Sensitivity

Climate stressors and disturbance regimes

Migratory birds are vulnerable to climate stressors and disturbance regimes that impact food and habitat availability, as well as factors that cause direct physiological stress or mortality.

- **Changes in the amount of precipitation** and **increased drought** reduce vegetation productivity, impacting food availability for migratory birds (Ferger et al. 2014), especially wintering songbirds (a group that relies heavily on seeds; Dunning & Brown 1982). Reduced rainfall would also limit the area of wetlands and flooded cropland across the region, decreasing habitat availability for waterfowl (Reiter et al. 2015).

- **Sea level rise** is likely to cause the loss of intertidal and estuarine areas used as breeding, wintering, or stopover habitat by migratory birds (Galbraith et al. 2002). Shorebirds, in particular, are highly vulnerable to the loss of intertidal foraging habitat, which could result in population declines (Galbraith et al. 2002, 2014).

- **Increased freshwater temperatures** will alter the timing and abundance of aquatic invertebrates (Jonsson et al. 2015), a primary food source for waterfowl.

- **More frequent and/or severe storms** could reduce migratory bird survival (Butler 2000), reproductive success (Bonter et al. 2014), and habitat availability (Galbraith et al. 2014).

- **Increased heat waves** may reduce migratory bird populations by reducing survival and reproductive success, especially among long-distance migrants and species with narrow thermal ranges (Jiguet et al. 2006).

- **Altered wildfire regimes** are likely to alter the community composition and abundance of migratory songbirds by changing habitat structure (e.g., reducing canopy cover or increasing dead limbs and snags), as well as indirectly causing shifts in food availability and predation (Alexander et al. 2004).

- **Diseases** such as avian malaria impact waterfowl where migratory and/or wintering birds are highly concentrated, such as at stopover sites in the Central Valley (Hénaux et al. 2012). Climate changes may alter environmental transmission of these diseases, as well as the pathogens to which migratory birds are exposed and the likelihood of transmission and infection (Leech & Crick 2007; Lang et al. 2008; Gilbert et al. 2008).

Non-climate stressors

Non-climate stressors impact migratory birds directly by increasing mortality, and also reduce habitat and prey availability and quality.

- **Fire suppression practices** contribute to changes in forest structure and composition, reducing habitat heterogeneity and increasing the severity of wildfires and associated impacts to migratory birds (Alexander et al. 2004).

- **Recreational activities** and associated human presence (e.g., traffic) on beaches and dunes degrade habitat quality (Pfister et al. 1992) and disturb resting or foraging shorebirds, reducing overall fitness by increasing metabolic activity or reducing food intake (Schlacher et al. 2013).


- **Livestock grazing** impacts migratory birds within riparian habitats, where cattle seeking shade and water may damage nests (Riparian Habitat Joint Venture 2004) and degrade habitat quality by removing vegetation cover, compacting soils, and increasing erosion (Campbell & Allen-Diaz 1997).

- **Hunting** reduces populations of wintering waterfowl (Fleskes et al. 2007), although hunting activities also support the protection and restoration of wetland habitat (North American Waterfowl Management Plan 2012).
Dependence on habitat and prey/forage species
Migratory birds are highly dependent on the availability of breeding and wintering habitats, as well as stopover sites, and degradation or loss in any of these areas can reduce survival and lead to population declines (Stralberg et al. 2010; Small-Lorenz et al. 2013). In addition, the timing of migration and breeding is generally timed to coincide with times of peak food availability, and phenological shifts in plant and insect production could impact bird survival and reproductive success (Leech & Crick 2007).

Adaptive Capacity

Geographic extent
Migratory birds in northern California utilize a wide range of habitat types across the region, including beaches, estuaries, wetlands, grasslands, shrublands, and forests (Stralberg et al. 2010; Gardali et al. 2012). Changing climate conditions may shift the location and/or alter the size of breeding and wintering ranges for migratory birds, contributing to changes in species composition and population size and health (Stralberg et al. 2009).

Overall health and functional integrity
Population declines are occurring in many migratory bird species, especially among long-distance migrants (Both et al. 2009).

Dispersal ability
Migratory birds are highly mobile, allowing them to travel long distances to reach suitable habitat and food resources (Newton 2010). However, increased habitat connectivity decreases foraging energy requirements (Elphick 2000) and enhances breeding success (Stephens et al. 2003).

Life history diversity
Migratory birds are a diverse group, representing a wide array of migration strategies and life history traits (Dolman & Sutherland 1995; Gardali et al. 2012; Galbraith et al. 2014). Many species exhibit a fair amount of behavioral and phenotypic plasticity, allowing individuals to respond to changing climate conditions and habitat loss (Dolman & Sutherland 1995).

Ability to resist/recover from stressors
High mobility within migratory birds confers resistance to changing conditions by allowing individuals to seek out higher-quality habitat, shift their range, and/or change their migration strategy (Dolman & Sutherland 1995). However, their dependence on habitat availability in disparate locations increases the risk that one or more sites will be affected by climate or non-climate stressors (Small-Lorenz et al. 2013). Overall, species with wide thermal ranges may be better able to tolerate climate extremes such as heat waves (Jiguet et al. 2006).

Literature Cited


Draft vulnerability briefing for the Northern California Climate Adaptation Project.


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