Performance Measure 4.16: Acres of Natural Communities Restored

Performance Measure (PM) Component Attributes

Type: Outcome Performance Measure

Description

Restoring large areas of natural communities to provide for habitat connectivity and crucial ecological processes, along with supporting viable populations of native species.

Expectations

Increase acres of natural communities to contribute to suitable habitat for fish and other wildlife, restored habitat connectivity, and viable populations of native species.

Metric

Acres of natural communities restored. This metric will be updated and evaluated every five years.

Baseline

Acres of natural communities from the 2007 Vegetation Classification and Mapping Program (VegCAMP) dataset by the California Department Fish and Wildlife (CDFW), as designated below:

Ecosystem Type	Baseline Acres (2007 VegCAMP)
Seasonal Wetland Wet Meadow Nontidal Wetland	5,100
Willow Riparian Scrub/Shrub Valley Foothill Riparian Willow Thicket	14,200
Tidal Wetland	19,900
Stabilized Interior Dune Vegetation	20
Oak Woodland	0
Grassland	33,000
Vernal Pool Complex	5,100
Alkali Seasonal Wetland Complex	700

Target

Net increase of target acres of natural communities by 2050:

Ecosystem Type	Target Acres Net Increase (from Baseline Acres)	Total Area (Baseline Acres Plus Net Increase)
Seasonal Wetland Wet Meadow Nontidal Wetland	19,000	24,100
Willow Riparian Scrub/Shrub Valley Foothill Riparian Willow Thicket	16,300	30,500
Tidal Wetland	32,500	52,400
Stabilized Interior Dune Vegetation	640	660
Oak Woodland	13,000	13,000
Grassland	No net loss	33,000
Vernal Pool Complex	670	5,770
Alkali Seasonal Wetland Complex	230	930

Basis for Selection

The wetland and riparian ecosystems of the Delta once supported productive food webs and rich arrays of native plant and animal species that contributed to exceptional biological diversity (Myers et al. 2000). Historically, the Delta and Suisun Marsh supported more than 650,000 acres of natural communities including riparian, wetland, and oak savanna. More than 90 percent of those ecosystems have been lost through reclamation and land conversion to agriculture and urban land uses (Bay Institute 1998,

SFEI-ASC 2014). Reestablishment of some of these natural communities on the landscape—as the result of process-based restoration, improving ecosystem processes such as primary production and energy transfer—is a critical step in native species recovery. Natural community restoration will provide the physical space, connectivity, and habitat structure that species populations currently lack, as well as providing critical ecological functions such as aquatic primary production and vegetation community succession (Frermier et al. 2008, Golet et al. 2013). Multiple, interacting components of functional landscape will foster resilient and enduring restoration and management outcomes that benefit both people and wildlife (Wiens et al. 2016).

Recovery goals and biodiversity targets play a key role in translating ecological science and policy into on-the-ground action (Tear et al. 2005). Science-based objectives are often used to provide a unified understanding of conservation objectives among stakeholders and to make progress toward measurable goals (Dybala et al. 2017a, Dybala et al. 2017b). Recovery plans provide comprehensive guidance on the restoration and management of ecosystems based on the biology of the most threatened and endangered species (USFWS 2013).

Planning and management efforts, such as recovery plans, species-specific resiliency strategies, and conservation strategies identify specific actions for ecosystem preservation and restoration to meet species needs. Most of these efforts are focused on benefiting a single species or suite of similar species (e.g., riparian birds). Collectively, however, these plans provide valuable insight into the scale of ecosystem preservation, enhancement, and restoration necessary to benefit the multitude of species that rely upon the Delta ecosystem. At least 11 recovery and conservation plans exist which have geographic coverage in the Delta and Suisun Marsh (Council 2018). These plans identify restoration and management actions needed to achieve recovery of 35 species of special-status plants and 86 fish and wildlife species of conservation concern (Delta Plan, Appendix Q4). Nearly half of these species of conservation concern are endemic to the California floristic province, heightening the importance of recovering and conserving their populations in alignment with global conservation priorities (Wilson et al. 2006, Brum et al. 2017).

Restoration targets put forward by recovery and conservation plans are organized by the historical natural community types outlined in the Sacramento-San Joaquin Delta Historical Ecology Investigation: Exploring Pattern and Process (Whipple et al. 2012). The historical natural community types are classified by plant community structure and physical characteristics such as hydrology and landscape position. Modern habitat types use the same classification by plant communities (SFEI-ASC 2014). Importantly, the natural communities described in both Whipple (2012) and SFEI-ASC (2014) are derived from VegCAMP, which uses the U.S. National Vegetation Classification System to organize species assemblages (Hickson and Keeler-Wolf 2007).

Restoration of complex ecosystems will require reestablishment of native vegetation communities and the underlying processes that support their recruitment, disturbance regimes, and community succession (Frermier et al. 2008, Golet et al. 2013). Restoring a variety of native vegetation cover types can promote ecological resilience and enhance native biodiversity by providing a range of habitat options for species, thus expanding the types and numbers of species that a landscape can support (SFEI-ASC 2014, DSC 2018). It can take many years for a restored habitat to establish, and the trajectory of natural communities' evolution is dependent on site-specific conditions and external factors (Zedler and Callaway 1999, Lowe et al. 2014). Post-project monitoring, habitat assessments and scientific studies about restoration trajectories will inform ecosystem restoration management (Golet et al. 2013).

Linkages to Delta Reform Act and the Coequal Goals

Delta Reform Act

Large areas of natural communities provide functional, diverse and interconnected habitat suitable for fish and other wildlife, and support recovery of native species. Achieving the target net increase in acres of the natural communities will provide diverse and functional habitats that support the following characteristics of a healthy Delta ecosystem:

- "Viable populations of native and resident and migratory species" (Water Code section 85302(c)(1)). Native resident and migratory species rely on natural habitats for their life cycle and the ecosystem functions they provide.
- "Diverse and biologically appropriate habitats and ecosystem processes" (Water Code section 85302(c)(3)). Reestablishment of large areas of natural communities provides for recovery of diverse habitats and ecosystem processes such as primary production and energy transfer.
- "Reduced threats and stresses on the Delta Ecosystem" (Water Code section 85302(c)(4)). Large areas of restored natural communities support the capacity of native species to respond to changing environmental conditions.
- "Conditions conducive to meeting or exceeding the goals in existing species recovery plans and state and federal goals with respect to doubling salmon populations" (Water Code section 85302(c)(5)). Target acres for riparian, seasonal wetland, and emergent tidal marsh support rearing habitat needs for juvenile salmon, contributing to recovery of naturally spawning salmon populations.

Delta Plan Core Strategy

4.2 Restore Ecosystem Function.

Methods

Baseline Methods

The acreage of natural communities was derived from CDFW VegCAMP (2007) and by referencing the associated ecosystem types described in the 2016 Central Valley Flood Protection Plan (CVFPP) Conservation Strategy (DWR 2016a) and SFEI-ASC (2014). The VegCAMP dataset maps vegetation in the Delta from field observations and high-resolution digital imagery, and classifies the vegetation based on the U.S. National Vegetation Classification Standard (http://usnvc.org). Vegetation classification (e.g., pickleweed, broadleaf-cattail) from the VegCAMP was referenced to ecosystem types (e.g., alkali seasonal wetland complex, valley foothill riparian) found in SFEI-ASC (2014, Appendix A, pages 102 – 105).

Target Methods

Targets for each natural community (ecosystem) type were derived from conservation and restoration targets identified in conservation and recovery plans within the Delta and Suisun Marsh (Delta Plan, Appendix Q4). These conservation and recovery plans include overlapping actions (e.g., the CVFPP Giant Garter Snake Recovery Plan and Tidal Marsh Recovery Plan include targets for the tidal wetland ecosystem).

The table below shows net increase of target acres by ecosystem type, and associated recovery and/or conservation plans with source references provided. Targets from recovery and conservation plans with geographically larger footprints, such as the CVFPP Conservation Strategy (DWR 2016a, DWR 2016b), were proportionally calculated for the Delta and Suisun Marsh region.

Net Increase of Target Acres and Associated Source References

Ecosystem Type	Target Acres Net Increase (Net Increase from Baseline Acres)	Source Reference (Recovery and Conservation Plans)
Seasonal Wetland Wet Meadow Nontidal Wetland	19,000	Central Valley Flood Protection Plan (DWR 2016b)
Willow Riparian Scrub/Shrub Valley Foothill Riparian Willow Thicket	16,300	Central Valley Joint Venture Implementation Plan (Dybala et al. 2017b)
Tidal Wetland	32,500	Central Valley Flood Protection Plan (DWR 2016a, 2016b); Central Valley Flood Protection Plan (CVFPP 2017b); Giant Garter Snake Recovery Plan (USFWS 2017); Tidal Marsh Recovery Plan (USFWS 2013); Suisun Marsh Habitat Management Plan (USBR, USFWS, CDFW 2013)
Stabilized Interior Dune Vegetation	640	A Delta Transformed (SFEI-ASC 2014)
Oak Woodland	13,000	Central Valley Joint Venture Implementation Plan (DiGaudio et al. 2017b)
Grassland	No net loss[1]	A Delta Transformed (SFEI-ASC 2014)
Vernal Pool Complex	670	Conservation Measure 9, Bay Delta Conservation Plan (DWR 2013)
Alkali Seasonal Wetland Complex	230	Conservation Measure 9, Bay Delta Conservation Plan (DWR 2013)

Note:

[1] Currently there are more grasslands than historically; most of which are within the interior Delta that used to be freshwater emergent wetland (Whipple et al. 2012). Grassland on the Delta perimeter provides more natural functions in support of native species. Although the target is no net loss, more grasslands in the Delta perimeter is the goal.

The conservation and restoration targets for seasonal wetland, wet meadow, nontidal wetland, and tidal wetland are based on quantitative goals in the CVFPP Conservation Strategy (DWR 2016a, Appendix H, pg. H-4-6 to H-4-8). The CVFPP identified numeric targets for Central Valley floodplain and tidal marsh. Tidal Marsh targets identified in Giant Garter Snake Recovery Plan (USFWS 2017), Tidal Marsh Recovery Plan (USFWS 2013), Suisun Marsh Habitat Management Plan (USBR, USFWS, CDFW 2013), and Fish Restoration Program Agreement (DWR and DFW 2010) are included within the cumulative 32,500 target from the CVFPP. These targets were identified based on the modeled estimate of rearing habitat area required to help recover spring and fall-run Chinook salmon to meet the 1992 Central Valley Project Improvement Act salmon doubling goal. These Central Valley numeric target values were proportionally

calculated for the Delta and Suisun Marsh (52 percent of the Lower Sacramento Conservation Planning Area and 67 percent of the Lower San Joaquin Conservation Planning Area fall within the Delta). The conservation targets of the willow riparian scrub/shrub, valley foothill riparian, and oak woodland types are based on population and habitat objectives for avian conservation in the Delta region of the Central Valley Joint Venture (Dybala et al. 2017b). The willow riparian scrub/shrub and valley foothill riparian target of 16,300 was proportionally scaled for the Delta from the Central Valley (27.62 percent in Delta out of the total Central Valley acres).

Data Sources

Primary Data Sources

1. VegCAMP. Delta Vegetation and Land Use [ds292]. Biogeographic Information and Observation System (BIOS). California Department of Fish and Wildlife.
    a. Content: The VegCAMP data set has taxonomy for vegetation that is then assigned to appropriate habitat types in the Delta.
    b. Update Frequency: Every five years. First update toto the VegCAMP dataset was released in 2019.
2. VegCAMP. Vegetation - Suisun Marsh [ds2676]. Biogeographic Information and Observation System (BIOS). California Department of Fish and Wildlife.
    a. Content: 2015 Suisun Marsh vegetation map.
    b. Update Frequency: Every five years.

Alternative Data Sources

Alternative data sources will be used if the primary data sources become unavailable or are insufficient. Alternative data sources can be used concurrently with the primary data sources depending on best available science and the availability of the primary source.

1. San Francisco Estuary Institute (SFEI). Bay-Delta EcoAtlas. Geographic Information System of wetland habitats, past and present.
    a. Content: EcoAtlas Project Tracker is a mapping tool for restoration projects and provides access to acres of habitat types to be restored by a project (Project Tracker).

- Update Frequency: Frequency of restoration project updates varies. Council staff will review EcoAtlas at least every five years for restoration project updates.

Process

Data Collection and Analysis

Every five years, Council staff will update the status of this performance measure by:

1. Obtaining the updated VegCAMP datasets (Delta Vegetation and Land Use, Vegetation – Suisun Marsh).
2. Categorizing VegCAMP Associated Native Vegetation Community type (VegCAMP CaCode) into associated natural communities (ecosystem types).
3. Calculating total acres by each of the natural communities and calculating net increase over the five-year period and against the baseline.
4. Displaying maps of natural communities in the Delta and Suisun Marsh, and displaying change over five-year period and against baseline.
5. Method and results will be provided on the Performance Measures Dashboard.

VegCAMP updates follow a consistent vegetation mapping and classification methodology. A VegCAMP update based on the 2016 National Agricultural Imagery Program dataset was completed in November 2019.

Interim Performance Assessment

In order to provide a short-term assessment of progress toward the restoration targets in this PM, intermediate milestones are set for evaluation every decade. The interim milestones below are established on an assumed linear progression toward the 2050 target date, and can be calculated as five-year averages (for example: the five-year average net increase for tidal wetland is about 5,500 acres), or ten-year averages:

Ecosystem Type	Baseline	Target Area (Baseline Acres Plus Net Increase)		
		2030	2040	2050
Seasonal Wetland Wet Meadow Nontidal Wetland	5,100	11,400	17,700	24,100
Willow Riparian Scrub/Shrub Valley Foothill Riparian Willow Thicket	14,200	19,600	25,100	30,500
Tidal Wetland	19,900	30,800	41,600	52,400
Stabilized Interior Dune Vegetation	20	240	450	660
Oak Woodland	0	4,400	8,700	13,000
Grassland	33,000	33,000	33,000	33,000
Vernal Pool Complex	5,100	5,300	5,500	5,700
Alkali Seasonal Wetland Complex	700	780	860	930

Although linear progression is assumed for setting interim milestones, many management and scientific uncertainties exist in implementing restoration projects and achieving the target acres of desired natural communities. Interim assessments of the performance measure will consider the existing state of restoration in the Delta and disclose conditions impacting the rate of restoration interim progress.

Existing efforts and tools evaluating restoration effectiveness and natural communities' conditions will be considered in interpreting this performance measure. These may include: Wetland Regional Monitoring Program (WRMP) and Habitat Development Curves for wetland and aquatic resources, Tidal Wetland Monitoring Framework for the Upper San Francisco Estuary for fisheries benefits, and project-specific long-term monitoring and operations plans.

Process Risks and Uncertainties

A linear increase in the net acres of natural communities may not be a reasonable expectation. Rather, longer-term restoration projects may cause nonlinear increase in restored areas based on type and size of restoration action completed. In addition, changes in natural communities in response to restoration actions may be nonlinear, discontinuous, abrupt, and have multiple trajectories. Scientific advances, emerging tools, effectiveness monitoring, and long-term monitoring of restoration areas will inform adaptive management of ecosystem restoration.

The Delta is subject to sea level rise, subsidence, and urbanization, all of which can constrain where and how much ecosystem restoration can be implemented compared

to other conservation actions. It is uncertain whether restoration will be able to outpace sea level rise and rising temperatures associated with climate change.

Reporting

Every five years, Council staff will assess and report the status of this performance measure by:

1. Posting updates on the Performance Measures Dashboard.
2. Providing results in the Council's annual report (published in January).
3. Communicating findings in the five-year review of the Delta Plan.
4. Informing Council's adaptive management and other decision-making.
5. Communicating management-relevant results at Council and Delta Plan Interagency Implementation Committee (DPIIC) public meetings.
6. Presenting findings at technical interagency groups, professional gatherings, and conferences.

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