



Southern Colorado Plateau

INVENTORY & MONITORING NETWORK

Publication Brief - Birds

Mixed-Conifer 2024

Title: Breeding birds of high-elevation mixed-conifer forests have declined in national parks of the southwestern U.S. while lower-elevation species have increased, with responses to drought varying by habitat

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Plumbeous Vireo/
Peter E. Hart
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Parks Included in this Brief: [Bandelier National Monument](#) and [Grand Canyon National Park](#)

Legacy Data Overview: From 2007-2018 the [Southern Colorado Plateau Inventory and Monitoring Network](#) conducted bird surveys at six parks to determine status and trends in species composition and abundance as well as improve our understanding of breeding bird habitat relationships.

Management Implications

- Population declines occurred for 11 of 26 species that commonly occur in [mixed-conifer forests](#) over the 2007-2018 period, including eight species not encountered in other habitats. This is likely due to die-off of subalpine tree species (spruces and firs) during drought, and the occurrence of high-severity wildfire which fragments and destroys habitat.
- Species associated with spruce-fir forest (Ruby-crowned Kinglet and Red-breasted Nuthatch) declined at Bandelier National Monument and Grand Canyon National Park despite regional population increases, while species associated with open forest structure (e.g., Plumbeous Vireo, White-breasted Nuthatch, Chipping Sparrow) increased in or colonized post-burn forest.
- Densities of mixed-conifer forest birds were positively affected by spring and summer drought the previous year (11 of 26 species). This effect is likely driven by earlier snowmelt, which leads to earlier breeding attempts, higher recruitment of breeding individuals, and greater nest success.
- Mixed-conifer forest bird species responded positively to earlier monsoon rains (7 of 26 species), and this effect is likely strongest for species that molt in the monsoon region of northwestern Mexico (e.g., Western Flycatcher, Black-headed Grosbeak, Warbling Vireo).

Overview: [Climate change](#) is a major driver of bird population declines and is feared to be negatively affecting species abundances in the drought-stricken southwestern United States. Changes to the timing and amount of precipitation can not only result in direct mortality of breeding birds, but also negatively affect aspects of their habitat that are crucial for breeding. Complicating this picture is the fact that the [Colorado Plateau](#) contains a diversity of habitat types across a wide elevational span which may respond differently to climate change. In this work, we analyzed twelve years of bird monitoring data (2007-2018) from six national parks and monuments on the Colorado Plateau to obtain habitat- and park-specific, breeding-season population trends and understand how they are influenced by two important climate variables: spring and summer drought and the timing of the North American monsoon (an important regional pulse of rainfall from July-October). We examined population trends and climate effects in four distinct habitat types that encompass the full elevational gradient: grassland-shrubland, riparian woodland, pinyon-juniper woodland, and mixed-conifer forest.

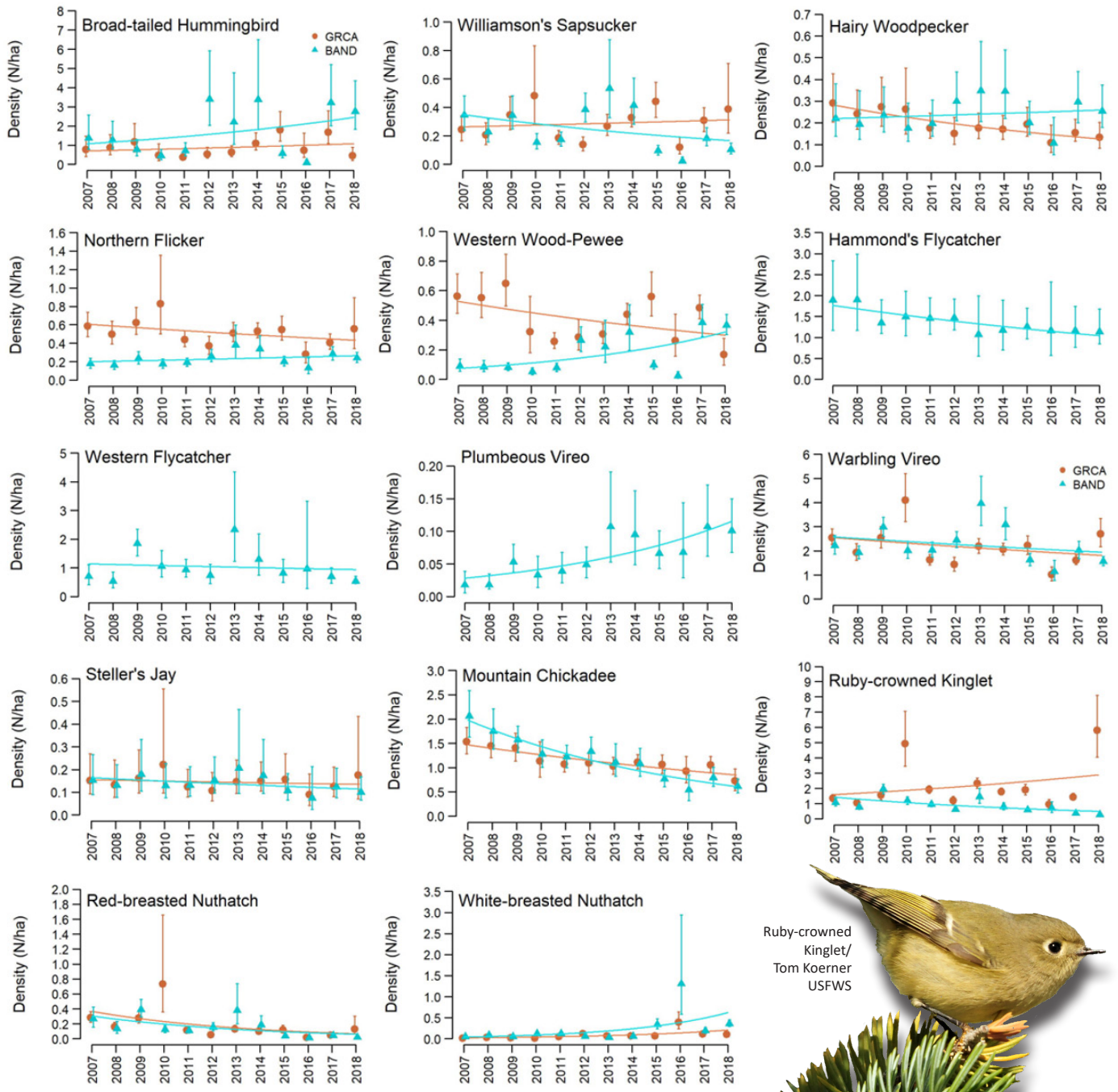
Overall, we modelled the trends in breeding-season densities of fifty bird species and compared them to reported trends for the Colorado Plateau as a whole. Trends in the parks correlated closely and significantly with those from the regional Breeding Bird Survey. We found more species with increasing population trends (18) than decreasing ones (13), though population trends were habitat specific. Low- and mid-elevation species of grasslands and pinyon-juniper woodlands tended to be increasing or showed no change, while high-elevation mixed-conifer forest species showed declines, likely due to negative effects of drought-related tree die-off and high-severity wildfire events.



Red-breasted Nuthatch/Jim Peaco-NPS

Both drought and monsoon timing showed effects on breeding-season bird densities. The effects of drought were habitat-specific and changed over the elevational gradient. High-elevation mixed-conifer forest species benefited from spring and summer drought, likely because earlier snowmelt leads to earlier breeding and greater reproductive success. By contrast, middle-elevation species were relatively unaffected by drought, and low-elevation grassland-shrubland birds suffered negative effects. The effects of monsoon timing were also habitat-specific: grassland-shrubland species populations responded negatively to earlier (July and August) monsoon rainfall, while mixed-conifer bird populations preferred earlier monsoon rains. Species that undertake stopover molts in the monsoon region of northwestern Mexico also showed positive effects of earlier monsoons, regardless of habitat. These species may suffer from mistimed molts (phenotypic mismatch) in years when the monsoon arrives late.

Park-Specific Trends: Figure 1 scatterplots show annual density estimates for the 26 species that were analyzed for breeding-season population density from 2007-2018. These are species associated with mixed-conifer forest habitat in both Bandelier National Monument (BAND), where densities of all 26 species were modelled, and Grand Canyon National Park (GRCA), where densities of 21 species were modelled. We only estimated densities of species with > 50 detections at a park over the timeseries. Please refer to figure caption for more detail.



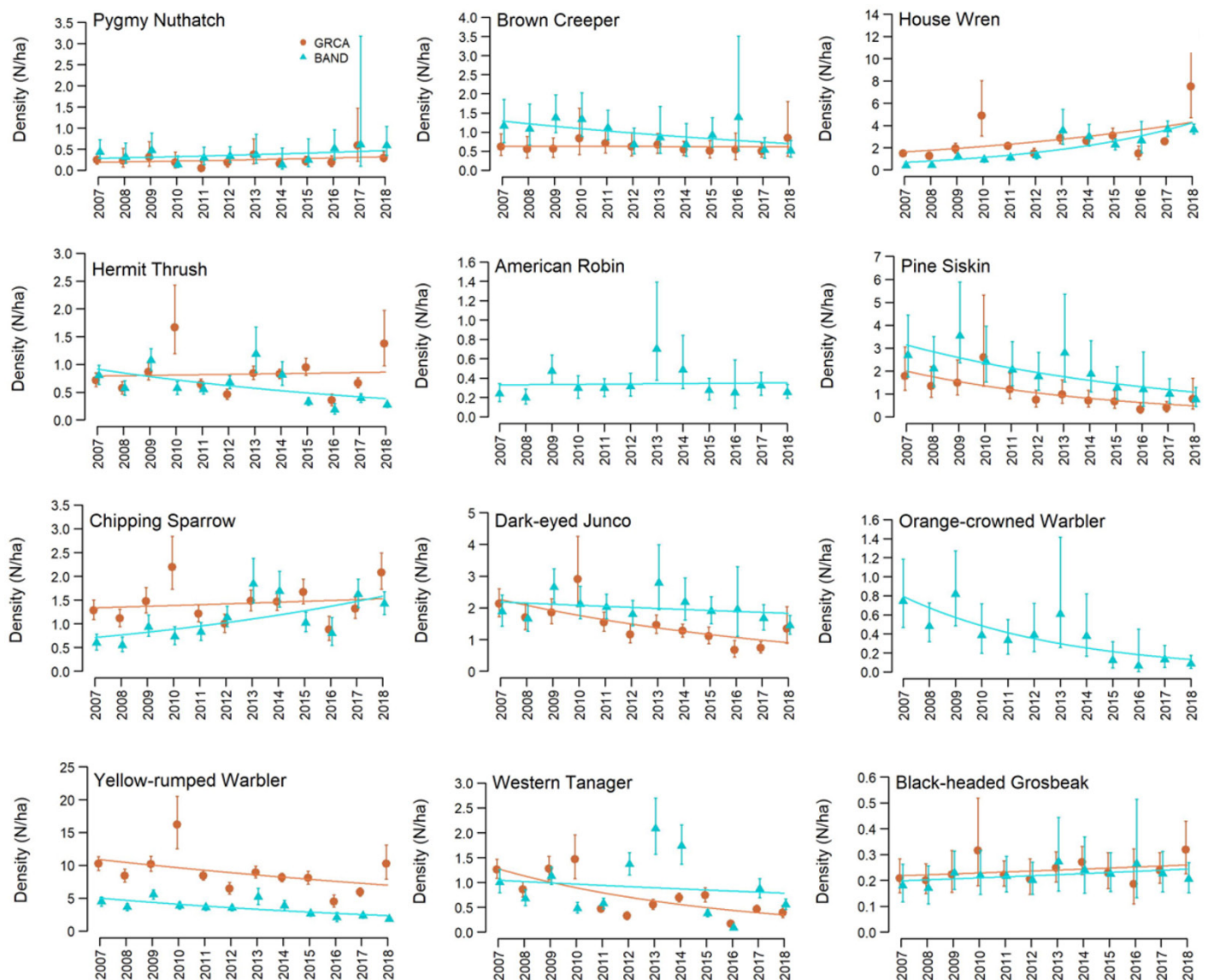


Figure 1. Yearly densities of grassland-shrubland bird species at Bandelier National Monument (BAND, blue symbology) and Grand Canyon National Park (GRCA, orange symbology). The points and error bars represent the median and 95% Bayesian credible interval (a range with a 95% probability of containing the true value) of the estimated breeding-season density at each park in each year. Trend lines represent Poisson regressions of year against density. Species are listed in taxonomic order following the American Ornithological Society's 2023 checklist.

Mixed-Conifer habitat at Bandelier National Monument/Adam Reeder

WHY IS THIS STUDY IMPORTANT? This study indicates that human-induced climate change in the Southwest is already impacting bird populations, marking the beginning of a new climate era. As we start to grasp how wild-life is being affected, long-term monitoring becomes increasingly crucial. It serves as an early warning system for the changes we're witnessing and helps us understand the underlying causes.