Permanent Wetlands Habitat
Vulnerability Assessment Summary

Overall Vulnerability

Rice Croplands	Score	Confidence
Sensitivity	Moderate (3)	High (3)
Exposure	Mod-high (4)	High (3)
Adaptive Capacity	Moderate (3)	High (3)
Vulnerability	Moderate (3)	High (3)

Sensitivity

Climate-driven Stressors	**Potential Impacts**
Snowpack	Climate sensitivity is based primarily on changes in snowpack and storage since rice croplands receives most of their water from these sources during the spring and summer growing season, and relatively little from precipitation.
Precipitation timing and amount	Large rainfall events have an immediate positive effect on the habitat, but too much rain falling on rice fields can make water depth a problem for foraging waterbirds, and too much rain in late spring/early summer can prevent farmers from planting. Early fall rain (e.g., September) is detrimental for rice because it interferes with harvest. The ability to flood fields post-harvest is dependent on winter rainfall.
Drought	Periods of severe drought result in a decrease in rice croplands, but declines are usually delayed because stored water reserves and water management practices slow the impact.
Heat waves, increasing temperatures	Early heat waves have a negative impact on rice growth, with May-July heat waves reducing growth by 6.1%. Rice requires warm temperatures; currently the Delta is too cool for growing rice.

Disturbance Regimes	**Potential Impacts**
Flooding	Flooding practices in rice fields are highly managed, but the timing and severity of natural flooding can negatively impact crops-- late spring flooding delays or prevents planting, can destroy young plants too late in the season for farmers to replant. Flooding deeper than 15 cm may also limit foraging access for shorebirds
Insects & disease	Warmer temperatures may alter the types of diseases that affect both wildlife and crops via expansion into new areas or overwintering. Warm conditions may favor rice weevil, which can reduce crop yields by 10-25%. Mosquitos outbreaks in warmer water would lead to increased pesticide use.
Wind	Wind is a minor issue when plants begin to break the water surface in spring and water, as movement can rip the plant out of the soil. Wind can also affect bird migration and movement on ground.

Non-climate Stressors	Potential Impacts
Dams, levees, and water diversions	Necessary for this habitat type, especially with less snowpack for water storage. Levees and water diversions are also important, as they are part of the infrastructure to deliver the water to rice.
Commodity prices	Seventy percent of rice land in California can't have other crops grown on it because of the soil type, so conversion to other crops is not a huge issue.

Exposure

Projected Changes	Potential Refugia
Decreased snowpack, earlier runoff, changes in precipitation (amount) causing decreased water storage	Wherever there is a secure source of water, which depends on water rights and water district boundaries. Duck clubs and wildlife refuges near cropland. Areas with groundwater availability and pumping infrastructure (but not a lot of gw infrastructure in the Sacramento Valley). Restrictions on water transfers in giant garter snake mitigation lands.
Urban/suburban development	
Increased drought/extreme heat	
Extreme flood events, Increased flooding	Dependent on vulnerable water infrastructure in all areas. Exposure is higher in bypasses; only a small percentage of rice in that area.
Increased air temperature	Rice could be moved towards the delta to track increasing temperatures. Currently, the delta is mostly too cold for rice
Increased water temperature	East side of the valley is a potential refuge in near future. Longer term, impacts will be valley-wide and magnified during drought years, with no refugia remaining.
Altered stream flows	Fields where riparian water is used for irrigation are more vulnerable to impacts from low stream flows. Areas with off-stream water storage could act as refugia during both high and low flows.

Adaptive Capacity

Extent, Integrity, and Continuity	Winter-flooded rice in the northern Central Valley increased by 47% (25,000 ha) between 1988 and 2000. Located primarily in the Sacramento Valley. The canals surrounding rice cropland offer reliable aquatic habitat and movement corridors for giant gartersnakes and other species.
Resistance & recovery	Primarily dependent on human decision-making processes based on commodity prices, crop health and yield, and farming/management practices. When water comes back, so does rice. Incentive programs and conservation-focused policies may increase resistance of flooded croplands .
Diversity	Low habitat diversity, high species diversity- waterbird species richness in flooded fields is double that in non-flooded fields.
Management potential	Services of flooded rice croplands must compete with value of water. Rice as a plant is resilient, but need to build the infrastructure for water storage to maintain rice croplands in the future. Incentive programs can create pop-up wetlands during critical periods for migrating and wintering birds, increasing habitat availability and quality.