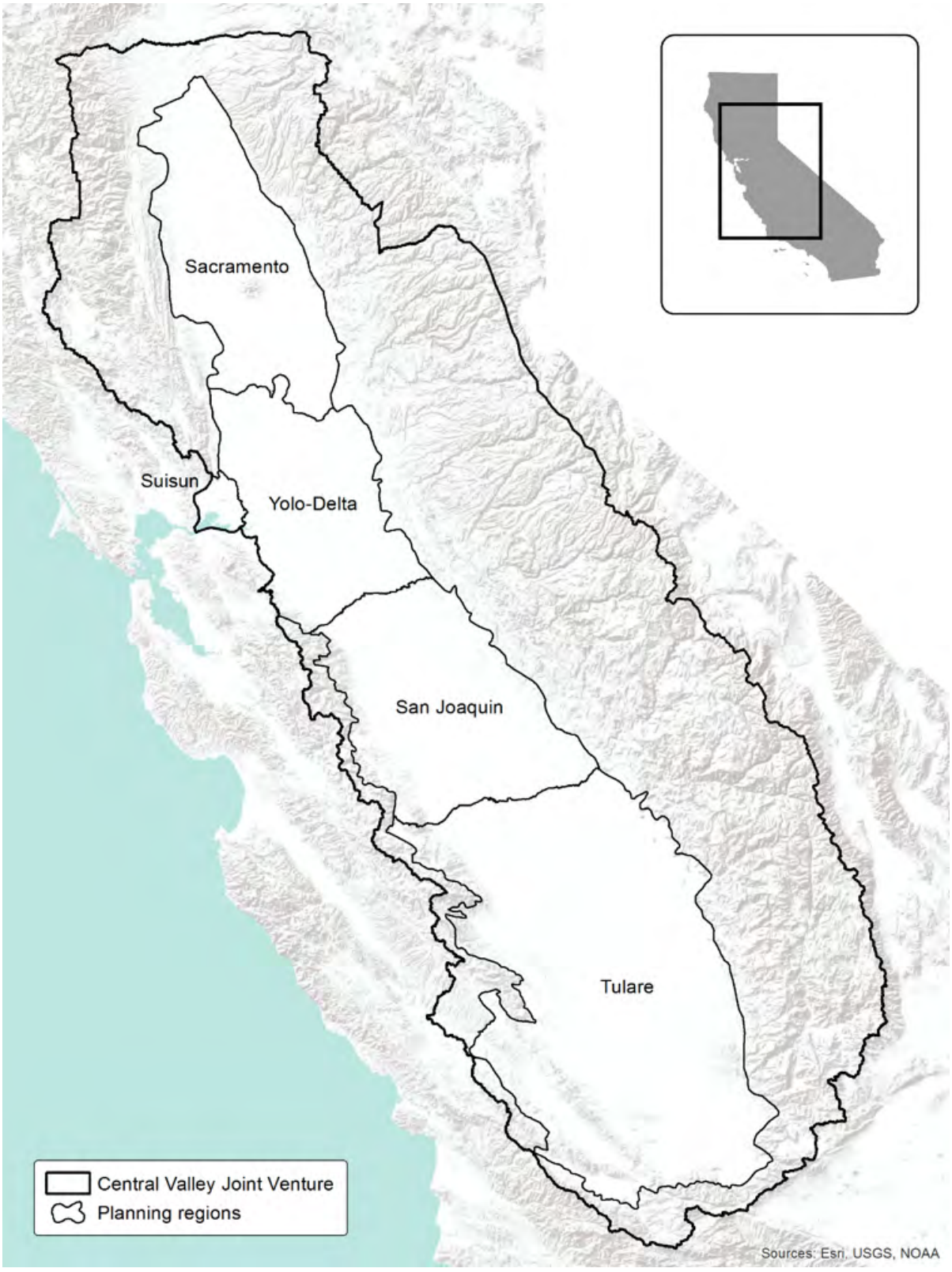

FIGURE 11.1 Central Valley Joint Venture perimeter and Primary Focus Area, showing the five planning regions.

CURRENT CONDITIONS

Current Population Sizes and Trends

The current population sizes and trends of many waterbird species in the Central Valley are unknown. Recent (2010–2012) censuses of colonial nesting waterbirds throughout California (Shuford 2014b) provide data for five of the 10 focal species. These surveys estimated a total of only five breeding pairs of eared grebes and 16 pairs of Forster's terns, versus 755, 996, and 18,005 pairs of snowy egrets, black terns, and white-faced ibis, respectively. The numbers of nesting black and Forster's terns were well below those recorded in the Central Valley in 1998 (Shuford et al. 2016). The reasons for these changes are unknown but likely reflect the effects of recent drought conditions rather than a long-term trend. Waterbird populations in the Central Valley may vary substantially between years with variation in habitat availability, particularly during the breeding season. The CVJV did not find any recent, comparable population size estimates for Central Valley waterbirds during the non-breeding season.

Current Habitat Conditions

The habitat types currently available to waterbirds in the Central Valley vary seasonally and spatially. During the breeding season, these include an estimated total of 22,800 acres of semi-permanent managed wetlands and 141,600 acres of riparian forest (Table 11.2). Some of the riparian forest is located near suitable waterbird foraging habitat and provides nesting substrate for colonies of breeding herons, egrets, night-herons, and cormorants. Researchers also estimated a 2007–2014 average of 541,400 acres of cultivated rice fields, 94 percent of which falls in the Sacramento planning region. The rice fields provide potential nesting habitat for black terns and foraging habitat for white-faced ibis, egrets, herons, and night-herons.

During the non-breeding season, available habitat types for foraging and roosting include many of the same types available during the breeding season, as well as winter-flooded seasonal wetlands and postharvest-flooded crops. There were an estimated total of 196,400 acres of winter-flooded seasonal wetlands in 2015, concentrated in the Sacramento and San Joaquin planning regions (Table 11.3). Of the 541,400 acres of planted rice, approximately 374,600 acres (69 percent) have open water during the peak of postharvest flooding in early January (Table 11.4). Similarly, there were an estimated 2007–2014 average of 227,600 acres of planted corn in the Yolo-Delta region, of which approximately 52,800 acres (23 percent) have open water during the peak of postharvest flooding in early February. Other suitable crop types planted in the Central Valley add another 2.8 million acres of potential waterbird habitat, depending on the extent and timing of irrigation and any postharvest flooding. These crops include alfalfa, irrigated pasture, field and row crops, and other grains such as winter wheat, triticale, and barley (Table 11.4). However, the estimated peak area of field and row crops and other grains that were flooded, on average, between 2007 and 2011 was just three percent (Dybala et al. 2017).

The assessment of current existing habitat acreage does not include estimates for habitat types not included in the objectives, such as alfalfa, irrigated pasture, various grain crops, field and row crops, flood-water storage or recharge facilities, freshwater reservoirs, lakes, ponds, and agricultural evaporation and wastewater treatment ponds.

DEVELOPING THE CONSERVATION OBJECTIVES

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Population Objectives

Historical population sizes and long-term trends of waterbirds in the Central Valley are unknown. Because at least 90 percent of the Central Valley's historical wetlands have been lost, most waterbird species are likely to have experienced population declines of at least 50 percent over the last 100 years. Therefore, to meet the goal of reversing the impacts of these historical wetland losses, this Implementation Plan (hereafter, "the Plan") set long-term (100-year) conceptual population objectives of doubling the current population sizes (100 percent increase) of most of the waterbird focal species. The corresponding short-term (10-year) objective is to increase population sizes by 10 percent. For species estimated to have relatively very small populations (fewer than 500 breeding individuals), namely the eared grebe and Forster's tern, the long-term objective was increased to tripling current population sizes (200 percent increase), with a corresponding 20 percent increase over the short-term. For the white-faced ibis, which is estimated to have a relatively large population (>20,000 individuals) and an increasing population trend (Shuford et al. 1996; Shuford 2014b), the Plan defined long- and short-term objectives of maintaining current population sizes.

Habitat Objectives

Waterbirds use a wide range of habitat types in the Central Valley. For this Plan, habitat objectives were defined for the six habitat types with the highest potential for restoration and enhancement: semi-permanent wetlands, riparian forest, summer-flooded seasonal wetlands, winter-flooded seasonal wetlands, postharvest-flooded rice, and postharvest-flooded corn.

The Plan does not call for the creation or enhancement of new lakes, ponds, reservoirs, rivers, or agricultural canals, or for crops (e.g., alfalfa, irrigated pasture, summer-flooded growing rice) for which there appears to be limited capacity or opportunity to increase their extent or enhance their suitability for waterbirds. The Plan also recognizes that the extent of cultivated rice and other crops will vary according to market forces and climatic conditions (e.g., drought). In addition, habitat objectives were not defined for nesting habitat in evaporation ponds or waste-water treatment ponds due to concerns about contaminants and disease. There still may be conservation opportunities in each of these habitat types, however, such as enhancing nesting habitat for grebes in lakes, ponds, and reservoirs (Table 11.5).

Short-term habitat objectives were defined by hypothesizing that meeting the short-term population objective of a 10 percent increase in most of the populations of waterbird focal species would likely require a 10 percent increase in the total area of each of the six key habitat types. Further research will be required to test this hypothesis by quantifying current waterbird population sizes and tracking whether increases in habitat directly correspond to increases in population size. In the meantime, short-term habitat objectives were defined as a 10 percent increase (acres needed) for most key habitat types. Because summer-flooded seasonal wetlands are currently rare and their extent unknown, the short-term habitat objective for this cover type was set to be equivalent to the acres needed for semi-permanent wetlands. In addition, because the specific location of riparian vegetation is more limiting than its total acreage, the habitat objective for riparian forests was set as a 1 percent increase, that should be strategically located adjacent to waterbird foraging habitat.

Portions of each habitat objective were then assigned to each of the five planning regions. For winter-flooded seasonal wetlands and postharvest-flooded rice and corn, these were simple 10 percent increases in the existing habitat estimated for each region. For semi-permanent wetlands, riparian vegetation, and summer-flooded seasonal wetlands, larger proportions of the overall habitat objective were assigned to the San Joaquin and Tulare planning regions, where there is the greatest need for improvement. In addition, objectives for more extensive increases in semi-permanent and summer-flooded seasonal wetlands in these planning regions will benefit eared grebes and Forster's terns, the two focal species with very small breeding populations and the most ambitious relative population objectives.

Extending this general approach leads to the assumption that meeting the long-term objectives of doubling the populations of most waterbird focal species would require long-term habitat objectives of doubling the extent of corresponding habitats. At this time, however, the Plan is focusing only on the short-term habitat objectives, given the uncertainty in the current population sizes and trends of the focal species and in the relationship between increases in habitat and increases in waterbird population size.

Additional details on the sources of data, methods, results, and references relative to setting conservation objectives for waterbirds in the Central Valley can be found in Shuford and Dybala (2017).

(1) White-faced ibis flock - R. McLandress (2) Fledgling Forster's tern - Tom Grey

CONSERVATION OBJECTIVES

Habitat Objectives

The Plan defines short-term (10-year) habitat objectives for each of six key habitat types used by waterbirds during either the breeding or non-breeding seasons for nesting, roosting, and/or foraging (Tables 11.2 and 11.3). These objectives represent the estimated total extent of each habitat type required to meet the short-term population objectives.

The key waterbird habitat types include:

- Semi-permanent wetlands, used year-round for nesting, roosting, and foraging. Some of these target increases are in addition to the wetland habitat objectives for waterfowl and shorebirds.
- Riparian forest, used year-round for nesting and roosting during the breeding season and roosting during the non-breeding season. These objectives are not in addition to the objectives for riparian landbirds, but should be strategically placed adjacent to waterbird foraging habitat (i.e., wetlands and irrigated crops and pasture).
- Summer-flooded seasonal wetlands (also called "reverse-cycle" wetlands), used during the breeding season for nesting, foraging, and roosting. These objectives may have to be increased to account for year-to-year fluctuations in availability of this habitat type (see Applying the Conservation Objectives).
- Winter-flooded seasonal wetlands, used during the non-breeding season for roosting and foraging.
- Postharvest-flooded rice and corn fields, used during the non-breeding season for roosting and foraging. The objectives for these two habitat types assume no change in the average annual extent of rice and corn planted (Table 11.4), but rather an enhancement of these cover types by increasing the proportion that is flooded postharvest.

Gray Lodge Wildlife Area - Brian Gilmore

HABITAT TYPE PLANNING REGION	SHORT-TERM HABITAT OBJECTIVE	CURRENT ESTIMATE	ACRES NEEDED BY 2030 (difference)
Semi-Permanent Wetlands			
Sacramento	5,575	5,348	228
Yolo-Delta	4,238	4,010	228
Suisun	5,722	5,494	228
San Joaquin	3,668	2,872	796
Tulare	5,830	5,034	796
Total	**25,033**	**22,758**	**2,276**
Riparian Forest			
Sacramento	70,022	67,897	213
Yolo-Delta	34,995	32,869	213
Suisun	1,408	0	141
San Joaquin	29,198	24,949	425
Tulare	20,144	15,893	425
Total	**155,768**	**141,608**	**1,416**
Summer-Flooded Seasonal Wetlands[a]			
Sacramento	228	–	228
Yolo-Delta	228	–	228
Suisun	0	–	0
San Joaquin	682	–	682
Tulare	1,138	–	1,138
Total	**2,276**	**–**	**2,276**

[a] *Although there do not appear to be any estimates for the extent or distribution of summer seasonal wetlands in the Central Valley, this type of wetland generally appears to be rare in the region overall.*

TABLE 11.2 Short-term (10-year) habitat objectives for waterbirds: year-round or breeding season. Breeding season is mainly March–July. Objectives (in acres) are shown by planning region along with current estimates of each habitat type and the estimated additional acres needed to meet the habitat objectives. (Sums may not be exact, due to rounding in original data.)

HABITAT TYPE PLANNING REGION	SHORT-TERM HABITAT OBJECTIVE	CURRENT ESTIMATE	ACRES NEEDED (DIFFERENCE)
Winter-Flooded Seasonal Wetlands			
Sacramento	75,344	68,495	6,849
Yolo-Delta	24,150	21,955	2,195
Suisun	31,628	28,752	2,876
San Joaquin	64,213	58,375	5,837
Tulare	20,718	18,834	1,884
Total	**216,053**	**196,411**	**19,641**
Postharvest-Flooded Rice			
Sacramento	391,395	355,814	35,581
Yolo-Delta	20,690	18,809	1,881
Suisun	0	0	0
San Joaquin	0	0	0
Tulare	0	0	0
Total	**412,085**	**374,623**	**37,462**
Postharvest-Flooded Corn			
Sacramento	0	0	0
Yolo-Delta	58,084	52,804	5,280
Suisun	0	0	0
San Joaquin	0	0	0
Tulare	0	0	0
Total	**58,084**	**52,804**	**5,280**

TABLE 11.3 Short-term (10-year) habitat objectives for waterbirds: Non-breeding season. Objectives (in acres) are shown by planning region, along with current estimates of the peak availability of each habitat type during the non-breeding season and the estimated additional amount needed to meet the habitat objectives. For postharvest-flooded rice and corn, the peak availability is less than the total extent planted (Table 11.4) because it includes only the proportion that has open water during the non-breeding season. Note that objectives for semi-permanent wetlands and riparian vegetation (Table 11.2) also contribute to habitat during the non-breeding season. (Sums may not be exact, due to rounding in original data.)

Population Objectives

The Plan defines long-term (100-year) population objectives of doubling (100 percent increase) the population sizes of most of the focal species; tripling (200 percent increase) populations of the eared grebe and Forster's tern, and maintaining the current population sizes of the white-faced ibis. Corresponding short-term (10-year) objectives are increases of 10 percent and 20 percent for the grebe and tern, respectively, and no increase for the ibis. These objectives represent current estimates of the population sizes needed to achieve the goal of reversing the impacts of historical habitat losses and degradation on waterbird populations in the Central Valley. However, these population objectives are not currently quantifiable because the current population sizes of many waterbird species in the Central Valley are unknown. Thus, these population objectives are solely conceptual, used to estimate the increase in habitat required to double or triple current population sizes.

PLANNING REGION	RICE	CORN	ALFALFA	IRRIGATED PASTURE	OTHER GRAINS	FIELD AND ROW CROPS
Sacramento	509,873	33,350	47,274	24,083	75,960	135,389
Yolo-Delta	26,953	227,626	162,887	24,950	162,395	176,283
Suisun	0	17	220	1,737	4,407	154
San Joaquin	4,536	143,178	176,839	35,818	127,444	334,006
Tulare	0	202,761	251,693	67,937	352,854	687,365
Total	**541,362**	**606,932**	**638,915**	**154,525**	**723,061**	**1,333,198**

TABLE 11.4 Estimated total area of crops potentially compatible for waterbird habitat. Estimates (in acres) shown by planning region and for crops that could be used by waterbirds, depending on the extent and timing of flooding or other management efforts. The estimate for irrigated pasture is from 2013; all other estimates represent the 2007–2014 average. (Sums may not be exact, due to rounding in original data.)

APPLYING THE CONSERVATION OBJECTIVES

Habitat Objectives

Because the understanding of waterbird population sizes and dynamics is uncertain, the Plan focuses on short-term objectives. For the flooded habitat types, the objectives represent the total extent that will need to be reliably flooded every year by the end of the 10-year period, i.e., current acres plus additional acres needed, assuming none of the current acreage is lost. These additional acres can be achieved through restoration and, in some cases, through enhancement as described below.

For the purposes of this Plan, "habitat restoration" means conversion of land that does not currently consist of the target land cover type into that cover type. For seasonal and semi-permanent wetlands, this includes creating and flooding new wetlands (measured from 2015, the most recent estimate for the extent of Central Valley managed wetlands). For riparian forest, this includes establishing new areas with native riparian-associated shrubs and trees (measured from 2012, the year of the most recent riparian vegetation GIS layer). The acreage of new wetlands that are reliably flooded, and new riparian habitat created by a restoration project adjacent to waterbird foraging habitat, would both count as contributing to the waterbird habitat objectives.

"Habitat enhancement," in this situation, indicates increasing the extent of flooding of existing habitat, making it more available and more useful to waterbirds. For rice and corn, this includes increasing the proportion of planted croplands that are regularly flooded postharvest.

Similarly, the additional acres of summer-flooded seasonal wetlands can be met through restoration or by opportunistically flooding dormant wetlands or fallow agricultural fields in years of exceptional runoff (when water is freely available). Managing summer-flooded seasonal wetlands can be costly due to high evaporation rates, rapid vegetation growth, and mosquito abatement. Therefore, it may be more feasible to provide summer seasonal wetlands opportunistically. In this case, the habitat objectives for summer seasonal wetlands should be increased to make up for the lack of this habitat type in most years. For example, if such conditions occur only once every 10 years, the habitat objectives would be increased 10-fold.

Suisun Marsh - Steve Martarano/USFWS

The CVJV can track overall progress toward the semi-permanent and seasonal wetland objectives through a combination of tracking wetland restoration projects and recording satellite imagery of surface water to estimate the area flooded. Similarly, progress toward the postharvest-flooded rice and corn objectives can be tracked through a combination of National Agricultural Statistics Service surveys and satellite imagery of surface water. Overall progress toward the riparian habitat objectives can be tracked through updates to California Department of Fish and Wildlife vegetation GIS layers (http://www.dfg.ca.gov/biogeodata/bios/dataset_index.asp).

(1) Greater sandhill crane - Steve J. McDonald (2) Lesser sandhill cranes - Bruce Miller, Elk Grove, CA (3) Birdwatchers - Shelley Hammon

SUCCESS STORY

SANDHILL CRANE FESTIVAL

Every year in November, thousands of visitors make their way to public wetlands and private farmlands around Lodi, California to see overwintering migratory birds. The annual festival is timed to coincide with the arrival of thousands of sandhill cranes from their long migratory journey from nesting grounds as far away as Siberia. The cranes remain in the Central Valley through February.

Since 1996, the Lodi Sandhill Crane Festival has helped to promote bird and wetland conservation and connect people with nature in the Central Valley. Significantly, the event also brings an influx of dollars to the area, as bird- and wildlife-watchers pay for hotels, meals and local transportation and support local artists, in addition to paying for the various festival events. This consumer activity provides an incentive to area landowners and voters to protect crane habitat.

The CVJV is one of numerous sponsors of the Lodi Sandhill Crane Festival. This annual event showcases the private/public partnerships that are key to meeting the goals of the CVJV Implementation Plan.

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ADDITIONAL CONSERVATION CONSIDERATIONS

Manage habitat for species-specific needs

In addition to meeting the habitat objectives for each of the key waterbird habitat types, achieving the CVJV's long-term goals will require providing specific habitat features required by individual waterbird species. Such requirements may include a particular combination of vegetation cover, water depth, timing of flooding and water level stability, or proximity of foraging habitat to roosting or nesting sites (Table 11.5). For example, American white pelicans require extensive open water ranging from 1 to 8 feet deep with robust fish populations for foraging, whereas California black rails require wetlands with shallow water (less than 1.2 inches deep) and dense vegetation cover.

Also, habitat requirements for particular species may vary among geographic regions of the Central Valley. Consequently, the Plan makes species-specific conservation recommendations that sometimes vary by planning region (Table 11.5). For example, at least half of the wetland habitat acreage in the Sacramento and Yolo-Delta planning regions should have features suitable for black rails, and at least half of the habitat acreage in the Sacramento, San Joaquin, and Tulare planning regions should have features suitable for western grebes or Forster's terns. These specific habitat features do not overlap extensively with those needed by most waterfowl and shorebirds.

Half of the additional semi-permanent wetlands created to meet the habitat objective for each planning region should have features specifically suitable for particular waterbird species. Meeting the needs of all of these waterbird species will likely require coordination of restoration, enhancement, and management across the Central Valley.

Western grebes performing a courtship dance - Tom Grey

FOCAL SPECIES	KEY PLANNING REGIONS	CONSERVATION RECOMMENDATIONS
Eared grebe	San Joaquin Tulare	Provide nesting habitat in shallow wetlands with emergent or surface vegetation for building floating nests and abundant aquatic invertebrates. Avoid botulism outbreaks by rotating wetlands among areas with no prior evidence of disease. Avoid human disturbance of floating nests (e.g., airboats).
Western grebe	Sacramento San Joaquin Tulare	Provide extensive areas of open, clear water (e.g., reservoirs) with emergent or aquatic vegetation for building floating nests and abundant fish prey. Maintain water levels and establish low-wake zones or enforce closed zones for boats around nesting colonies. Use signage and public outreach to reduce other causes of mortality (e.g., boat propeller strikes, fishing line entanglement). Restore nesting substrates where feasible (Ivey 2004; Robison et al. 2010).
Black rail	Sacramento (and Sierra Nevada foothills)	Provide shallow (<1.2 inch deep) semi-permanent wetlands (particularly those >0.25 acres) with flowing water and dense vegetation. Avoid overgrazing at spring- or stream-fed marshes, especially during the breeding season (March–July). Maintain and improve wetland connectivity (Richmond et al. 2010, 2012).
	Yolo-Delta Suisun	Protect and restore tidally influenced in-stream islands with dense wetland and riparian cover (particularly those >30 acres; Tsao et al. 2015). Maintain or establish upland habitats for escape cover during flood events.
Sandhill crane	Sacramento Yolo-Delta San Joaquin Tulare	Protect vulnerable roost sites by fee-title acquisition or conservation easements; protect foraging landscapes around existing roosts through easements restricting incompatible crop types and development. Enhance food availability (e.g., waste grain) on conservation lands and encourage crane-friendly management on private lands. Develop new protected roost sites toward the edge of crane use areas to enable them to access additional foraging areas (Ivey et al. 2014).
Black tern	Sacramento	Maintain sufficient acreage of rice fields for breeding and foraging. Avoid short-term draw-downs of water during the tern breeding season (May-July).
	San Joaquin	Create tern nesting habitat primarily in years of exceptional runoff, when it will have the greatest impact (Shuford et al. 2001; Shuford 2008). For example, spread water (~ 5 inches deep) over large areas within the Eastside Bypass near Los Banos and the James Bypass/ Fresno Slough south of Mendota Wildlife Area, or draw water from upstream, circulate it through wetland impoundments, and drain it back into the bypass downstream. Maintain a slow but steady flow to reduce botulism risk.
	Tulare	In wet years, flood fields with residual vegetation or crop stubble for use as breeding habitat; retire fields with marginal crop yields and put them in a conservation bank to be flooded when water is available. Avoid botulism outbreaks by rotating wetlands among areas with no prior evidence of disease (Shuford et al. 2001; Shuford 2008).
Forster's tern	San Joaquin Tulare	Provide semi-permanent wetlands and reservoirs with abundant small fish and features attractive for nesting, including barren, isolated islands and clumps of emergent vegetation surrounded by open water. Reduce human disturbance through signage or by closing zones around nesting islands (Shuford 2010, 2014a). In the Tulare planning region, create tern nesting habitat primarily in years of exceptional runoff, as described for the black tern above.
American white pelican	All	Provide large and deep (1-8 ft) semi-permanent wetlands with robust fish populations for foraging during late summer through early winter. Also provide isolated loafing and roosting areas, such as islands and gravel bars (Shuford 2014a).
Least bittern	All	Provide shallow marshes (>25 acres) with dense emergent vegetation, particularly in semi-permanent wetlands already occupied by bitterns. Manage summer wetlands to increase dense emergent vegetation and prevent the spread of invasive plant species (Sterling 2008; Poole et al. 2009).
Snowy egret	All	Restore riparian woodlands for nest colonies near rice fields, wetlands, or flood-irrigated agriculture for foraging. Protect nest colonies from development, human disturbance, and if needed, excessive nest predation (Kelly 2014).
White-faced ibis	Sacramento Yolo-Delta San Joaquin Tulare	Provide shallow marshes with tall, open (early successional) emergent vegetation for nesting. Encourage growers to flood-irrigate (particularly pasture and alfalfa) to provide additional foraging habitat, and promote practices that favor earthworms and other invertebrate prey (e.g., organic). Reduce pesticide use, particularly in wintering areas where currently unregulated (Shuford 2014a).

TABLE 11.5 Conservation recommendations for waterbird focal species, by key planning regions.

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