Climate change has altered habitats and impacted ecosystems across the planet, threatening biodiversity. Adverse impacts on ecosystems, on both their biological and physical components, have been attributed to more frequent and intense extreme events such as droughts and marine heatwaves, as well as to long-term warming and changing precipitation patterns. The global evidence shows species responses that include poleward and elevational shifts in habitat range; changes in the timing of life cycle events (known as “phenology”); declines in the abundance of species; and changes in the makeup of species (or community composition) (IPCC, 2022).

Human well-being is dependent on the natural resources and services provided by ecosystems, which include carbon storage, flood protection, cultural resources, and the production of food, fiber, and other materials (IPCC, 2022; USGCRP, 2018). Many plant and animal species are important as food, medicine, and ceremonial materials to California Tribes, who are deeply affected by the impacts of climate change on these culturally significant resources.

Many of the same climate change impacts on ecosystems observed globally are happening in California. Warmer temperatures and changes in precipitation patterns are driving plants and animals to shift to elevations or latitudes with more favorable habitat conditions. Species that cannot adjust or move fast enough may experience declines in abundance; some may face local extinction. Along with observed changes in the distribution of plants and animals are changes in the timing of important biological events, such as bloom and fruit maturation in plants, and migration and egg-laying in animals.

Drought and warming temperatures have also contributed to large-scale tree mortality, which has fueled larger and more severe wildfires. The lack of moisture available to plants has also been associated with changes in the structure and composition of California’s forests and woodlands—changes that have been accelerated by wildfires. Warming ocean temperatures have amplified blooms of toxin-producing algae (“harmful algal blooms”) that have led to economically devastating fisheries closures. Changing conditions in freshwater, estuarine, and ocean habitats are threatening the survival of California Chinook salmon populations.

The threat to biodiversity posed by climate change is compounded by multiple other societal and environmental challenges intensifying risks and impacts (IPCC, 2022; USGCRP, 2018). This includes increasing development, habitat fragmentation and environmental pollution. Global initiatives, including the Paris Agreement, recognize the close interconnectedness between biodiversity, climate change, and human well-being, and have begun to jointly address these crises (Pörtner et al., 2021). California has committed to the goal of conserving 30 percent of the state's lands and coastal waters by 2030. This initiative, known as the 30x30 California initiative, is part of an international movement to conserve natural areas across our planet. Established by Executive Order (N-82- 20), this goal elevates biodiversity conservation as a priority and emphasizes the role of nature in the fight against climate change.

INDICATORS: IMPACTS ON VEGETATION AND WILDLIFE

VEGETATION

- Marine harmful algal blooms *(new)*
- Forest tree mortality *(updated)*
- Wildfires *(updated)*
- Ponderosa pine forest retreat (*updated)*
- Vegetation distribution shifts *(no update)*
- Changes in forests and woodlands *(updated)*
- Subalpine forest density *(updated)*
- Fruit and nut maturation *(updated)*
- Navel orangeworm abundance *(new)*

WILDLIFE

- Spring flight of Central Valley butterflies *(updated)*
- Migratory bird arrivals *(no update)*
- Bird wintering ranges *(no update)*
- Small mammal and avian range shifts *(updated)*
- Nudibranch range shifts *(no update)*
- Copepod populations *(updated)*
- Chinook salmon abundance *(updated)*
- Cassin's auklet breeding success *(no update)*
- California sea lion pup demography *(no update)*

References:

IPCC (2022): *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Pörtner H-O, Roberts DC, Tignor M, Poloczanska ES, Mintenbeck K, et al. (Eds.). Cambridge University Press.

Pörtner HO, Scholes RJ, Agard J, Archer E and Arneth A (2021). *Scientific outcome of the IPBES-IPCC co-sponsored workshop on biodiversity and climate change.* IPBES secretariat, Bonn, Germany.

USGCRP (2018). Fourth National Climate Assessment. Retrieved April 26, 2022.