



Climate change beliefs among waterfowl hunters in Arkansas

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Waterfowl conservation, management, and recreation share connections to anticipated climate change impacts. Climate change projections and assessments indicate that global warming will affect waterfowl populations valued by recreationists via multiple mechanisms at broad geographic scales (Niemuth et al., 2014). These effects include disturbance of spring migration due to changes in habitat availability, loss of critical goose and duck breeding/nesting grounds, cross-seasonal effects of wintering habitat conditions and subsequent breeding, shifts in nonbreeding bird distribution, and drought periodicity shifts in migratory wetland habitat (Lehikoinen et al., 2013). Those facts notwithstanding, the U.S. general population displays a spectrum of beliefs regarding the reality of climate change and support of actions needed to address this issue. Moreover, in the context of waterfowl conservation, little is known of its stakeholders' beliefs about climate change, although several approaches to assess climate change beliefs exist. The "Six Americas," for example, is a climate change belief assessment and audience segmentation protocol (Leiserowitz et al., 2009). This protocol partitions individuals into distinct groups that range from alarmed (i.e., those who are convinced of the reality and danger of climate change, and are highly supportive of individual and political action to mitigate climate change) to dismissive (i.e., those who are equally certain that climate change is not occurring and that no action should be taken).

Revealing stakeholders' beliefs about climate change could benefit conservation agencies and organizations as they consider communication strategies to build support for waterfowl management strategies that mitigate the effects of climate change. For instance, knowing which stakeholders hold beliefs associated with climate change denialism and support inaction can direct organizations to address issues of cognitive dissonance, motivated reasoning, or moral tribalism rather than simply providing information or engaging in education and awareness campaigns (Markowitz & Shariff, 2012). Given the strong connections among climate change, waterfowl habitat, and hunters, we assessed waterfowl hunters' beliefs about climate change in Arkansas using the Six Americas audience segmentation framework (Leiserowitz et al., 2009). We suggest that this framework is a useful tool for informing management agencies' and conservation organizations' communications and messaging around climate change using waterfowl management as a medium (Glick, 2005).

Arkansas supports a large percentage of hunters in the Mississippi Flyway, which is North America's largest and most hunted waterfowl migration corridor, making the state ideal for research on waterfowl stakeholders (Fronczak, 2019). In 2018–2019, 97,908 Arkansas waterfowl stamps were purchased (to hunt duck and goose), 52,212 of which

were resident purchases, and 39,486 of which provided an e-mail contact (76% coverage). From this sampling frame, a random sample ($n = 4,000$) was invited via e-mail on August 12, 2019 to complete a questionnaire online (with Qualtrics software) with five subsequent reminders sent at four-day intervals. A total of 1,153 responses were collected (840 full and 313 partial completes; 29% combined response rate and 22% completion rate; 3% margin of error at the 95% confidence level). Given the controversial topic, only complete responses to the 4-item Six Americas Short Survey scale (SASSY; described below) were used in our analyses ($n = 914$).

Beliefs about climate change were measured using SASSY, which asks: (a) how important is the issue of global warming to you personally (1 not at all important to 5 extremely important), (b) how worried are you about global warming (1 not at all worried to 4 very worried), (c) how much do you think global warming will harm you personally (1 not at all to 4 a great deal, 5 don't know), and (d) how much do you think global warming will harm future generations (1 not at all to 4 a great deal, 5 don't know; Chryst et al., 2018). The fourth question was modified to ask how global warming would harm "future generations of duck hunters." We also asked: (a) do you think global warming is happening (no/yes), (b) how sure are you that climate change is/is not happening (1 not at all sure to 4 extremely sure), and (c) how would you describe your political views (1 very liberal to 5 very conservative).

Respondents were 95% male, 96% white, and averaged 42 years of age. More than half of respondents indicated that they believe global warming is happening (57%), which is slightly below the general populations of Arkansas (60%) and the U.S. (67%; Leiserowitz et al., 2019). In terms of their level of belief that global warming is happening, 19% were extremely sure (very sure = 29%, somewhat sure = 43%, not at all sure = 9%). In contrast, 17% were extremely sure that climate change is not happening (very sure = 27%, somewhat sure = 42%, not at all sure = 14%). Most respondents (54%) emerged in either the alarmed (13%), concerned (20%), or cautious (22%) segments (Figure 1). Analytical segmentation procedures related to machine learning, regression, and classification are detailed in Chryst et al. (2018). The

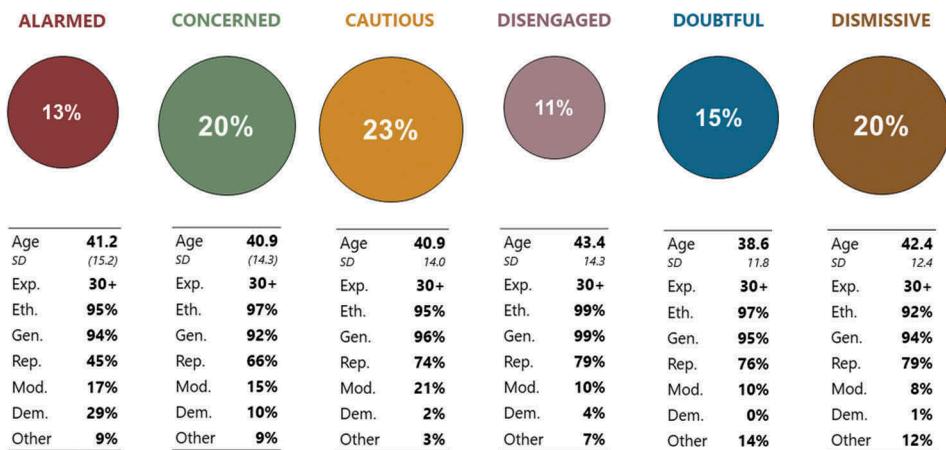


Figure 1. Climate change belief segments of Arkansas waterfowl hunters based on the Six Americas framework with associated socio-demographic data.

Table 1. Correlations between Six Americas segment and political views among sample of 2019 Arkansas waterfowl hunters.

	Alarmed	Concerned	Cautious	Disengaged	Doubtful	Dismissive
Very conservative	-.11**	-.15**	-.05	-.02	.05	.34**
Conservative	-.13**	.05	.05	.08*	.01	-.06
Moderate	.06	.08*	.06	-.04	-.06	-.15**
Liberal	.32**	-.02	-.08*	-.08*	-.07	-.09*
Very liberal	.10**	-.05	-.01	-.03	-.03	.01

* $p < .05$. ** $p < .01$.

remaining 46% of respondents emerged within the disengaged (11%), doubtful (15%), and dismissive (20%) segments. Alarmed and concerned segments were below the national averages (31% and 26%, respectively), whereas all other Arkansas segments were above the national averages (i.e., 16% cautious, 7% disengaged, 10% doubtful, 10% dismissive; Leiserowitz et al., 2019). Respondents' political views were primarily conservative (67%), split between very conservative (19%) and conservative (48%). The remaining respondents identified as moderate (23%), liberal (3%), very liberal (1%), and other (6%). In correspondence with previous research, correlations between political views and the Six Americas segments are displayed in Table 1. In general, significant patterns of correlations were observed within the extreme segments, alarmed and dismissive, which parallels other findings (e.g., Hornsey et al., 2016).

Our results suggest that a majority of Arkansas waterfowl hunters believe climate change is happening and fall within segments (i.e., alarmed, concerned, cautious) that potentially support natural resource policies to mitigate and adapt to climate change within the context of waterfowl and related habitat conservation. Although a substantial proportion remain doubtful or dismissive (35%), cautious and disengaged groups (33%) are well-positioned to be influenced by appropriately designed policies and communications (Roser-Renouf et al., 2015). We argue that assessments of climate change beliefs and policy support must become more common (Mawdsley et al., 2009). For example, of the various efforts that inform the North American Waterfowl Plan (NAWMP), none discuss beliefs or behaviors associated with climate change (U.S. Fish and Wildlife Service [USFWS], 2018). Limited direct engagement with climate change among agencies and organizations that serve hunters and anglers may be related to the fact that these entities operate within the parameters of politics. From a political perspective, within a democratic political system, majority opinion tends to have an advantage. Our results offer SASSY as a useful tool to identify if and where such a majority exists, and support beneficial waterfowl conservation, management, and recreation efforts. From a pragmatic perspective, it may be that practitioners' ability to address potential climate change impacts is limited by their expertise and/or range of experience, or because those impacts are not well understood at the spatial-temporal scales they manage (Conroy et al., 2011). Such concerns require more collaborative efforts across the climate change and waterfowl research communities, of which assessments of climate change beliefs are merely a piece of the larger puzzle.

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