



## Channel Islands National Park

### Background

Birds are useful indicators of ecological change because they are highly mobile and generally conspicuous. As climate in a particular place changes, suitability may worsen for some species and improve for others. These changes in climate may create the potential for local extirpation or new colonization. **This brief summarizes projected changes in climate suitability by mid-century for birds at Channel Islands National Park\* (hereafter, the Park) under two climate change scenarios (see Wu et al. 2018 for full results, and Langham et al. 2015 for more information regarding how climate suitability is characterized).** The high-emissions pathway (RCP8.5) represents a future in which little action is taken to reduce global emissions of greenhouse gases. The low-emissions pathway (RCP2.6) is a best-case scenario of aggressive efforts to reduce emissions. These emissions pathways are globally standardized and established by the Intergovernmental Panel on Climate Change for projecting future climate change. The findings below are model-based projections of how species distributions may change in response to climate change. A 10-km buffer was applied to each park to match the spatial resolution of the species distribution models (10 x 10 km), and climate suitability was taken as the average of all cells encompassed by the park and buffer.

### Results

**Climate change is expected to alter the bird community at the Park, with greater impacts under the high-emissions pathway than under the low-emissions pathway (Figure 1).** Among the species likely to be found at the Park today, climate suitability in summer under the high-emissions pathway is projected to improve for 18, remain stable for 20, and worsen for 23 species. Suitable climate ceases to occur for 10 species in summer, potentially resulting in extirpation of those species from the Park (e.g., Figure 2). Climate is projected to become suitable in summer for 26 species not found at the Park today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 52, remain stable for 32, and worsen for 37 species. Suitable climate ceases to occur for 6 species in winter, potentially resulting in extirpation from the Park. Climate is projected to become suitable in winter for 27 species not found at the Park today, potentially resulting in local colonization.

#### IMPORTANT

This study focuses exclusively on changing climatic conditions for birds over time. But projected changes in climate suitability are not definitive predictions of future species ranges or abundances. Numerous other factors affect where species occur, including habitat quality, food abundance, species adaptability, and the availability of microclimates (see Caveats). Therefore, managers should consider changes in climate suitability alongside these other important influences.

We report trends in climate suitability for all species identified as currently present at the Park based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Park is projected to become suitable in the future (Figure 1 & Table 1). This brief provides park-specific projections whereas Wu et al. (2018), which did not incorporate park-specific species data and thus may differ from this brief, provides system-wide comparison and conclusions.

\*Analysis for this brief excludes a small area of Park property on the mainland that lacks significant natural resources.

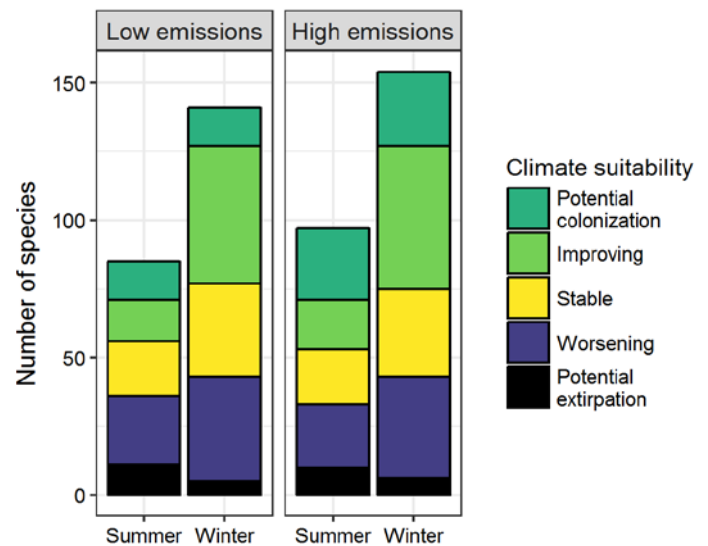


Figure 1. Projected changes in climate suitability for birds at the Park, by emissions pathway and season.

## Results (continued)

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### Potential Turnover Index

**Potential bird species turnover for the Park between the present and 2050 is 0.19 in summer (29<sup>th</sup> percentile across all national parks) and 0.10 in winter (8<sup>th</sup> percentile) under the high-emissions pathway. Potential species turnover declines to 0.12 in summer and 0.07 in winter under the low-emissions pathway.** Turnover index was calculated based on the theoretical proportions of potential extirpations and potential colonizations by 2050 relative to today (as reported in Wu et al. 2018), and therefore assumes that all potential extirpations and colonizations are realized. According to this index, no change would be represented as 0, whereas a complete change in the bird community would be represented as 1.

### Climate Sensitive Species

The Park is or may become home to 25 species that are highly sensitive to climate change across their range (i.e., they are projected to lose climate suitability in over 50% of their current range in North America in summer and/or winter by 2050; Table 1; Langham et al. 2015). Suitable climate is not projected to disappear for these 25 species at

### Management Implications

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Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Channel Islands National Park falls within the intermediate change group.** Parks anticipating intermediate change can best support landscape-scale bird conservation by emphasizing habitat restoration, maintaining natural disturbance regimes, and

### Caveats

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The species distribution models included in this study are based solely on climate variables (i.e., a combination of annual and seasonal measures of temperature and precipitation), which means there are limits on their interpretation. Significant changes in climate suitability, as measured here, will not always result in a species response, and all projections should be interpreted as potential trends. Multiple other factors mediate responses to climate change, including habitat availability, ecological processes

the Park; instead the Park may serve as an important refuge for these climate-sensitive species.



**Figure 2. Although currently found at the Park, suitable climate for the American Robin (*Turdus migratorius*) may cease to occur here in summer by 2050, potentially resulting in local seasonal extirpation.** Photo by Andy Reago & Chrissy McClarren/Flickr (CC BY 2.0).

reducing other stressors. Furthermore, park managers have an opportunity to focus on supporting the 25 species that are highly sensitive to climate change across their range (Table 1; Langham et al. 2015) but for which the park is a potential refuge. Monitoring to identify changes in bird communities will inform the selection of appropriate management responses.

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that affect demography, biotic interactions that inhibit and facilitate species' colonization or extirpation, dispersal capacity, species' evolutionary adaptive capacity, and phenotypic plasticity (e.g., behavioral adjustments). Ultimately, models can tell us where to focus our concern and which species are most likely to be affected, but monitoring is the only way to validate these projections and should inform any on-the-ground conservation action.

## More Information

For more information, including details on the methods, please see the scientific publication ([Wu et al. 2018](#)) and the [project overview brief](#), and visit the [NPS Climate Change Response Program website](#).

## References

eBird Basic Dataset (2016) Version: ebd\_relAug-2016. Cornell Lab of Ornithology, Ithaca, New York.

Langham et al. (2015) Conservation Status of North American Birds in the Face of Future Climate Change. PLOS ONE.

Wu et al. (2018) Projected avifaunal responses to climate change across the U.S. National Park System. PLOS ONE.

## Contacts

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## Species Projections

**Table 1. Climate suitability projections by 2050 under the high-emissions pathway for all birds currently present at the Park based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Park is projected to become suitable in the future. "Potential colonization" indicates that climate is projected to become suitable for the species, whereas "potential extirpation" indicates that climate is suitable today but projected to become unsuitable. Omitted species were either not modeled due to data deficiency or were absent from the I&M and eBird datasets. Observations of late-season migrants may result in these species appearing as present in the park when they may only migrate through. Species are ordered according to taxonomic groups, denoted by alternating background shading.**

\* Species in top and bottom 10th percentile of absolute change

^ Species that are highly climate sensitive

- Species not found or found only occasionally, and not projected to colonize by 2050

x Species not modeled in this season

| Common Name            | Summer Trend           | Winter Trend           |
|------------------------|------------------------|------------------------|
| Brant                  | -                      | Improving              |
| Muscovy Duck           | -                      | Potential colonization |
| American Wigeon        | -                      | Improving              |
| Mallard                | Worsening <sup>^</sup> | Worsening              |
| Green-winged Teal      | -                      | Worsening              |
| Surf Scoter            | x                      | Worsening              |
| White-winged Scoter    | -                      | Worsening*             |
| Red-breasted Merganser | -                      | Stable <sup>^</sup>    |
| Plain Chachalaca       | -                      | Potential colonization |
| California Quail       | Worsening              | Worsening              |
| Ring-necked Pheasant   | Potential colonization | -                      |
| Wild Turkey            | x                      | Stable                 |
| Red-throated Loon      | -                      | Stable                 |
| Pacific Loon           | Stable                 | Worsening*             |
| Common Loon            | -                      | Stable <sup>^</sup>    |
| Pied-billed Grebe      | -                      | Improving              |

| Common Name              | Summer Trend                        | Winter Trend           |
|--------------------------|-------------------------------------|------------------------|
| Horned Grebe             | -                                   | Stable                 |
| Eared Grebe              | -                                   | Stable                 |
| Western Grebe            | x                                   | Worsening              |
| Clark's Grebe            | -                                   | Stable                 |
| Northern Fulmar          | x                                   | Worsening*             |
| Black-vented Shearwater  | x                                   | Worsening*             |
| Wood Stork               | -                                   | Potential colonization |
| Magnificent Frigatebird  | -                                   | Potential colonization |
| Brandt's Cormorant       | x                                   | Worsening              |
| Double-crested Cormorant | x                                   | Improving              |
| Pelagic Cormorant        | x                                   | Worsening*             |
| Anhinga                  | Potential colonization <sup>^</sup> | -                      |
| American White Pelican   | -                                   | Potential colonization |
| Brown Pelican            | Improving                           | Stable <sup>^</sup>    |
| Great Blue Heron         | Stable                              | Improving              |

| Common Name                | Summer Trend            | Winter Trend           |
|----------------------------|-------------------------|------------------------|
| Great Egret                | -                       | Improving              |
| Snowy Egret                | -                       | Improving*             |
| Little Blue Heron          | -                       | Potential colonization |
| Tricolored Heron           | -                       | Potential colonization |
| Cattle Egret               | Potential colonization  | -                      |
| Green Heron                | Potential colonization  | -                      |
| Yellow-crowned Night-Heron | Potential colonization  | Potential colonization |
| White Ibis                 | Potential colonization  | -                      |
| Osprey                     | x                       | Improving*             |
| White-tailed Kite          | Improving*              | Improving*             |
| Swallow-tailed Kite        | Potential colonization  | -                      |
| Golden Eagle               | x                       | Stable                 |
| Mississippi Kite           | Potential colonization  | -                      |
| Northern Harrier           | Improving^              | Worsening              |
| Sharp-shinned Hawk         | -                       | Improving              |
| Cooper's Hawk              | x                       | Stable                 |
| Bald Eagle                 | x                       | Potential extirpation  |
| Short-tailed Hawk          | -                       | Potential colonization |
| Swainson's Hawk            | Potential colonization^ | -                      |
| Red-tailed Hawk            | Stable                  | Stable                 |
| American Coot              | -                       | Improving              |
| Limpkin                    | -                       | Potential colonization |
| American Oystercatcher     | x                       | Improving^             |
| Black Oystercatcher        | x                       | Worsening*             |
| Black-bellied Plover       | x                       | Stable                 |
| Snowy Plover               | -                       | Improving*             |
| Wilson's Plover            | -                       | Potential colonization |

| Common Name             | Summer Trend | Winter Trend            |
|-------------------------|--------------|-------------------------|
| Piping Plover           | -            | Potential colonization^ |
| Killdeer                | Improving    | Improving               |
| Spotted Sandpiper       | -            | Stable                  |
| Wandering Tattler       | x            | Worsening*              |
| Willet                  | -            | Improving^              |
| Lesser Yellowlegs       | -            | Potential colonization  |
| Whimbrel                | x            | Improving*              |
| Long-billed Curlew      | Improving^   | Improving*              |
| Marbled Godwit          | -            | Improving*              |
| Black Turnstone         | -            | Worsening*              |
| Sanderling              | -            | Improving               |
| Least Sandpiper         | -            | Improving               |
| Red-necked Phalarope    | Stable       | -                       |
| Pomarine Jaeger         | x            | Worsening^              |
| Common Murre            | x            | Worsening*              |
| Pigeon Guillemot        | Improving    | Worsening               |
| Rhinoceros Auklet       | x            | Worsening               |
| Laughing Gull           | -            | Potential colonization  |
| Heermann's Gull         | x            | Worsening               |
| Mew Gull                | -            | Improving               |
| Ring-billed Gull        | -            | Improving*              |
| Western Gull            | Improving*   | Stable^                 |
| California Gull         | x            | Stable^                 |
| Herring Gull            | -            | Stable^                 |
| Iceland Gull (Thayer's) | -            | Worsening*              |
| Glaucous-winged Gull    | -            | Worsening               |
| Caspian Tern            | x            | Improving*              |
| Forster's Tern          | x            | Improving*              |
| Royal Tern              | x            | Improving^              |
| Sandwich Tern           | -            | Potential colonization^ |
| Rock Pigeon             | Improving    | -                       |
| Band-tailed Pigeon      | Worsening    | Stable                  |

| Common Name               | Summer Trend            | Winter Trend           |
|---------------------------|-------------------------|------------------------|
| Eurasian Collared-Dove    | x                       | Improving              |
| White-winged Dove         | -                       | Potential colonization |
| Mourning Dove             | Improving               | Improving              |
| Burrowing Owl             | Potential colonization^ | Stable                 |
| Lesser Nighthawk          | Improving               | -                      |
| Common Nighthawk          | Potential colonization  | -                      |
| White-throated Swift      | x                       | Worsening*             |
| Black-chinned Hummingbird | Potential colonization  | -                      |
| Anna's Hummingbird        | Worsening*              | Worsening              |
| Costa's Hummingbird       | Stable                  | -                      |
| Allen's Hummingbird       | Stable^                 | Stable                 |
| Belted Kingfisher         | -                       | Improving              |
| Acorn Woodpecker          | Worsening*              | Stable                 |
| Golden-fronted Woodpecker | Potential colonization  | -                      |
| Red-breasted Sapsucker    | -                       | Worsening*             |
| Nuttall's Woodpecker      | -                       | Improving              |
| Northern Flicker          | Stable                  | Worsening              |
| American Kestrel          | x                       | Improving              |
| Merlin                    | -                       | Worsening^             |
| Peregrine Falcon          | x                       | Stable                 |
| Western Wood-Pewee        | Worsening*^             | -                      |
| Willow Flycatcher         | Potential extirpation   | -                      |
| Dusky Flycatcher          | -                       | Potential colonization |
| Pacific-slope Flycatcher  | Worsening*              | -                      |
| Black Phoebe              | Stable                  | Worsening              |
| Say's Phoebe              | -                       | Worsening              |
| Vermilion Flycatcher      | Potential colonization  | -                      |
| Ash-throated Flycatcher   | Worsening*              | -                      |
| Great Crested Flycatcher  | -                       | Potential colonization |

| Common Name              | Summer Trend            | Winter Trend          |
|--------------------------|-------------------------|-----------------------|
| Brown-crested Flycatcher | Potential colonization  | -                     |
| Great Kiskadee           | Potential colonization  | -                     |
| Western Kingbird         | Improving*              | -                     |
| Loggerhead Shrike        | Stable                  | Improving             |
| Bell's Vireo             | Potential colonization  | -                     |
| Hutton's Vireo           | Worsening*^             | Worsening             |
| Warbling Vireo           | Potential extirpation   | -                     |
| Black-whiskered Vireo    | Potential colonization  | -                     |
| Green Jay                | Potential colonization  | -                     |
| American Crow            | Stable                  | Improving             |
| Fish Crow                | Potential colonization  | -                     |
| Common Raven             | Potential extirpation   | Stable                |
| Horned Lark              | Stable                  | Improving*            |
| Tree Swallow             | Stable                  | -                     |
| Barn Swallow             | Potential extirpation   | -                     |
| Cliff Swallow            | Worsening               | -                     |
| Bushtit                  | Worsening               | Stable                |
| White-breasted Nuthatch  | -                       | Improving*            |
| Brown-headed Nuthatch    | Potential colonization^ | -                     |
| Rock Wren                | Stable                  | Worsening*            |
| Canyon Wren              | x                       | Stable                |
| House Wren               | Stable                  | Improving             |
| Bewick's Wren            | Worsening               | Worsening             |
| Blue-gray Gnatcatcher    | Improving*              | Improving             |
| Golden-crowned Kinglet   | -                       | Potential extirpation |
| Ruby-crowned Kinglet     | -                       | Stable                |
| Hermit Thrush            | -                       | Improving             |
| American Robin           | Potential               | Stable                |

| Common Name             | Summer Trend           | Winter Trend           |
|-------------------------|------------------------|------------------------|
|                         | extirpation            |                        |
| Varied Thrush           | -                      | Potential extirpation  |
| Sage Thrasher           | -                      | Improving              |
| Northern Mockingbird    | Improving*             | Improving              |
| European Starling       | Stable                 | Stable                 |
| American Pipit          | -                      | Stable                 |
| Cedar Waxwing           | -                      | Improving*             |
| Phainopepla             | Improving              | -                      |
| Swainson's Warbler      | Potential colonization | -                      |
| Orange-crowned Warbler  | Worsening              | Improving              |
| Common Yellowthroat     | Worsening              | Improving              |
| Northern Parula         | -                      | Potential colonization |
| Bay-breasted Warbler    | Potential extirpation  | -                      |
| Yellow Warbler          | Potential extirpation  | -                      |
| Pine Warbler            | -                      | Potential colonization |
| Yellow-rumped Warbler   | -                      | Improving              |
| Yellow-throated Warbler | -                      | Potential colonization |
| Townsend's Warbler      | -                      | Stable                 |
| Wilson's Warbler        | Potential extirpation  | Improving              |
| Red-faced Warbler       | Potential colonization | -                      |
| Spotted Towhee          | Worsening              | x                      |
| Rufous-crowned Sparrow  | x                      | Stable                 |
| Canyon Towhee           | Potential colonization | -                      |
| Bachman's Sparrow       | Potential colonization | -                      |
| Chipping Sparrow        | Stable                 | Improving              |
| Vesper Sparrow          | -                      | Potential colonization |
| Lark Sparrow            | Worsening              | Improving              |

| Common Name                                       | Summer Trend           | Winter Trend            |
|---|------------------------|-------------------------|
| Savannah Sparrow                                  | Potential extirpation  | Improving               |
| Grasshopper Sparrow                               | -                      | Improving               |
| Henslow's Sparrow                                 | -                      | Potential colonization  |
| Nelson's/Saltmarsh Sparrow (Sharp-tailed Sparrow) | -                      | Potential colonization^ |
| Seaside Sparrow                                   | -                      | Potential colonization^ |
| Fox Sparrow                                       | -                      | Worsening*              |
| Song Sparrow                                      | Worsening              | Stable                  |
| Lincoln's Sparrow                                 | -                      | Stable                  |
| Harris's Sparrow                                  | -                      | Improving               |
| White-crowned Sparrow                             | -                      | Worsening               |
| Golden-crowned Sparrow                            | -                      | Worsening               |
| Dark-eyed Junco                                   | x                      | Potential extirpation   |
| Summer Tanager                                    | Improving              | -                       |
| Western Tanager                                   | Stable                 | -                       |
| Rose-breasted Grosbeak                            | Improving              | -                       |
| Black-headed Grosbeak                             | Worsening              | -                       |
| Blue Grosbeak                                     | Improving*             | -                       |
| Lazuli Bunting                                    | Stable                 | -                       |
| Indigo Bunting                                    | -                      | Potential colonization  |
| Painted Bunting                                   | -                      | Potential colonization  |
| Red-winged Blackbird                              | Stable                 | -                       |
| Western Meadowlark                                | Worsening              | Worsening               |
| Brewer's Blackbird                                | Worsening              | -                       |
| Bronzed Cowbird                                   | Potential colonization | -                       |
| Brown-headed Cowbird                              | Potential extirpation  | -                       |
| Hooded Oriole                                     | Improving*             | -                       |
| Bullock's Oriole                                  | Worsening              | -                       |
| House Finch                                       | Worsening              | Worsening               |
| Purple Finch                                      | Worsening*             | Potential               |

| <b>Common Name</b> | <b>Summer Trend</b> | <b>Winter Trend</b>   |
|--------------------|---------------------|-----------------------|
|                    |                     | extirpation           |
| Pine Siskin        | -                   | Potential extirpation |

| <b>Common Name</b> | <b>Summer Trend</b> | <b>Winter Trend</b> |
|--------------------|---------------------|---------------------|
| Lesser Goldfinch   | Stable              | Improving           |
| American Goldfinch | -                   | Improving           |
| House Sparrow      | x                   | Improving           |