CENTRAL DELTA CORRIDOR PARTNERSHIP

Conservation Opportunity Region Overview

Regional Setting and Management History

The Central Delta Corridor (Figure 1) is characterized by lakes, floodplain, and tidal wetland areas within the Stone Lakes National Wildlife Refuge (NWR), Cosumnes River Preserve (CRP), and the Cosumnes-Mokelumne river confluence to the north and northeast; deeply subsided islands[1] southward (Staten, McCormack-Williamson Tract, Bouldin, Webb, Holland, Bacon, Twitchell, Sherman, and Decker); and the flooded Franks Tract Recreation Area (Figure 2). The integrity of central Delta island levees is critically important due to their strategic position in the Delta. This single characteristic drives much of the vision and opportunities for conservation in the area. The region is crisscrossed by transmission lines, natural gas transmission and underground storage facilities, and shipping lanes. These infrastructure assets can represent significant constraints when converting agricultural land use to wetlands. Because of their predominately below sea level elevations, these islands offer opportunities for subsidence reversal actions that can store carbon by planting of certain crops, provide revenue, and provide wildlife habitat and the potential for habitat restoration.[2]

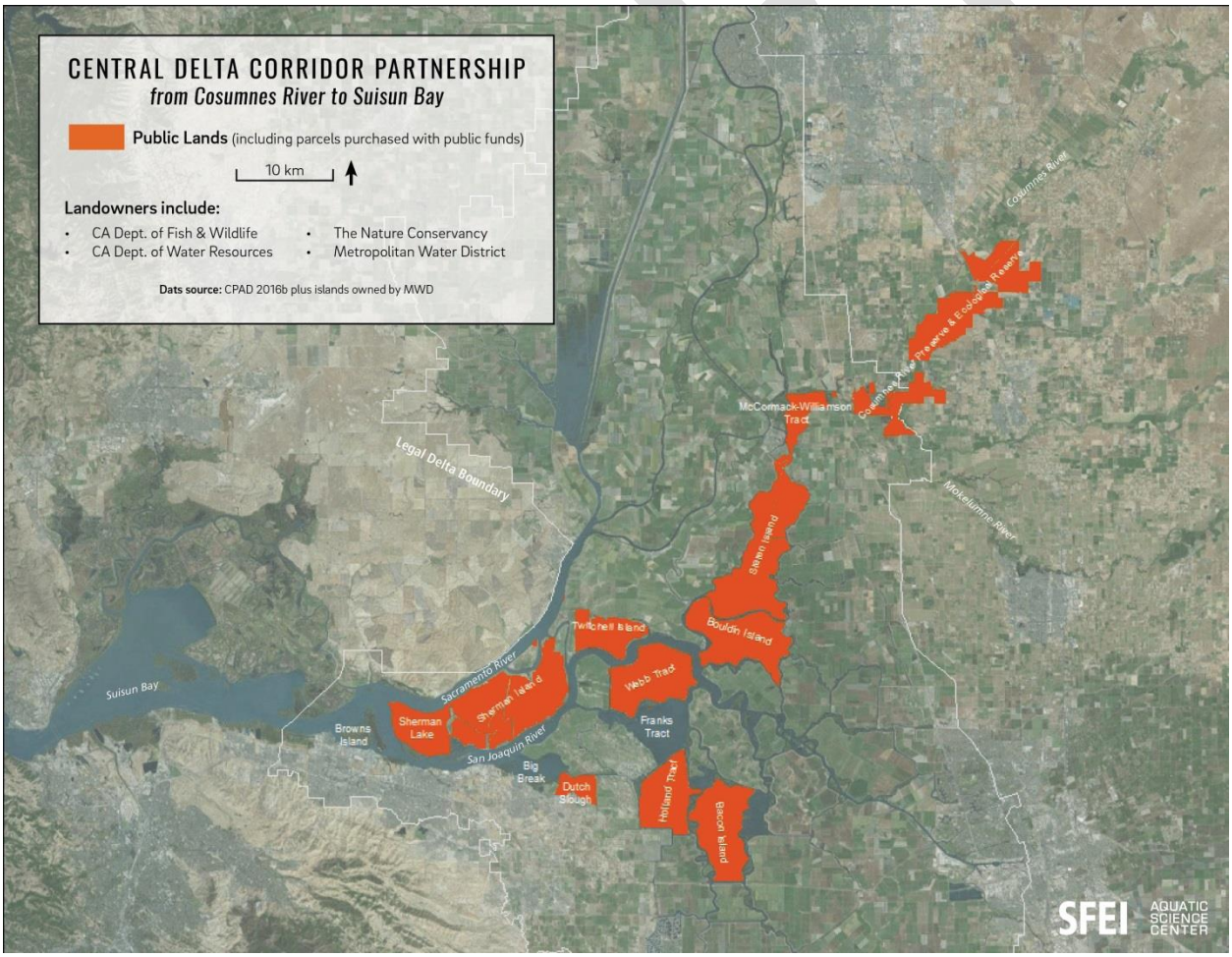

Figure 1: Map of Central Delta Corridor
Source: SFEI

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The Nature Conservancy (TNC) owns two parcels in the northeastern section of the Central Delta Corridor: **Staten Island**[3] (9,200 acres with 26 miles of levees) and **McCormack-Williamson Tract (MWT)**[4] (1,600 acres with nine miles of levees). First reclaimed in 1919, MWT's levees are lower than its neighboring islands by court decree. Consequently, MWT has flooded eight times in the recent past, most recently in 2017. Resulting floodwaters have significantly affected downstream properties. Because of its predominantly mineral versus organic peat soils, MWT is not severely subsided, with elevations extending from about +5 feet in its northern segment to -5 feet in its southern segment. Due to this elevation gradient, MWT is a perfect location for floodplain and tidal marsh habitat restoration. Floodplain and tidal marsh habitat restoration are currently under way at MWT through the support of the California Department of Water Resources (DWR) and California Department of Fish and Wildlife (CDFW) bond monies.

Figure 2: Aerial view of Franks Tract Recreation Area.
Photo: C. Sloop

Just south of MWT is **Staten Island**. Its elevation extends between -5 inches in the north to -17 inches in the south. It is managed for agriculture and migratory waterfowl, but predominantly for sandhill crane (*Antigone canadensis*). In its southern portion, agricultural production is diminishing due to wet and salty soil conditions caused mainly by subsidence. Historically, Staten Island has been a very vital component of Delta sandhill crane habitat. The importance of Staten Island to sandhill cranes has increased even further in recent times, as other lands in the Delta are converted to permanent crops (vineyards, orchards) that offer little habitat value to sandhill crane and waterfowl as compared to the field crops (corn and other vegetables) grown on Staten Island.

The **CRP**[5], located to the east of MWT, is managed to provide wildlife habitat, including birds that migrate throughout the Pacific Flyway, as well as various social, economic, and recreational benefits for surrounding communities and cities. The CRP consists of over 50,000 acres of wildlife habitat and agricultural lands owned by seven land-owning partners (Bureau of Land Management, CDFW, TNC, Sacramento County Regional Parks, DWR, Ducks Unlimited, and the California State Lands Commission). Buffered by a variety of agricultural operations, the CRP is centered along the Cosumnes River and associated floodplains and riparian habitat.

Further north, **Stone Lakes NWR**[6] is partially owned by the U.S. Fish and Wildlife Service (USFWS). The USFWS is currently managing 6,550 acres of the 17,640 acres of approved Refuge boundary—the area within which the USFWS is authorized to acquire, protect, and manage land. Established as a NWR in 1992, the unique lakes and waterways of the Stone Lakes basin are entirely within the 100-year floodplain. Its strategic location allows for buffering urban encroachment into the Delta and provides a habitat link with the neighboring CRP. The Stone Lakes NWR could serve as the northernmost extension of the Central Delta Corridor, thus providing continuous habitat linkages to the CRP and MWT that connect further through most of the central Delta southward to the central Delta islands (see Figure 1).

The Metropolitan Water District of Southern California (MWD) acquired four central Delta islands in 2016 –**Bacon, Webb, Holland, and Bouldin**– and a section of one island near Suisun Marsh, **Chipps Island**.[7] In buying these subsided islands, MWD's objectives are to preserve agriculture while promoting conservation objectives via wildlife-friendly farming, carbon sequestration, and improvement of channel margin habitat. In total, these five Delta islands constitute about 21,200 acres, and they are cumulatively protected by 56 miles of levees. On average, they are roughly 13 feet below sea level, except for Holland Tract being about nine feet below sea level.

Approximately 90 percent of **Sherman Island** (9,900 acres and 19.5 levee miles), 80 percent of **Twitchell Island** (Figure 3; 3,500 acres and 12 levee miles), and a portion of **Decker Island** in the west end of the Delta are owned and managed by DWR. Sherman and Twitchell Islands[8] were acquired mainly to protect water supplies in the Delta by maintaining island levees to reduce flood risk and prevent salt water intrusion into the Delta. As with other landowners, DWR is responsible for upholding the stability of the levees protecting these islands to safeguard its investment, the habitat features on these lands, and Delta water quality. Sherman and Twitchell Islands are both extremely subsided (about 21 feet below sea level), and like a number of Delta islands, are persistently at risk of flooding. Over the past 12 years, DWR has been experimenting with reversing subsidence by creating interior wetlands and planting native vegetation. In addition to reversing subsidence, these experiments have resulted in the sequestration of significant amounts of atmospheric carbon by the native vegetation. This has resulted in a strong interest from entities intent on developing a Delta carbon market to provide economic and flood management benefits to Delta landowners.

Figure 3: Aerial view of setback levee riparian strip and carbon farming at Twitchell Island. ***Photo: C. Sloop***

Owned and managed as a California State Park by the California Department of Parks and Recreation (State Parks), the 3,500-acre flooded **Franks Tract**[9] is accessible only by water. Situated between the False River and Bethel Island, the area is used primarily for fishing and waterfowl hunting. Franks Tract was originally reclaimed between 1902 and 1906 for farming. In 1938, the False River levee broke and flooded Franks Tract. It was never reclaimed. The 2016 Delta Smelt Resiliency Strategy includes an action for CDFW to develop a Franks Tract conceptual plan and feasibility study to assess restoring Franks Tract by reducing invasive aquatic weeds, decreasing predation on Delta smelt, increasing turbidity, and improving food webs.[25] Restoration of Franks Tract could begin as early as 2018 if the action is found to be feasible. Additionally, the **Delta Meadows River Park**[10] (DMRP), also owned and managed by State Parks, is an undeveloped piece of land located near the historic Chinese American town of Locke. The 472 acre property was established in 1985. The DMRP encompasses sloughs, wet meadows, and an island between the Sacramento and Mokelumne Rivers. At present, it is officially closed to the public and has no visitor services.

Vision

Due to the strategic location of the central Delta islands, their central role in maintaining water quality throughout the Delta, and the deeply subsided nature of many of the islands, levee integrity and subsidence reversal are high-priority components of a Central Delta Corridor vision. The deep subsidence on most central Delta islands limits potential prospects for conservation, but there are opportunities to enhance channel margin habitat and tidal habitat on the western-most islands. Invasive species control has also been identified as an important near-term action within this corridor. While central Delta islands are

Figure 4: Family fishing near Jersey Island. ***Photo: C. Sloop***

critically important for protecting water quality and water supply reliability, beyond levee strengthening, there are limited opportunities for near-term projects that would result in localized water quality or water supply reliability improvements. Recreation, mostly in the form of boating, fishing, wildlife viewing, and waterfowl hunting are important components of the Central Delta Corridor (Figure 4). With Proposition 1 bond funding[11], new opportunities exist for the implementation of pilot projects for potentially new technologies and approaches – such as living shorelines[12], horizontal levees[13], carbon farming[14], early detection and rapid response[15] – that could assist with levee strengthening, subsidence reversal, and invasive species control. A corollary vision for the Central Delta Corridor is one that incorporates potentially new technologies.

Opportunities for Conservation

From north to south, the Central Delta Corridor conservation areas owned by the public and nongovernmental organizations range from minimal to deep subsidence. Landscape-level conservation planning efforts need to consider opportunities along the full range of this environmental gradient; specific conservation strategies will only apply within parts of any given gradient.[16] Examples of specific conservation strategies include tidal marshes at intertidal elevations, woody riparian areas with stronger fluvial influence, and wildlife-friendly agricultural fields and managed marshes in deeply subsided areas.[16] Other critical connections to/from the Central Delta Corridor that should be considered in conservation planning include the tidal-terrestrial transition zone in the southwest portion (along the Sacramento River near the Sacramento-San Joaquin River confluence), remnant stepping stone marshes leading to the eastern and southern Delta from the confluence, connections to the upstream watershed and the Mokelumne/Cosumnes area, and connections to the brackish estuary on the western edge of the Delta.[16]

The northern/northeastern portions of the Central Delta Corridor are located within the planning area of the South Sacramento Habitat Conservation Plan (SSHCP),[17] which aims to streamline federal and state permitting processes for SSHCP-covered development and infrastructure projects while protecting habitat, open space, and agricultural lands. Long-term planning for the deeply subsided islands within the corridor is a critical issue that should be addressed early on. Additionally, as conservation moves forward in the Central Delta Corridor, local community concerns will have to be considered carefully to ensure long-term viability of the region.[18] Early and effective inclusion of all stakeholders in the planning process is essential to the success of conservation.[19]

Channel Margin Habitat and Levee Improvements

From Franks Tract east, through the Delta to the MWT and the CRP, the potential exists to restore suitable zones along the aquatic side of levees to a more natural state and benefit salmonids.[20] This can be accomplished by planting vegetation, anchoring woody debris, and constructing shallow benches to provide native species refuge areas from predators. A levee and habitat improvement plan developed by collaborating public landowners could simultaneously reduce flood risks, create strips of channel margin, and incorporate natural features such as mid-channel islands that would provide refuge areas for native species. Levee improvements and setbacks also set the stage for other important habitat enhancements, including reclaiming borrow sites as wetlands, stabilizing levee slopes by growing native perennial grasses, and providing erosion protection by establishing aquatic and waterside cover vegetation.

Wildlife-friendly Farming

In the Central Delta Corridor, as in the rest of the Delta, agriculture has been the main way of life, industry, and cultural linkage to the land for Delta residents for many generations. As a result of these strong cultural ties to the land, the local Delta community is concerned about the potential to lose their livelihood and lifestyle if conservation displaces agriculture. Therefore, it is important that conservation occur on public lands and other existing conservation lands first and include integrated management approaches that continue wildlife-friendly agriculture in a balanced land-use mosaic across the landscape.[21] It is well known that certain crops such as corn, rice, and irrigated pasture provide habitat for terrestrial and avian species, including iconic species like the sandhill crane.[22] For example, TNC has been managing lands on Staten Island for both agriculture production and migratory waterfowl habitat for the last 12 years, with additional benefits to recreational hunting. Public and private landowners could collaborate to provide valuable and sustainable habitat for migratory birds and other animals while maintaining their primary goals of agricultural economic vitality and resource conservation. This

management strategy becomes particularly valuable as many private lands are converting from habitat-friendly row crops to orchards and vineyards.

Carbon Sequestration and Subsidence Reversal

Since the late 1800s, more than 3.3 billion cubic yards of organic soils have disappeared in the Delta, resulting in land surface elevations 20 to 25 feet below sea level.[23] The volume below sea level (accommodation space) of approximately 1.7 million acre-feet represents a significant opportunity to implement carbon sequestration projects. Previous research has demonstrated that carbon dioxide (CO_2) emissions are positively correlated with subsidence.[24] Modeling results estimate that 1.5 to 2 million metric tons of CO_2 are emitted from about 200,000 acres of organic and highly organic mineral soils in the Delta each year as they continue to subside.[23] In addition to CO_2, nitrogen dioxide and methane emissions are also released during oxidation of soils.[24] Delta lands, such as Twitchell and Sherman islands, will continue to subside unless subsidence-neutral crops like rice, irrigated pasture, or wetland tules (*Schoenoplectus acutus*) are grown. These crops can store large quantities of carbon in rich peat soils while helping to slow or reverse soil subsidence. The 750,000-acre Sacramento-San Joaquin Delta, in particular the Central Delta Corridor, presents a key opportunity for carbon sequestration via tule wetlands and rice cultivation. Subsidence reversal actions also ultimately reduce the risk of flooding as islands increase in elevation over time; maintain revenue through agricultural sales and sale of carbon credits in a developing carbon market; and provide habitat for terrestrial, aquatic, and avian species.[2]

Aquatic Habitat Restoration – McCormack-Williamson Tract and Franks Tract

The MWT is viewed as a prime site for floodplain restoration, tidal freshwater marsh, seasonal wetlands, and riparian forest. TNC's current restoration vision for MWT is to let it flood naturally under high-water conditions to alleviate flood risks downstream while providing valuable aquatic and terrestrial habitat for native Delta species (Figure 5). Over time, a restored MWT could seasonally reconnect lakes, channels, and marshes to prominent features in the region including Delta Meadows, Snodgrass Slough, the Mokelumne River, Burton Lake, Grizzly Slough, Stone Lakes, Dead Horse Island, Staten Island, and the CRP. The ecological goals within this vision include increasing landscape complexity (the diversity of natural topography and native habitat types), landscape connectivity (provide continuous connections along physical gradients), and landscape resilience (the ability to adjust in response to environmental changes, including climate change). Franks Tract could be restored to enhance habitat conditions for Delta smelt[25] and other native fishes; minimize suitable habitat for nonnative fish and invasive plant species; modify tidal circulation to create conditions similar to historic conditions (pre-reclamation), with the tide entering and exiting primarily through False River; eliminate tidal flow through Franks Tract into Old River; create elevations to establish emergent marsh vegetation in the eastern portion of Franks Tract; and create conditions within Franks Tract to enhance turbidity through wind-wave action both onsite and downstream.

Figure 5: Aerial view of MWT flooded after 2017 levee breach
Photo: J. Grossman - TNC

Low-Impact Recreation

The Central Delta Corridor already contains recreation and related tourism opportunities, including wildlife viewing, hunting, fishing, camping, boating, and hiking.[26] These opportunities could be expanded and integrated with conservation efforts to provide increased economic value to local Delta communities. The Stone Lakes NWR and CRP at the northern edge of the corridor, the DMRP in the center (if opened to the public), and Franks Tract State Park at the southern end afford public recreational opportunities along the Central Delta Corridor. In some

areas, Central Delta Corridor landowners could consider developing additional recreational facilities (for example, picnic sites; trails; kayak, canoe and other small paddle-craft facilities; and interpretive services) with conservation activities. However, providing public access to additional conservation areas is also challenging because human disturbance to wildlife and other negative effects such as littering should be limited.[27]

Climate Change and Adaptation Opportunities for Long-term Sustainability

The Central Delta Corridor will be affected by climate change induced sea level rise within the next 30-100 years. Lands currently in the intertidal zones are projected to become subtidal.[28] Rising water levels will induce flooding when unprotected shorelines and nearby areas are submerged and will affect levee stability and resilience, especially along subsided islands (Figure 6).[29] In some parts of the Delta, sea level rise will mean that current agricultural land will be lost to increased salinity levels or inundation.[29] Additionally, flood dynamics are expected to change over the next few decades, with more frequent and extreme storm and rainfall events and associated flood pulses coming through the region.[29]

Figure 6: Levee failure at MWT during 2017 floods.
Photo: J. Grossman - TNC

Scenario planning[30] is a tool that could be used to help anticipate impacts of climate change on ecosystems, species, infrastructure, agricultural practices, recreation, and other land uses and to integrate these into the long-term conservation planning picture.[31] A scenario planning approach will also integrate long-term adaptive management and funding needs to anticipate how near-term conservation actions may evolve into the future. Using scenario planners and land managers to look ahead in a strategic way will help to determine the best way to prioritize conservation actions based on the likelihood of long-term effectiveness, the potential for outcomes to evolve over time, and cost effectiveness if implemented down the road. Regular reevaluation of scenarios over time will help with examining how exactly projections play out and how management actions of conservation lands need to be adjusted over time.

Potential Solutions to Recognized Challenges

Potential solutions to a number of challenges need to be considered to move forward with successful and sustainable conservation practices in the Central Delta Corridor. The incipient Central Delta Corridor partnership of public and private large-parcel landowners provides a unique chance to explore opportunities for conservation, identify collaborative multi-benefit solutions, and coordinate implementation. To realize this prospect, the Central Delta Corridor partnership could embark in a *Regional Conservation Strategy* planning process (see more information below) to substantiate their collective corridor vision.

Sustainable Long-term Operation and Management of Conservation Lands

Sherman and Twitchell islands, like other deeply subsided Delta islands, require high levees to protect them from routine flooding. These levees require significant and costly long-term maintenance. DWR has begun to address the causes of subsidence by withdrawing from agricultural leases and developing wetlands in their place to build back peat soils. The conversion of agricultural production to ecosystem services brings with it a significant increase in annual management costs and associated loss in revenue. Therefore, maintaining profitability and developing sustainable funding sources for land management and the operations and maintenance of these wetlands and levees is a priority. State bond funds used to construct the many subsidence-reversal wetland projects on these islands are not able to fund operations and management of conservation lands. Thus far, DWR has utilized traditional methods to provide the necessary funds for flood control and land management on their lands in the western Delta; however, these methods are not sustainable. One new possible funding source is revenue from

carbon market credits for carbon capture associated with subsidence reversal. By quantifying the level of carbon sequestered in the newly-developed peat soil of the wetland, credits can be sold.[2] Additional alternatives for funding sources include authorizing hunting leases on the wetlands and fulfilling mitigation requirements associated with other DWR projects.

Levee management and maintenance remains at the forefront of challenges to all Delta islands,[32] with California ground squirrels (*Otospermophilus beecheyi*) and beaver (*Castor canadensis*) dens threatening levee integrity and bird nesting season constraining maintenance activities. Alternative conservation-compatible management activities include sheep grazing on levees for clearing vegetation to maintain standards and detect leaks, providing raptor perches to help limit ground squirrel activity, and pre-placing emergency materials for flood events. Creating more gradual landside levee slopes could also counter balance levees and create more potential habitat.

Sustainable Wildlife-friendly Agricultural and Recreational Uses

Providing food resources for migratory birds within a diverse land use mosaic that balances minimal foraging distances with agricultural and recreational uses remains an ongoing challenge on a landscape scale (Figure 7). For example, an enduring management challenge is providing adequate wintering habitat (September-March) to sustain greater and lesser sandhill crane (*A. c. tabida* and *A. c. canadensis*) populations on Delta islands, while maintaining economically viable agricultural operations (Figure 8). Both species require shallow flooded areas for roost sites and dry agricultural fields (corn, wheat, pasture, alfalfa) for foraging habitat.[33] Land management to benefit sandhill cranes involves finessing the timing and amount of flooding and drawdown, carefully selecting the types and amounts of wildlife-friendly crops that can be grown, and balancing tradeoffs between harvest efficiency and availability of residual grain for waterbirds.[34] Crop diversity in the Delta can be limited as a result of soil, climate, low commodity prices, herbicide-resistant weeds, predation by grazing geese, salt build-up, and limited markets for non-GMO crops. All of these factors also limit the economic viability of farming operations on Staten Island. One potential solution to balancing agricultural production with wildlife needs would be to use additional flooding to reduce salts and subsequently increase yield.

Figure 7: Corn field at MWT before the 2017 flood.
Photo: C. Sloop

It will be critical to use strategic scenario planning to forecast and evaluate where decreased agricultural productivity aligns with opportunities for conservation as sea level rises and soil salinities increase. Reversal of land subsidence is a key management action critical to reestablishing agricultural lands as well as providing conservation benefits. As such, it will also be important to consider the carbon footprint of certain crop types commonly used to reverse subsidence of peat soils and fossil fuel use when conducting scenario planning to set the stage for the long-term sustainability of a balanced land-use mosaic across the Central Delta Corridor.

Currently, there are many possible opportunities to enhance monitoring and planning to inform conservation planning and management in the Central Delta Corridor including: regional sandhill crane monitoring, an assessment of Delta-wide habitat availability for sandhill cranes and other waterbirds, evaluation of winter food availability for waterbirds in the region, and large-scale pesticide (and possibly pharmaceutical) sampling in intake and drainage waters. In order to heighten public support for conservation and benefit the local agricultural economy, conservation planning could incorporate agro-tourism and increased public wildlife viewing opportunities via additional blinds, viewing platforms, and driving pull-outs. Sandhill crane conservation on Staten Island and Brack Tract is linked not only to wildlife-friendly agriculture, but also to the Lodi Crane Festival that celebrates the cranes' winter arrival and other crane viewing events, which bring many enthusiastic crane viewers to the area and draw in local revenue. In some cases, however, enhanced public use can result in trespassing,

poaching, vandalism, and burglary and compromise the safe access for public viewing of wildlife. As a result, public access planning should include consideration of greater enforcement in designated public areas and more signage.[18]

Link to Delta Conservation Framework

The Delta Conservation Framework is a high-level, 33-year planning framework with a landscape-scale focus across the entire Delta, Suisun Marsh, and Yolo Bypass, to guide conservation efforts until 2050. Implementation of its overarching goals and strategies is recommended in the context of regionally focused, multi-stakeholder partnerships that develop *Regional Conservation Strategies* with detailed regional objectives and implementation actions. The Central Delta Corridor planning partnership could become such a regionally focused effort, with the goal to develop a strategy with activities that tie in with Delta Conservation Framework goals. For example, the Central Delta Corridor partnership's interest in working with the Delta community aligns with Goal A of the Delta Conservation Framework. The Central Delta Corridor could also align with Goals C – E, which focus on developing multi-benefit conservation solutions through integrative data analysis and scenario planning. Strategies and objectives within these goals suggest utilizing best available datasets to implement actions that help reestablish ecological function; assist species recovery; and integrate conservation benefits with flood protection, wildlife-friendly farming operations, and recreation at the local and landscape scales. Development of a Central Delta Corridor *Regional Conservation Strategy* also presents a unique opportunity to address conservation-related permitting through a general regional permit (Goal F), and short- and long-term funding development via bond initiatives and other opportunities (Goal G).

Figure 8: Greater sandhill cranes in flight.
Photo: CDFW

Since starting in late 2016, the Central Delta Corridor partners have met regularly and have reached out to neighboring landowners. The partners are considering the upcoming planning steps, including the possibility of developing a *Regional Conservation Strategy*. They recognize that the cornerstones for successful conservation planning and implementation are: 1) establishing and maintaining trust among stakeholders, best achieved through continuous communication and evaluating goal-based progress; 2) an agreed-upon structure for roles and responsibilities to direct an implementation partnership; and 3) principles for stakeholder engagement based on inclusiveness, open and ongoing communication, and science-based decision support.

Entities/Partnerships Important for Implementation (Now and Ongoing)

Delta community members and stakeholders at the 2016 Delta Conservation Framework workshops commented that public lands should be the focus of Delta conservation efforts. The Central Delta Corridor represents a great opportunity to achieve this goal. Current Central Delta Corridor partners include MWD, TNC, DWR, CDFW, and the Natural Resources Agency. USFWS could be integrated into continuing planning activities if the Stone Lakes NWR is linked into the corridor in addition to other willing neighboring landowners. In the near term, the current Central Delta Corridor partnership is exploring steps to inventory and coordinate ongoing efforts, highlight additional opportunities, and develop an outreach strategy. The partnership also recognizes that a critical component to the success of the effort is local support. Therefore, outreach to and involvement of neighboring landowners is a key component of the strategy. Over the long term, the partnership is considering collaborating to develop a high-level strategy document that clearly identifies the most promising opportunities and most challenging constraints. This coordinated strategy is intended to help advocate for funding to better manage the conservation lands, encourage wildlife-friendly farming, and implement activities for habitat restoration.

Ongoing Research and Monitoring Activities

Ongoing monitoring and research activities (Figure 9) at Staten Island and McCormack-Williamson Tract:

- Sandhill crane roost and foraging surveys to assess population abundance and habitat use preferences (conducted weekly from mid-September to March)
- Large waterbird foraging surveys to monitor population abundance and habitat use preferences (conducted weekly from mid-September to March)
- Site conditions surveys to monitor progression of types and availability of habitat throughout the wintering season (conducted weekly from mid-September to March)
- Shorebird Surveys to document use by species in different crop and management types (conducted twice a month from mid-September to March)
- Waste grain (conducted in 2014 and 2015, may continue in 2017) and invertebrate diversity and abundance studies(conducted in 2015, continuation dependent on funding availability) to assess food by management practices and throughout the season
- Assessment of pesticides and nitrogen in intake and drainage water to determine presence and quantities of pesticides (conducted in 2014 and 2015, with plans to continue)
- Water use monitoring to determine best type of water meter on siphons to report water usage to the State Water Resources Control Board
- North Fork Mokelumne Slope Repair and Riparian Enhancement Project will address erosion issues on the levee and enhance riparian habitat
- Additional research projects are occurring on the island, conducted by visiting researchers

Figure 9: Monitoring Delta water quality. ***Photo: C. Sloop***

Collaborative Research Efforts

- Invertebrate diversity and biomass across crop cover types - U.S. Geological Survey
- Assessments of pesticide residues in intake and drainage water on Staten Island - Deltares, Inc.
- Testing the use of unmanned aerial vehicles to conduct sandhill crane roosting surveys – University of California, Merced
- Water use monitoring - Farm Data Systems, Inc.

Visiting Researchers

- Determining food availability for wintering waterfowl in Central Valley agricultural fields - University of California, Davis (UC Davis)
- Delta consumptive water use comparative study- UC Cooperative Extension (UCCE)
- Trial for winter cereal crops - UCCE
- Use of unmanned aerial vehicles for improving farm scale agricultural water management in agriculture at a farm scale - UC Davis
- Graduated Field Fish Barrier Project – U.S. Bureau of Reclamation
- Can habitat restoration mediate predator-prey interactions to increase juvenile salmon survival in the Sacramento-San Joaquin Delta?- University of California, Santa Cruz
- Monitoring weather - DWR

Habitat Enhancement Projects

- Implementation of rice on Staten Island for sustainability, ecosystem, and water quality benefits – HydroFocus; California State University, East Bay; UC Davis
- North Fork Mokelumne Slope Repair and Riparian Enhancement Project – Reclamation District 38

405 # Endnotes

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