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Communicating science to motivate action: A case study of birds and climate change

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Climate change is an existential threat to biodiversity and people, but building political will for action on climate change remains elusive. Research on climate change communications to increase effectiveness at motivating action include these recommendations: pairing risk and opportunity in message framing, localizing information, and appealing to a sense of place. Here, we present a case study on mobilizing bird enthusiasts to take action on climate change. The science communicated found that over two-thirds of North American birds are moderately or highly vulnerable to climate change under a 3.0°C warming scenario. Of these climate-vulnerable species, 76% would have reduced vulnerability if warming were stabilized at 1.5°C. These findings were summarized and communicated with the public in an award-winning interactive website, the “Birds and Climate Visualizer,” that allowed individuals to look up any location by postal ZIP code and learn what birds would be impacted by climate. Also included was a Climate Action Handbook providing sample personal actions. The communications rollout earned 2.5 billion media impressions, the visualizer has been used at least 42,000 times, and handbook circulated to 250,000 households. More than 33,000 people read headlines from the report or explored the visualizer and then completed an online action in support of clean energy policies. The message frame combined with the visualizer and handbook as tools to deliver the frame have contributed to climate legislative wins in four states. These early successes suggest that message and visual online tools that localize and personalize a message are effective to motivate action.

KEYWORDS

science communication, localization, politicization, climate change, storytelling, digital products, advocacy

Climate change communication

The need for aggressive and immediate coordinated global action to address climate change increases with each passing year (IPCC, 2014, 2018, 2021). In 2015, the Paris Agreement signed by 195 countries set the goal to avoid catastrophic global impacts of climate change by maintaining mean global temperature rise well below 2°C increase from pre-industrial mean temperatures and pursuing efforts to limit warming to +1.5°C (UNFCCC, 2015). Limiting increases to 1.5°C would go furthest to limit risks of climate

change across the globe and avoid the most catastrophic of impacts of climate change (IPCC, 2018).

The 2021 Conference of Parties (COP26) was the largest meetings since 2015 and had ambitious expectations for commitments to advance the goals of the Paris Agreement. The final COP26 “Climate Pact” resolution included over 190 countries with new pledges for carbon emissions reductions from many (EC, 2021). After the meeting, some concluded that the Pact has kept the goals of the Paris Agreement within reach, with pledges from countries having an estimated potential to keep warming between 1.8 and 2.4°C (EC, 2021); whereas others concluded that the major initiatives signed during the meeting fall short (Arora and Mishra, 2021), including agreements to transition away from coal, to halt deforestation, and to reduce methane emissions. In all cases, key emitters failed to sign on to these pledges or the goals were diluted such that the emissions impacts fall short (Arora and Mishra, 2021). Many top emitters including the United States, China, India, and Russia have an insufficient or worse rating of their current climate policies, suggesting that either their current target emissions reductions are still too modest or there is a significant gap between their target and their existing policies (climateactiontracker.org). Therefore, the impact of COP26 and effectiveness of the Paris Agreement still depends on whether pledged reductions are realized within each country and whether additional high-emitting countries sign on the existing pledges and further reduce emissions.

In countries where action on climate change is politicized and still widely debated, broadening support for climate policy action and clarifying what mechanisms are most impactful to reducing emissions remains a top priority for the research community (Nature, 2021). The United States is the most glaring example after having initiated its withdrawal from the Paris Agreement in 2017. The impact of US withdrawal would have reduced the overall effectiveness of the agreement by diluting the resolve and ambition of reluctant countries to comply (Pickering et al., 2018); however, withdrawal was reversed in 2020. More than half of the US population thinks that global warming is happening (73%), is human-caused (60%), and that there is a scientific consensus (57%) and this has been trending upward since 2010 (Ballew et al., 2019). But over that same period, fewer than half of moderate and conservative Republicans have consistently said global warming is human caused (Ballew et al., 2019; Yale Program on Climate Change Communication George Mason University Center for Climate Change Communication, 2020). Politics are a barrier to climate action in many of the greatest emitting countries, particularly in high-emitting countries where international organizations have less political influence (Kukkonen et al., 2018).

Building and sustaining the political will for within-country action on climate change requires effective science communication that counteracts politicization of climate change policy decisions (Bolsen et al., 2019). Effective communications

rely on strategic framing to shape the narrative and draw attention while also limiting the counter-narrative frames of others (Lakoff, 2010; Luxon, 2019). In climate change communications, many frames have been explored: scientific consensus, fear of risk or loss, and activating hope or self-efficacy, public health, economic opportunity, moral imperative, and national security (Bolsen et al., 2019; Luxon, 2019). Evidence from the press releases of 350.org, a non-profit focused on climate change, suggests that combining both negative and positive frames may be the most effective, and that a balanced approach was more likely to gain media attention (Luxon, 2019). This sequencing of emotional experiences, e.g., from fear to hope, can increase the persuasive effect (Nabi et al., 2018). Furthermore, pairing imagery or visualizations of specific and localized impacts, such as sea level rise maps for particular cities, can help reduce the politicization of scientific information and counter-act the most common politicized counter-frame that there is not a scientific consensus around climate change (McCright et al., 2016; Bolsen et al., 2019).

Localized framing and communication, either associated with where a person lives or a place that they hold dear, has proven to be more effective than global messaging at motivating action on climate change (Scannell and Gifford, 2013). The studies we reference above exploring the effectiveness of localized impacts focused on sea level rise (Bolsen et al., 2019) or wildfire (Scannell and Gifford, 2013). However, less studied is the effectiveness of using a local animal of interest. When animals are used, they are most often polar bears or penguins (Rebich-Hespanha et al., 2015), but people care a lot about birds (Robinson, 2019) and their popularity is increasing (Schuetz and Johnston, 2021). There were an estimated 47 million birders within the US in 2011 with \$107 billion in birding-industry output that year. People show higher interest in “celebrity” species that are universally popular and “friends and enemy” species that are locally abundant (Schuetz and Johnston, 2019). Other species are either “neighbors” that are local birds that garner relatively low attention or “strangers” that are not popular nor sought out locally (Schuetz and Johnston, 2019). A proposed bird conservation strategy are communications to move an at-risk species into the “celebrity” and “friends and enemy” category. Already, interest in migratory bird species has grown over the past decade (Schuetz and Johnston, 2021). Similarly, popular birds could be an effective frame to localize climate change communication.

A case study for birds and climate change

In 2019, the National Audubon Society released a report, *Survival by Degrees: 389 Bird Species on the Brink* (Wilsey et al., 2019) that assessed the vulnerability of 604 North American bird species under multiple global warming scenarios (Bateman

Vulnerable Birds in Maryland

Highly and moderately vulnerable birds may lose more than half of their current range—the geographic area where they live—as they are forced to search for suitable habitat and climate conditions elsewhere.

Maryland

Flyway Atlantic Flyway
State Brief Download [PDF]
Website <http://md.audubon.org>

Below, find out which of the birds that nest or spend the winter in your area are most vulnerable across their entire range. Some birds may lose range outside of your state, making the protection of their current habitat in your area even more important.

Warming scenario:

+1.5 °C +2.0 °C +3.0 °C

[Why these temperatures?](#)

Season:

Summer

[What is a season?](#)

High Vulnerability Species

27

Moderate Vulnerability Species

43

Low Vulnerability Species

33

Stable Species

77



Eastern Whip-poor-will



Red-headed Woodpecker



Blue-headed Vireo



Fish Crow



Brown-headed Nuthatch



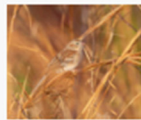
Winter Wren



Wood Thrush



Brown Thrasher



Field Sparrow



Dark-eyed Junco



Savannah Sparrow



Henslow's Sparrow



Eastern Towhee



Bobolink



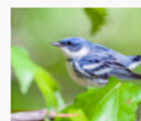
Boat-tailed Grackle



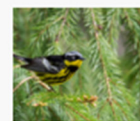
Worm-eating Warbler



Golden-winged Warbler



Cerulean Warbler



Magnolia Warbler



Blackburnian Warbler



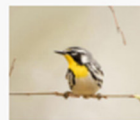
Chestnut-sided Warbler



Black-throated Blue Warbler



Pine Warbler



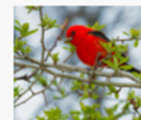
Yellow-throated Warbler



Black-throated Green Warbler



Canada Warbler



Scarlet Tanager

Search by ZIP code or State

FIGURE 1 Screenshot of Birds and Climate Visualizer depicting bird species highly vulnerable to climate change in the summer season. Red toggle buttons at the top allows users to switch between the 3.0°C, 2.0°C, and 1.5°C warming scenarios. A drop-down menu allows user to select the season (summer or winter). And, the user can select what level of vulnerability (high, moderate, low and stable) to explore species within.

et al., 2020b), as well as mapping overall risk to birds due to climate change-related threats (Bateman et al., 2020a). The communications rollout of this report is an informative case study for climate change communication that incorporated the recommendations reviewed above. Key themes included: combining negative (e.g., risk) and positive (hope and agency) frames, localization, and specific and local calls to action. Below we describe these elements in detail and share the quantitative metrics summarizing impact where available. We did not formally plan this public communications launch within an experimental framework. Therefore, we are not able to make inference on the success of the rollout. Learning was limited to observing website traffic and initial conversion rates for calls to action and using trial and error to find the most effective strategy (described below). However, now that the communication frame and online tools exist, we have a platform for experimentation, testing of hypotheses, and ultimately refinement.

Science

The science summarized in the *Survival by Degrees: 389 Bird Species on the Brink* report was published in two peer-reviewed scientific publications. Bateman et al. (2020a) assessed the vulnerability of 604 North American bird species and identified the species and locations most at risk under climate change. The study used species distribution models for both the breeding and nonbreeding seasons, projected under two global warming scenarios (an optimistic mitigation scenario 1.5°C and an unmitigated 3.0°C scenario) to evaluate vulnerability. The study found that over two-thirds of these 604 species of North American birds are moderately or highly vulnerable to climate change under a 3.0°C scenario. Of these climate-vulnerable species, 76% would have reduced vulnerability and 38% of those would be considered non-vulnerable if warming were stabilized at 1.5°C. Thus, the current pledge in greenhouse gas reductions set by the Paris Agreement is inadequate to reduce vulnerability to North American birds. Additionally, if climate change proceeds on its current trajectory, arctic birds, water birds, and boreal and western forest birds will be highly vulnerable to climate change, groups that are currently not considered of high conservation concern.

Bateman et al. (2020b) assessed the risk to 544 birds in the contiguous United States from future climate change-related threats under a mitigation-dependent global warming scenario of 1.5°C and an unmitigated scenario of 3.0°C. Threats considered included sea level rise, human land cover conversion, and extreme weather events. The study identified potential impacts to individual species by overlaying future bird ranges with threats to calculate the proportion of species' ranges affected, and mapped a place-based index of risk based on hazard (coincident threats), exposure (potential species richness), and vulnerability (potential richness of vulnerable species). Extreme

weather events had the most extensive spatial coverage and contribution to risk, but urbanization and sea level rise also had disproportionate impacts on species relative to their coverage. With unmitigated climate change, multiple coincident threats affected over 88% of the area of the conterminous United States, and 97% of these 544 species could be affected by two or more climate-related threats. Some species habitat groups could have up to 96% of species facing three or more threats. Species of conservation concern also faced more threats regardless of climate change scenario. However, climate change mitigation would reduce risk to birds from climate change-related threats across over 90% of the US.

Communications framing

The communications frame combined both negative framing of fear or risk and positive framing of hope and personal action (Table 1). Each scientific finding was paired with one or more positive messages drawn from the aforementioned science. Then, we developed a broad call to action: #BirdsTellUs it is time to act on climate. This was then paired with one or more specific actions that individuals could take. The communications strategy was grounded in the theory (outlined above) that people will be more motivated to take action and learn more when a large issue is framed locally, in this case, how climate change affects the birds that people can see in their backyard. The Birds and Climate Visualizer was created specifically to create this local connection for the user. The communications goal was to “move people who love birds and nature toward personal and collective action based on that love, not on fear.” The Climate Action Handbook was developed to connect people inspired by the science to specific actions.

Birds and climate visualizer

Accompanying the scientific report described above, Audubon debuted an award-winning “Birds and Climate Visualizer” web application, named a World Changing Idea by *Fast Company* in 2020 in the category of data science. The Visualizer allows users to look up any location by postal ZIP code, and produces a scrollable, visual report containing several elements of content tailored to that location (Figure 1).

- First, the users see which of the 604 bird species would be impacted by climate change under an unmitigated 3.0°C warming scenario and learn how those lists of most vulnerable local birds would be altered and reduced if we take policy action now to keep warming at 1.5°C. The user can select any species on those lists to see a visualization of how warming will shift that species' range in the future.

TABLE 1 Communications framework used for public rollout of the Survival by Degrees: 389 Birds on the Brink report.

Frame type	Negative: Fear or risk	Positive pairing: Hope or action
Scientific results	<ul style="list-style-type: none"> • Audubon’s report shows that two-thirds (64%) (389 out of 604) of North American bird species are at risk of extinction from climate change. • Every bird species will experience some kind of impact from climate change. • 305 species face three or more threats at the highest warming scenario (3.0 C) 	<ul style="list-style-type: none"> • The good news is that our findings also show that if we take action now we can help improve the chances for 76% of species at risk. • If we reduce emissions by 2050 and hold warming to 1.5 C then 76% (290) of vulnerable species will be better off and 38% of (148) species would come off the climate-vulnerable list • Climate change mitigation would reduce risk to birds across more than 91% of the conterminous United States • Only 35 species face three or more threats at the lowest warming scenario (1.5 C).
Calls to action	<ul style="list-style-type: none"> • #BirdsTellUs it is time to act on climate (paired with one or more of the options to the right depending on context) 	<ul style="list-style-type: none"> • Protect the places birds need now and in the future. <ul style="list-style-type: none"> ◦ Advocate for natural solutions, such as increasing marshlands along coasts and rivers, to help adapt our communities and landscapes to climate change. • In addition to taking personal action at home, we must urge action at state and federal levels to address the root causes of climate change and reduce carbon released to the atmosphere. • Reduce your use of energy at home and ask your elected officials to support energy-saving policies that reduce the overall demand for electricity. • Ask your elected officials to expand consumer-driven clean energy development that grows jobs in your community.

- Second, the Visualizer features a single, well-known species and maps where it is projected to lose range due to climate change in that region. This map can be redrawn based on multiple warming scenarios.
- Third is a visualization summarizing all of the 604 species organized by habitat type in the region and their relative vulnerabilities to climate change under different warming scenarios.
- Fourth, the visualizer summarizes current climate change policy legislation and renewable energy targets for the relevant US state. This feature is not included for provinces or states in Canada or Mexico.
- Fifth, there is a map visualization centered on the relevant US state showing the co-occurrence of climate change-related threats such as extreme weather events, including spring drought and extreme heat, sea level rise, and urbanization. This feature is not included for provinces or states in Canada or Mexico.
- Finally, there is a link to download a “state brief” PDF for US states that provides a summary of climate change vulnerability and climate change-related threats within the state.

The Birds and Climate Visualizer connects the over-arching messaging around the threat climate change poses to birds and

the opportunity to address that threat with immediate action with localized information on birds impacted by climate change, including identifying local climate change-related threats, and current policies to address climate change.

Climate action handbook

Accompanying the scientific report described above, Audubon published a special issue of *Audubon* magazine that included a climate action handbook. The magazine was mailed to 350,000 subscribers and members of Congress. In “[Start Here! Your Guide to Climate Action](#),” Audubon editors illustrated how everyday choices can spur social change, and helped readers amplify their actions to make a difference on ever-bigger scales. The guide won a National Magazine Award in the Personal Service category. As readers flip through it, the guide builds to match readers’ ambition and confidence. They learn how to turn a seemingly small step, like identifying their personal climate story, into a tool for writing a letter to the editor, going before their city council, or lobbying legislators. The guide does not only tell readers how to do these things, it also spotlights people who show how it’s done. And because it is broadly known how overwhelming climate change can be, the guide offers Coping Skills for climate anxiety ([Hickman et al., 2021](#))

as well—pointers for staying focused on the task ahead.

Measures of impact

The Survival by Degrees report, visualizer tool, and climate action handbook drove a meaningful conversation on climate change across international, national, state, and local stages, commanding a news cycle in early October 2019 with coverage in outlets that span conservative, moderate and progressive ideology. From *CNN New Day*, *The New York Times* and *USA Today* to *Fox News* and *Breitbart* to regional outlets like *The Chicago Tribune* and *Philadelphia Inquirer*, the release of *Survival by Degrees* garnered more than 2.5 billion media impressions and more than 1,300 placements in just 1 month. Media impressions are the sum of the circulation, viewership or listeners of all the 1,300 print, TV, radio, and online media outlets covering the topic. The message also crossed international borders and waters with coverage in a Canadian news outlet, *The Globe and Mail*, and placements in the UK such as *The Guardian* and *Daily Mail*. From the launch date in October 2019 through 2020, 120,986 visits to the Survival by Degrees website were logged.

Audubon took the Survival by Degrees report, communications frame, and interactive tools directly to legislators and met with numerous federal and state policymakers to convey the importance of taking immediate and aggressive action on climate change. Several legislators, including congressional leaders Senator Schumer (D-NY) and Braun (R-IN), used the visualizer to look up their own zip code and see the impacts of climate change in their own community and the homes of their constituents. From the public launch in October 2019 through 2021, the Birds & Climate Visualizer was used more than 42,000 times. The political ideology of these users was 54% progressive, 20% moderate, and 11% conservative. Notably, these closely match Audubon's membership (53, 28, 18, respectively). These ideological classifications were not self-identified. Rather, they were predicted based on a nationwide statistical model from *TargetSmart*, a political data firm, which classified over 240 million voters based on a statistical model predicting the differences between Liberals and Conservatives built from phone surveys. The model scores voters on a scale of 0–100 of their likelihood of being a liberal and these scores were classified into three categories: Conservative (0–26), Moderate (26–48), and Progressive (48–100) based the national distribution of ideology scores.

Audubon's goal was to “move people who love birds and nature toward personal and collective action based on that love, not on fear.” This fits within a broader theory of change to build durable public will for policy actions to address climate change at all levels of government, which includes inviting users

to engage in advocacy actions. Integrated in the Survival by Degrees website and the Birds and Climate Visualizer are digital calls for users to take action. This is an area where we used initial conversion rate data to refine our approach to be more effective. Originally, Audubon launched the Visualizer with a set of four personal actions that included: Expand US Renewable Energy, Work Locally on Climate, Plant Native Plants, and Give to Audubon. The conversion rate on this multi-action call was only 0.75%, well below industry standards. After observing this low return, Audubon switched to listing single calls to action and experimented with a few options that ultimately differed in their conversion rates: Urge representatives to support clean energy technology (4.2% conversion rate), Work on climate action in your community (1.8%), and Donate (0.14%). The 4.2% conversion rate is consistent with industry standards. Notably, there were more donations resulting from the clean energy call to action than from the donate action.

Overall, more than 2,300 people who visited the site took an online action in support of clean energy policies from the launch date through December 2020. These people were among more than 33,000 people who took an online action based on the report in this timeframe. For example, 5,400 people completed the action through this “engagement card,” which appeared on the Audubon.org website through December 2020 and 16,500 people responded to an email action alert sent on October 11, shortly after the report rollout. The online action supported a congressional omnibus energy *legislation* that included multiple policies supportive of clean energy technology development and was signed into law in 2020.

In addition to these national calls to action, Audubon incorporated these products into local advocacy training programs. 156 Audubon chapters, which are separate 501c3 organizations, representing 38 US states, participated in the public rollout. The organizations submitted 33 letters to the editor, of which 13 (39%) were published. Across six states, 2,000 people have attended at least two trainings on climate change advocacy in which the Communications Frame and Visualizer are used as core training tools. And in 2021, 19,000 people in those states took 40,000 online actions to support climate change policy legislation. These advocates have supported successful climate change legislative wins in Arkansas, South Carolina, North Carolina, and Washington.

Finally, readers of *Audubon* magazine responded enthusiastically to the climate action guide. One comment to the magazine read: “WOW! Audubon really stepped up. Its Guide to Climate Action is exactly what we need.” Legislators were impressed, too. Pennsylvania State Representative Steve McCarter as well as several faith groups and high school teacher and university professors requested copies of the climate-action guide to give to constituents. Online, Audubon created a more robust, interactive experience—one that can continually be revised with new material, ensuring it remains a valuable resource in the future.

Conclusion

This case study brings together multiple best practices from the climate communications literature. It serves as a template much like similar tool-kits for hope-based communication techniques for climate change (Bonanno et al., 2021). Audubon's Survival by Degrees report and accompanying digital and print products were successful at reaching and motivating to action a unique and growing constituency of bird lovers spanning political party affiliations supporting the conclusion that paired messaging (risk and hope) and localized data and storytelling can cut through partisanship.

We share this case study as a perspective of how theory can be translated into action in a launch of a major scientific study and report like Audubon's. However, admittedly, we haven't proven experimentally that this worked or that this approach was superior to another. While we learned a lot from this effort, we would have learned more had we incorporated social science approaches into the rollout. It is our intention to do this moving forward as we continue to reference the science, Visualizer, and Action Guide as part of continued advocacy. We initiated an experimental study in 2020 examining conversion rates to several updated messaging frames linking science to action, but paused it when the global pandemic began. We hope to re-initiate that soon. Similarly, there is space to collect constructive feedback on the Visualizer and Handbook through user-testing and user-experience surveys. This is another avenue for future refinement.

As conservation organizations increasingly focus on impact, and adopt best practices from science AND industry (e.g., digital products), we need to bring the same rigor to our communications and advocacy as our science. Each of the elements of this rollout approach (paired risk/hope messaging, localized data and place-based storytelling using birds) could be tested independently for its effectiveness at delivering action as well as reducing politicization. This requires bringing on additional expertise, particularly in social sciences, to design and test effective approaches. Equally important, is breaking down silos within a single organization. The success of this Audubon case study is the result of the intra-organizational

collaboration across science, marketing, policy and campaigns, content, and digital products. Building and executing projects in cross-functional teams is as important to success as the underlying science itself.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found at: <https://adaptwest.databasin.org/pages/audubon-survival-by-degrees>.

Author contributions

CW led ideation, writing, and submission. BB, LP, JB, and RS contributed to ideation and writing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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