Western Bumble Bee Declines in US and Sample Design for Filling Range-Wide Information Gaps

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In recent decades many bumble bee species have declined due to changes in habitat, climate, and pressures from pathogens, pesticides, and introduced species. The western bumble bee (*Bombus occidentalis*), once common throughout western North America is a species of concern and will be considered for listing by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA). We attempt here to improve the alignment of data collection and research with USFWS needs to consider redundancy, resiliency, and representation in the upcoming species status assessment. We reviewed existing data and literature on B. occidentalis, highlighting priority topics for research. We used existing data to model changes in B. occidentalis occupancy from 1998 to 2018. The probability of local occupancy in the continental United States declined by 93% over 21 years from 0.81(95%CRI = 0.43, 0.98) in 1998 to 0.06 (95%CRI = 0.02, 0.16) in 2018. The decline in occupancy varied spatially by landcover and other environmental factors. However, we found considerable spatial gaps in recent sampling, with limited sampling in many regions, including most of Alaska, northwestern Canada, and the southwestern U.S. We therefore propose a sampling design to address these gaps to best inform the ESA species status assessment through improved assessment of the spatial drivers of occupancy changes. Finally, we request involvement via data sharing, participation in occupancy sampling with repeated visits to distributed survey sites, and complementary research to address priorities outlined in this paper.