

# Appendix 1: Coastal Wetland Ecosystem Services

of the *Wetlands on the Edge: The Future of Southern California's Wetlands Regional Strategy 2018*

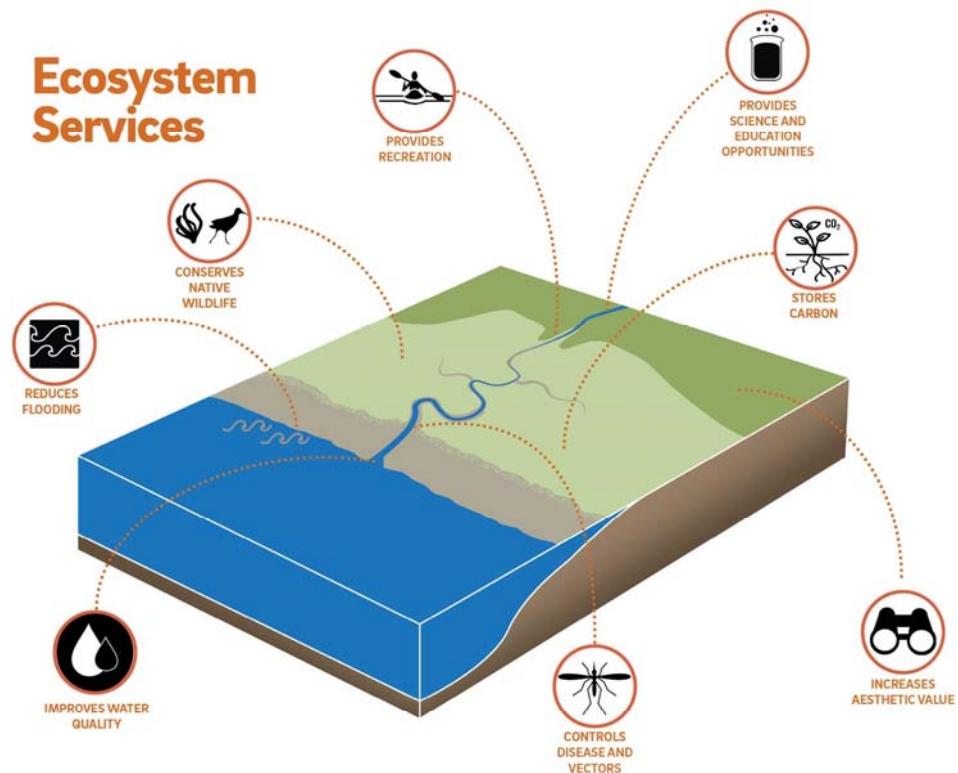


Written by *Regional Strategy 2018* authors

Throughout most of recorded world history, wetlands were regarded as wastelands and problem areas to be drained and filled. Despite this history, a shift in the understanding and appreciation of these habitats has occurred, and wetlands are now valued worldwide for the many benefits they provide (Needles et al. 2015; Costanza et al. 1997).

According to the Millennium Ecosystem Assessment (Millennium Ecosystem Assessment 2005), ecosystem services are “the benefits people obtain from ecosystems, including products, functions, and attributes.” The Millennium Ecosystem Assessment (M.E.A.) identifies 18 ecosystem services attributed to coastal wetlands. Ecosystem services of coastal wetlands include climate regulation, water storage, pollution control, flood and shoreline protection, nutrient cycling, and providing opportunities for education and recreation. Additionally, coastal wetlands provide habitat for plants and animals, including many unique and threatened or endangered species, and serve as critical fish nursery areas.

As a part of the *Regional Strategy 2018*, the Science Advisory Panel (SAP) evaluated the coastal wetland services identified in M.E.A. and a local project in the Tijuana River Valley, *Temporal Investigations of Marsh Ecosystems*, to create a paired-down list of services identified as the most important to the WRP. Those services were deemed important based on funding goals for coastal wetland restoration projects in the region, management priorities for the region, and importance by the Wetlands Managers Group and Wetland Advisory Group. As shown in Figure 1, the WRP ecosystem services include: conservation of native wildlife, water quality improvement, carbon sequestration, flood hazard reduction, disease and vector control, recreation, aesthetics, and opportunities for education and science.



**Figure 1. Coastal wetland ecosystem services for the WRP.**

The SAP then qualitatively analyzed how these 8 ecosystem services would be affected by the implementation of the *Regional Strategy 2018* and by an increase in sea-level rise. In general, many of the ecosystem services either remained the same or increased with the implementation of the *Regional Strategy 2018* (Table 1). Only 3 ecosystem services for Intermediate Estuaries and 1 service for Large Lagoons were found to decrease after restoration mainly due to tidal inlet closures possibly resulting in an increase in potential flooding, poor water quality, and vector control issues.

The WRP initially tried ecosystem services to develop the quantitative regional objectives. However, when the SAP attempted to quantify services on a regional scale and identifying the services that could guide the design of a restoration project, this approach to the objectives broke down. As noted in Needles et al. 2015, there are a range of management actions that can be aimed to enhance a particular ecosystem service, but many times those actions are site-specific and result in strong trade-offs. Given the site-specific nature of an ecosystem services analysis, the WRP used a more qualitative approach to identify the ecosystem services of Southern California's coastal wetlands as well as to analyze the impacts to those services by the *Regional Strategy 2018* and future sea-level rise.

**Table 1. Changes (green arrows indicate increase, yellow circles indicate no change, and red minuses indicate decrease) in coastal wetland ecosystem services by archetype after *Regional Strategy 2018* implementation.**

**After Implementation of Regional Strategy**

		Conservation of Native Wildlife	Flood Hazard Reduction	Water Quality Improvement	Disease and Vector Control	Recreation	Carbon Sequestration	Science and Education	Aesthetics
1	Small Creek	↑↑↑	0	0	0	↑	0	↑↑↑	↑
2	Small Lagoon	↑↑↑	0	0	0	↑	0	↑↑↑	↑
3	Intermediate Estuary	↑↑↑	↓	↓	↓↓	↑	↑↑	↑↑↑	↑
4	Large Lagoon	↑↑↑	↑	0	↓↓	↑	↑↑	↑↑	↑↑↑
5	Large River Valley Estuary	↑↑↑	↑	0	0	↑	↑↑↑	↑↑	↑↑↑
6	Fragmented River Valley Estuary	↑↑↑	↑	0	0	↑	↑↑↑	↑↑	↑↑↑
7	Open Bay/Harbor	↑↑↑	0	0	0	0	0	↑↑	↑↑

On the other hand, without the implementation of the *Regional Strategy 2018* many of the ecosystem services would either remain the same or decrease after 24 inches of sea-level rise (Table 2). In particular, conservation of native wildlife was determined to significantly decrease across all of the archetypes due to habitat loss.

**Table 2. Changes (green arrows indicate increase, yellow circles indicate no change, and red minuses indicate decrease) in coastal wetland ecosystem services by archetype after 24 inches of sea-level rise.**

**Without Implementation of Regional Strategy**

		Conservation of Native Wildlife	Flood Hazard Reduction	Water Quality Improvement	Disease and Vector Control	Recreation	Carbon Sequestration	Science and Education	Aesthetics
1	Small Creek	↓↓	↓	0	↑	0	0	↑	0
2	Small Lagoon	↓↓	↓↓	0	↑↑	0	0	↑	0
3	Intermediate Estuary	↓↓↓	↓↓↓	↑	↑↑	0	↓↓	↑	0
4	Large Lagoon	↓↓	↓↓↓	0	0	0	↓↓↓	↑	0
5	Large River Valley Estuary	↓↓↓	↓↓	↑	0	0	↓↓↓	↑	0
6	Fragmented River Valley Estuary	↓	↓	↑↑	0	0	↓	↑	0
7	Open Bay/Harbor	↓	0	0	0	0	0	↑	0

The drastic losses of wetland form and function from past human disturbances and the projected losses from the impacts of sea-level rise, have resulted and will continue to result in the detrimental removal of invaluable ecosystem services provided by Southern California coastal wetlands. Luckily, with the implementation of the *Regional Strategy 2018* the region’s coastal wetlands will become more resilient to the impacts of sea-level rise and can continue to support humans.

## References

---

- Costanza, R., d'Arge, R., De Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J. and Raskin, R.G. 1997. The value of the world's ecosystem services and natural capital. *Nature*. 387(6630): 253.
- Millenium Ecosystem Assessment. 2005. Ecosystems and human well-being: current state and trends. Millennium Ecosystem Assessment, Global Assessment Reports.  
<https://www.millenniumassessment.org/documents/document.356.aspx.pdf>.
- Needles, L.A., Lester, S.E., Ambrose, R., Andren, A., Beyeler, M., Connor, M.S., Eckman, J.E., Costa-Pierce, B.A., Gaines, S.D., Lafferty, K.D. and Lenihan, H.S. 2015. Managing bay and estuarine ecosystems for multiple services. *Estuaries and Coasts*. 38(1): 35-48.