



Article Public Attitudes towards Birds and Private Forest Land Conservation

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Abstract: The eastern United States is dominantd by private forest lands, which are important for supporting a significant proportion of global bird populations. Here, we examine public attitudes towards bird conservation, government involvement in private lands issues, and private forest management objectives with an aim to better understand how these perceptions may shape broader attitudes about bird conservation. Data were collected using psychometric scales and a statewide web survey of the general public in Pennsylvania, USA (n = 656). Findings reveal four unique perspectives about birds and important correlations with conservation support on private lands. Respondents with positive views about landowner assistance programs often had more complex attitudes towards birds and were associated with relational and ethical perspectives about birds. We conclude that future public education efforts might cultivate in learners a more robust understanding of bird conservation if they included private forest lands values and culture in their programs.

Keywords: bird conservation; attitudes; education; trust in government; forest management



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1. Introduction

Birds are one of the most identifiable and varied classes of modern vertebrates [1]. However, many bird species and population numbers are in decline, primarily due to habitat loss and pollution [2]. Government policies designed to protect vulnerable wildlife populations are dependent on strong public support to help justify the cost of taking action. Advocates of conservation seek to encourage public action by cultivating a more empathetic and knowledgeable public (e.g., environmental centers, summer camps). However, there is still a considerable amount of complacency and ignorance regarding the specific conservation needs of select wildlife [3,4]. In the United States (US), private lands are critical to the maintenance of many species as well as the recovery of federally listed endangered species [5,6]. However, the subject of wildlife habitat conservation on private lands is often relegated to the idea that it is one of the benefits of land ownership (i.e., private benefit) rather than a public service. Research on family forest owners in the US, one of the dominant categories of forest landowners, shows many owners have a strong ethical motivation to do right by the land and for wildlife [7]. However, wildlife conservation on private lands can result in conflict when private interests are at risk, such as in the use of regulatory interventions that may interfere with the free exercise of private property rights [8]. The importance of private lands to bird conservation merits an examination of how public opinions about the role of private lands may interact with attitudes toward wildlife conservation [9].

Research into environmental education has found that helping people connect to nature and learn about wildlife increases the perceived value of nature and conservation actions [10]. Perceptions of value and the desire for more information often occur within a feedback loop, each feeding the other. For example, landowners with positive perceptions of wildlife were found to be more willing to learn about birds and bird-friendly forestry [11]. Feeding garden birds has been found to increase people's personal wellbeing by viewing

themselves as a caretaker [12]. Some organizations will strategically promote wildlife with appealing attributes to help invoke positive emotions towards conservation more broadly (e.g., panda bears) [13]. Information about endangered wildlife has also been found to increase the likelihood that the public will support species conservation [14,15]. Our ability as humans to manipulate our concern for certain species through learning suggests that wildlife values are often a social construction operating independently of the ecological importance or inherent value of a species. Likewise, definitions of 'knowledge' have expanded from being an accumulation of facts to something embedded in sets of social relations [16,17]. Independent learners will often follow social cues when seeking out information about conservation [18,19]. Choices are also guided by a person's perception of the issue, and these perceptions tend to be a function of associated structures and spatial parts, underlying senses, and visual expressions [20]. Learner characteristics, such as profession, rank, and mobility, also shape the lens through which people perceive and understand, which explains why people can have different views about the same problem [21,22]. The attitudes that emerge from new understandings are generally defined as the tendency to think, feel, or act positively or negatively toward objects in our environment [23,24]. Cognitive connections between related issues are validated or reinforced when a learner compares new information with their own established knowledge and attitudes, as well as the viewpoints of others [25–27].

In many places, it is up to the forest owner to decide how much support (e.g., habitat) they will give to wildlife occurring on their land. However, owners face many of the same challenges as the public when looking to take action, including limited resources and knowledge, and competing priorities [7]. For example, timber harvesting can be an important habitat management tool, but the knowledge needed to direct certain harvesting activities is often limited and cost-prohibitive [28]. Many owners also need technical and financial assistance to help manage habitat and offset potential negative impacts of having wildlife on their land (e.g., crop damage) [29]. Since owners are not required to engage in bird conservation activities specifically, the motivation to take action may emerge for other reasons. Concepts such as sense of place are often used to explain community response to social and ecological changes and recognize the embeddedness of environmental issues. Psychological connections to the land are also understood as a "way of life", which includes the actions taken on the land (e.g., timber harvesting) and the relationships that emerge from working on the land [30]. This is why opinions about government involvement in private land issues often adjoin community values about landowner autonomy since the type of government intervention (e.g., regulation, incentives, technical assistance) can compromise or enhance these values [31]. The interactions between attitudes towards government and attitudes towards wildlife are most apparent in situations of human-wildlife conflict [32].

Landowner and public attitudes toward animals are often rooted in the desire to find a balance between affection/sympathy and economic self-interest [33,34]. Human evolutionary coexistence with wildlife as a source of food/competition/predation is a likely origin of some attitudes toward animals [35]. Human values toward animals may also be contingent on the biological and communicative resemblance between animals and humans [36]. People also tend to be empathetic towards small animals, like birds and squirrels, but this does not always hold true for all small animals, such as bats, snails, and other invertebrates [37]. Kellert was the first to provide a holistic explanation of human attitudes and actions towards wildlife as a function of the perceived utility of the animal [38], if it is capable of drawing empathy from humans and our moral obligation to other living things [13]. In this paper, we examine the cognitive connections (the ways thoughts and feelings are processed to inform behavior) that exist between people's ideas about bird conservation and private forest lands in order to help direct public education and policy efforts [8]. We hypothesize that attitudes towards birds are a function of people's knowledge about birds, as well as their opinions about private forest lands. The cognitive-based parameters measured in this study include knowledge and

perceptions about birds, attitudes towards birds, and attitudes towards timber harvesting and government involvement in private lands decisions.

2. Materials and Methods

2.1. Approach

The theoretical framework used in this study posits that knowledge and attitudes often underpin behavioral intentions [39,40]. To understand how information may be processed (i.e., cognitive connections) when making decisions about conservation, we explore how attitudes about bird conservation could be embedded in the perspectives people hold about related issues, such as government interventions and timber harvesting on private lands (Figure 1).



Figure 1. Conceptual model of the relationship between attitudes towards birds, knowledge and perceptions and attitudes toward decisions that impact private lands.

The study was conducted in the state of Pennsylvania, which is located in the northeastern region of the United States. The Pennsylvanian landscape is dominantd by forests, and the majority of forest lands are privately owned (70% private ownership) which means that much of the public may already be familiar with concepts related to private forest ownership [41]. Forests in this region are also an important landscape feature for many types of local and migratory birds, and forest management is an important strategy for enhancing the habitats needed to support healthy bird populations [42]. Data were collected using a statewide web survey targeting members of the public. The survey tool was developed using a multistep process, including a literature review, interviews with stakeholders, validation procedures for the psychometric scales, and testing with prospective respondents. The final survey tool contained 40 questions and was estimated to take approximately 17 min to complete.

The survey development process started with setting study goals and survey design using the advice of experts from Pennsylvania State University, Audubon Pennsylvania, Pennsylvania Game Commission and Western Pennsylvania Conservancy. Multiple-choice questions were developed to measure the demographic characteristics of respondents. Agree/disagree Likert scales (five-point) were developed to measure knowledge, perceptions, and relevant attitudes. To help refine survey questions thirty-four interviews were held with farmers, loggers, and forest landowners during Forest Expo and Ag Progress days in State College, PA. Experts from five private forest conservation agencies and related federal agencies were also interviewed through telephone conversations and emails.

To understand attitudes towards birds, a new psychometric scalar tool was developed using standard methods [43]. The initial items in the scale were based on attitudinal dimensions previously identified by Kellert [38], including naturalistic, moralistic, ecologistic, aesthetic, humanistic, scientistic, dominionistic, negativistic, and symbolic. Over 30 potential items (i.e., statements) were drafted and tested using a literature review, expert consultations, and interviews with the public (n = 39). A preliminary study was conducted with a seven-point Likert scale to determine the reliability or internal consistency of the proposed items in the scale using the Cronbach's alpha test (n = 40). The Cronbach's alpha test assesses the internal consistency of the scale items, i.e., the degree to which the set of items in the scale co-vary, relative to their sum score [44]. This resulted in retaining a total of 27 items across nine Kellert's dimensions.

After the statewide survey data were collected (n = 656) construct validity was explored via factor analysis and a varimax rotation. A four-factor solution was found using 26 of the 27 items and accounted for 99% of the total variation. The eigenvalues for the first four factors were 9.74, 2.10, 1.47, 0.83 respectively. We classified the new dimensions as being common types of perspectives about birds, including the ethical scientist, relational humanist, abstractor and negative/dominant. However, because the eigenvalue for negative/dominant items was less than one, this construct may not be valid as it explains less than a single original variable. The Cronbach alpha scores reported in Table 1 were calculated using the final statewide survey data set (n = 656).

Table 1. Statements represent	ng four common	perspectives about birds a	across nine attitudinal dimensi	ons $(n = 656)$
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Perspective	Kellert's Dimensions	Statements	Alpha		
		It is wrong to produce excessive pollution that harms birds and other wildlife			
	Moralistic Attitudes	Humans should work to reduce excess pollution to help improve the survival of birds and other wildlife			
_		Humans should conserve and manage habitat for birds along with other wildlife			
		I would describe the sights and sounds of birds as beautiful, pleasing or satisfying			
Ethical	Aesthetic Attitudes	I would describe the sights and sounds of birds as fascinating or very interesting	0.9419		
Scientist		I think birds are often colorful or eye catching			
		I appreciate the way that birds help make human lives better (i.e., pollination, seed dispersal, reducing pests, removing waste)			
	Ecologistic Attitudes	cologistic Attitudes I place a high value on bird species that are in danger of going extinct			
		It is important to me that we protect bird species so that future generations may enjoy them.			
_		We can learn a lot from understanding how bird species reproduce (i.e., courting, mating)			
	Scientistic Attitudes	itudes We can learn a lot from understanding the survival strategies that birds use (i.e., hunting, and nesting strategies, defend territory, migration)			
		We can learn a lot from understanding how birds fly (e.g., wing shape)			
	Naturalistic Attitudes	I am very interested in observing birds in their natural habitat Birds often help enhance my recreational experiences (i.e., hiking, biking, camping)			
Relational Humanist		Observing birds in nature helps me feel connected with nature			
	Humanistic Attitudes	I feel a connection with birds because they seem to communicate the same way I do (e.g., vocal patterns/ language /conversation) I feel a connection with birds because of the way birds care and provide for their family (e.g., nesting, collecting food) I consider myself a caretaker of the birds that live around me	0.8877		

Dominionistic Attitudes

Perspective	Kellert's Dimensions	Statements	Alpha
Abstractor	Symbolic Attitudes	Birds are important/useful to me as symbols of my religion or spirituality (e.g., peace, messenger) Birds are important/useful to me as symbols of groups or organizations I care about (e.g., company logo, sports team) Birds are important/useful to me as symbols of important cultural values (e.g., freedom, patriotism)	0.8379
Negative/ Dominant	Negativistic Attitudes	I get very upset when birds damage my property (e.g., crashing into windows, defecating on cars) I am very concerned about the public health risks associated with birds (e.g., fly into airplanes, carry disease) I think wild birds often destroy crops and harm domestic poultry	0.7516

Table 1. Cont.

An existing scale was used to measure public attitudes toward harvesting on private forest lands [31] (Table 2). The five-point Likert scale contained seven statements representing either pro-harvesting (e.g., "harvesting is good for the economy") or anti-harvesting views (e.g., "forests should be left untouched by humans"). Another four statements related to harvesting for either forest management purposes (e.g., improve forest health and regeneration) or harvesting for production and economic purposes. A companion scale by [31] was used to measure attitudes towards government involvement in private decisions about forest management ($\alpha = 0.85$). Four statements represented interventions through landowner assistance strategies, and the other four statements represented top-down or regulatory approaches (Table 2.).

I am not bothered when birds are caged

The purpose of birds is to please and entertain people

Table 2. Statements used to measure public attitudes towards timber harvesting and government involvement on a 5-point Likert scale.

Торіс	Attitudes	Statements
Timber Harvesting	Management	Cutting trees can sometimes be good for a forest Some forest management by humans is necessary Cutting and removing trees should be following by planting trees Forests should be left untouched by humans
	Production	Harvesting is good for the economy Cutting and removing trees is sometimes necessary to provide economic profits to the forest owner Forests should be used to provide products such as paper and lumber that human can use
Government Involvement	Landowner Assistance	The government should use financial incentives to help or encourage private owners to change management practices The government should conduct workshops on best forest management practices for private forest owners The government and private forest owners should work together toward forest conservation The government should use positive images and cultural symbols to promote forest conservation
	Regulation	The government should be able to regulate the use of forests located on private land to protect public benefits The government should have the right to tell private forest owners how to best manage their forests There should be regulations regarding how trees are managed on private forest land The government should fine privately forest owners who fail to use best management practices

Scalar tools were also used to obtain subjective and objective measures of knowledge about birds and their condition [45] (Table 3). Respondents were asked how strongly they agreed with statements describing judgments of their own knowledge about birds (2 statements), if they demonstrated reasoned action in the past by supporting local bird conservation activities (1 statement) and how strongly they agreed with a list of bird facts (4 statements; $\alpha = 0.70$). An "I don't know" option was also presented, along with the list of bird facts. The level of agreement with statements measuring subjective knowledge and reasoned action indicates the respondent's level of confidence in how much the respondent thinks they know. The level of agreement with statements measuring objective knowledge indicates the level of confidence that they answered the question correctly. Respondents who more often agreed with true bird facts were considered generally knowledgeable. Respondents who more often disagreed with bird facts were considered potentially misinformed. The "I don't know" response was used as an indicator of a lack of knowledge about birds. Perceptions were measured in a similar way using a agree/disagree five-point Likert scale (α = 0.80). The perception statements described positive and negative views about the current and future condition of birds and the condition of different types of habitats. Those who more often agreed with positive statements about the current condition of birds and habitats were considered to have generally positive perceptions. A draft of the full survey was pretested with 11 volunteers including students and professionals from forestry, resource economics, sociology, agriculture, engineering, law, management, business, Physics and Geoscience and the public.

Table 3. Statements used to measure knowledge and perceptions about bird conservation on a five-point Likert scale.

Topic	Measure	Statements
Knowledge ⁻	Subjective	I know most of the birds I encounter in my day-to-day surroundings I know most of the birds I encounter when visiting natural areas in Pennsylvania I actively support organizations that seek to conserve wildlife habitat (e.g., member, donor, voter)
	Factual	Plant and animal biodiversity is needed to ensure the sustainability of most ecosystems Some species of cranes, warblers, and grouse are on the federal endangered species list In more recent years, whip-poor-wills have been less abundant The golden-winged warbler interbreeds with the blue-winged warbler to produce offspring
Perceptions	Present	Most common bird populations are in good condition Most rare bird populations are in good condition Field habitats are generally available and in good condition Young forest/shrubby habitats are generally available and in good condition
	Future	Mature forest/old tree habitats are generally available and in good condition In ten years, some common bird populations will be worse off than they are now In ten years, some rare bird populations will be worse off than they are now In ten years, some field habitats will be lost or in worse condition

2.2. Data Collection and Analysis

The Qualtrics web survey service was used to collect panel responses from 656 households in Pennsylvania based on gender, age, education, race and income (95% CI and a 5% margin of error). The survey had a 99% completion rate indicating a low level of response bias [46]. When compared to the 2010 US Census, respondents were approximately representative of the general population in Pennsylvania (Table 4). Over half (52.75%) of respondents were female. Most respondents (69.42%) were classified as 25 to 64 years in age, and 46.66% had obtained a two-year college degree or greater. Respondents who were white/Caucasian were oversampled by almost 10%.

Descriptive Variables	Sample	Sample	Pennsylvania Census 2010
	Count	%	%
Gender			
Male	322	46.67	48.73
Female	364	52.75	51.17
Prefer not to answer	4	0.58	-
Age			
18 to 24	82	11.88	9.63
25 to 44	257	37.25	24.63
45 to 64	222	32.17	27.9
65 and over	129	18.70	16.68
Race			
White/Caucasian	594	86.09	77.7
African American	63	9.13	11.00
Asian/Pacific Islander (mixed)	10	1.45	4.8
Hispanic/Latino	17	2.46	6.1
Other	6	0.86	0.30
Education			
Some high school	25	3.62	8.80
High school graduate	216	31.30	30.80
Some college/no degree	127	18.41	11.00
Associates/ technical degree	100	14.49	12.30
Bachelor's degree	145	21.01	26.40
Graduate degree (MS/Ph.D.)	69	10.00	10.60
All other degrees	8	1.16	0.10
Income			
Less than \$25,000	151	21.88	22.03
\$25,000-\$49,999	218	31.59	23.43
\$50,000-\$74,999	133	19.30	18.36
\$75,000-\$99,999	91	13.19	12.70
\$100,000-\$149,999	60	8.69	13.54
\$150,000-\$199,999	20	2.89	5.03
>\$200,000	17	2.46	4.91

Table 4. Table showing respondent's characteristics in Pennsylvania.

To determine the strength and direction of attitudes, means and grand means were calculated for each item and attitudinal dimensions (group of 3 items). Means greater than four suggest that respondents frequently selected "agree" or "strongly agree" as response options. All reported means are accompanied by the standard deviation. To understand associations between designated cognitive parameters (i.e., attitudes, knowledge), Spearman's rank correlation analysis was conducted using the grand means of the items [47]. The closer the coefficient is to zero, the weaker the association between the ranks. Demographic variables were coded using the response categories presented in the survey question (e.g., male = 1, female = 0).

3. Results

Across all scales, the largest grand means were associated with the perspective of the ethical scientist, the perception that birds will decline in the future and attitudes towards landowner assistance programs (Table 5). Comparatively, mean values for parameters measuring knowledge were generally lower and variation in mean response to the knowledge scales was generally greater than 1.

Subjective knowledge

Factual Knowledge

Perceived condition of birds

Perceived risk of a decline in birds

parameters ($n = 656$).					
Scale	Grand Mean	St. Dev.	Min	Max	No. of Statements
Ethical scientist perspective	4.28	0.68	1	5	12
Relational humanist perspective	3.61	0.87	1	5	6
Abstractor perspective	3.32	1.04	1	5	3
Negative/dominant perspective	2.99	0.45	1	5	5
Attitudes towards timber harvesting for management purposes	3.68	0.70	1	5	4
Attitudes towards timber harvesting for economic purposes	3.50	0.83	1	5	3
Attitudes towards landowner assistance programs	3.98	0.79	1	5	4
Attitudes towards government regulation	3.59	0.77	1	5	4

Table 5. Descriptive statistics for 5-point Likert scale agree/disagree questions measuring attitudes and knowledge parameters (n = 656)

3.13

2.75

3.09

4.05

A majority of respondents agreed or strongly agreed with items representing the ethical scientist (94.21%), relational humanist (75.15%) and the abstractor (56.85%; Figure 2). Highly ranked statements describe humans as having a moral responsibility to reduce pollution, to protect birds, to protect birds so that future generations can enjoy them, the idea that birds are colorful and eye-catching, and the idea that we can learn a lot from bird survival behaviors. Less than half agreed or strongly agreed with negative and dominating perspectives about birds (41.76%).

1.02

1.24

0.77

0.77

1

1

1

1

5

5

5

5

3

5

5

5



Figure 2. Percent response to 26 statements on a five-point Likert Scale representing four perspectives about birds in Pennsylvania (n = 656).

Attitudes toward harvesting on private lands were mixed, with approximately half of respondents being neutral or positive (Table 6). There was no significant difference in attitudes towards harvesting for management or production purposes. Items with the highest percent agreement include the opinion that harvesting is good for the economy but that trees should be replanted after harvesting.

		Attitudes towards	Harvesting		
Attitudes	Pr	oduction	Management		
	Number	% of the Total Sample	Number	% of the Total Sample	
Positive	266	40.54	295	44.97	
Neutral	319	48.62	329	50.15	
Negative	71	10.82	32	4.88	
Total	656	100	656	100	

Table 6. Number and percent of survey respondents classified as having positive or negative attitudes towards harvesting trees for the purpose of timber production and management.

In regard to government involvement in private land decisions, over half (63%) of respondents were classified as having positive attitudes towards landowner assistance programs, whereas attitudes towards regulations were more mixed (Figure 3). Most agreed and strongly agreed with statements that pose that forest owners and the government should work together towards forest conversion. Most either disagreed or were neutral toward the statement that the government has a right to tell private forest owners what to do.



Figure 3. Percent of survey respondents and attitudes towards government involvement on private forest lands through landowner assistance programs and regulations (n = 656).

Metrics assessing knowledge classified most respondents as having moderate levels of subjective knowledge (48.78%) and a low level of fact-based knowledge (61.28%; Table 7). Only 13% of respondents were classified as having a high level of factual knowledge about birds. Across factual statements, respondents selected "I don't know" an average of 29%. Three percent of respondents disagreed with some factual statements indicating misinformation about birds is infrequent.

Table 7. Number and percent of survey respondents and level of subjective and factual knowledge based on respondent's confidence in identifying wild birds, support for conservation, and agreement with scientific facts about bird ecology.

T 1	Subject	ve Knowledge	Factual Knowledge			
Level	Number	% of the Total Sample	Number	% of the Total Sample		
High	187	28.51	84	12.80		
Moderate	320	48.78	204	31.10		
Low	183	27.90	402	61.28		
Total	656	100	656	100		

Over 76.0% were classified as strongly believing that birds and their habitats will be worse off in 10 years (Figure 4). Just over half (56.7%) expressed concern for birds at present, but these concerns were more moderate. Most respondents agreed with statements that described common birds as being in good condition, and both young and old forest habitats are generally available. Most were concerned that rare birds would be worse off in the future, followed by mature forests and young forest habitats.



Figure 4. Percent of survey respondents classified by perceptions of risk that birds and their habitats may be worse off today and in 10 years (n = 656).

Spearman's correlation analysis revealed several important correlations between perspectives about birds and other cognitive parameters (Table 8). Coefficients greater than 0.4 are bolded and indicate a moderate to strong correlation. The relational humanist perspective was more often associated with a higher level of subjective knowledge. The ethical scientist perspective was more often correlated with perceptions of a risk that birds will decline in the future. Attitudes toward landowner assistance programs were associated with the two most dominant perspectives about birds: relational humanist and ethical scientist. The abstractor and negative/dominant perspective, while significant, were not strongly associated with most of the other cognitive parameters. The coefficients describing attitudes towards harvesting and demographic variables were also not strongly associated with any given perspective towards birds.

Table 8. Spearman's rank correlation test between perspectives and designated cognitive parameters (n = 656).

Perspective	Subjective Knowl- edge	Factual Knowl- edge	Perception (Condi- tion)	Perception (Risk)	Harvesting (Manage- ment)	Harvesting (Produc- tion)	Landowner Assistance	Regula- tions	Male	Age	White	Educa- tion
Ethical Scientist	0.2929	0.2040	-0.2029	0.4594	0.1182		0.6425	0.2556		0.1307	0.1185	
Relational Humanist	0.5110	0.3747		0.2564			0.4476	0.2383				
Abstractor Negative/Dominant	0.2976	$0.2928 \\ 0.0804$	0.21581	$0.1774 \\ -0.1324$	-0.0782	0.1333	$0.2732 \\ -0.1371$	0.2497	0.1013	-0.078	6	-0.0897

All reported values are significant at p < 0.05, Bold text = rho > 0.40.

4. Discussion

The ethical scientist perspective was so named because of the specific mix of attitudes including moralistic, aesthetic, ecologistic and scientistic attitudes. This was also a dominant perspective held by almost all respondents. In short, many agree that birds are interesting, important to both ecosystems and people and we have a moral responsibility to protect birds. This perspective about birds was also correlated with the perception that birds will be worse off in 10 years, but not strongly correlated with concerns about the condition of birds today. Likewise, most agreed that birds and habitats today are in good condition and were more strongly concerned about birds in the future. This somewhat incongruent with research that examines the true condition of birds today and which found almost three million birds have been lost over the last 50 years [2]. Perceptions about birds and ecosystems are often unrelated to the true condition when it comes to species richness or biodiversity [48]. One of the reasons may be due to local and regional differences in species and distribution of habitats [49]. The lack of correlation with knowledge parameters suggests that without certain information, current perceptions could underpin misunderstandings about the condition of birds and this can eventually limit a person's sense of responsibility and their willingness to pay for conservation [50–52].

The information used to inform perceptions of risk may not even be about birds [53]. It could be personal experiences with declines in environmental quality and associated health impacts that uphold people's empathy and moral reasoning for protecting birds [54]. People also tend to use the perceived harm construct (e.g., the magnitude of consequences, probability of effect, temporal immediacy, and concentration of effect) to determine intentions in situations involving ethical issues [55]. Those with higher risk perceptions were more likely to agree that birds simply because they exist as part of a holistic ecosystem or want to maintain birds for future generations to enjoy [56]. This is in accord with a growing body of research highlighting much of the value associated with conserving ecosystems is non-use value [57,58]. How these risk perceptions were formed was not examined in this study, but may be related to broader perceptions about land-use change and a general interest in the wellbeing of animals overall [36,59]. Furthermore, responses may have been affected by how the risk question was framed in this study. Economic studies show that presenting loss frames in ecological messages is often more effective in gaining support for conservation [60]. Likewise, loss aversion is often considered to be a powerful driver of conservation support [61]. More research is needed to better understand the factors that shape risk perceptions since moralistic attitudes towards birds seem to serve an important role in motivating bird conservation behaviors.

A relational humanist is primarily concerned with the relationship process with other humans; however, this classification seemed justified considering many respondents felt birds have human-like qualities and enjoy being with birds while recreating in nature. This relationship seems to be dependent on what people think they know about birds rather than having a fact-based understanding of birds, as indicated in the Spearman rank correlation test. Most respondents also reported higher levels of subjective knowledge about birds compared to factual knowledge as well. This is in accord with related studies that attribute a person's familiarity with bird species to a person's past experiences with the species [36,62]. When a person has enough similar experiences, they tend to reach some generalization about birds, and they tend to label it as knowledge [20]. While a relational perspective of birds may be fundamentally good for motivating bird conservation behaviors, it may also bias people to support programs that focus only on local birds or birds with behaviors similar to humans (e.g., nesting). For example, people often derive wellbeing by adopting a warden-like role in supporting the wildlife in their backyards [12]. The relational humanist perspective may fail to support efforts to conserve birds that are hidden from view (e.g., in a remote location) or birds that display behaviors that are revolting to humans (e.g., eating carrion).

The abstractor perspective is intended to correspond to a summative view of birds within a simple cultural narrative (i.e., a symbol). It would be reasonable to assume that birds who serve as cultural symbols would be considered more valuable (e.g., bald eagle) [63]. However, the weak correlation between the abstractor perspective and knowledge and risk perceptions about birds suggests that valuing birds as symbols may not work to support conservation for birds as a category, but perhaps only for specific species of birds. The abstractor perspective along with the negative/dominant perspective was also weak in explaining attitudes about how private lands should be managed, and there were validation problems with the construct for the negative/dominant perspective. The one item excluded from the negative/dominant construct was intended to represent recreational hunting as a dominionistic attitude. Hunting in developed countries, however, does not necessarily conflict with conservation objectives when hunters are the primary source of

funding (e.g., Ducks Unlimited) [64]. More research is needed to better understand the dichotomy between dominionistic attitudes and conservation across different contexts.

Timber harvesting could have important implications for bird habitats; however, the association found between attitudes toward timber harvesting and all four perspectives about birds was weak. The finding that almost half of the respondents were neutral towards timber harvesting, and indifference was found between harvesting for production or management purposes, also suggests that public opinions about harvesting in Pennsylvania may not be well informed. For example, the large support for replanting after harvesting is incongruent with the practice of natural tree regeneration after harvest which is commonly used by foresters in Pennsylvania. Related studies show that public opinions about harvesting are often not well informed. Many people tend to have intermittent experiences with forests (e.g., recreation) which may not give rise to a better understanding of forest management over extended periods [65]. People's preconceptions about silvicultural activities also do not always correspond with visual assessments of the forest condition [66].

Support for landowner assistance programs was strongly correlated with both the ethical scientist and relational humanist perspectives. This is consistent with the finding that many respondents support landowner assistance programs over environmental regulations. Pennsylvania, like many states in the US, has a long history of supporting strong private property rights [45,67,68]. Interest in environmental quality often increases when people are given the right to protect, manage, and utilize (e.g., revenue) the land resource [69]. It may be cultural values about landowner autonomy and resource management helps support bird conservation across multiple dimensions of value. Demonstrating ways in which humans can coexist with birds in private spaces, such as private forest lands, could complement efforts to build in people a more sophisticated perspective of birds and bird conservation. In comparison, attitudes about government regulation were weakly correlated with attitudes towards birds. This weak correlation is notable since environmental regulations are often used to control negative impacts on ecosystems, and there is a strong moral sentiment among most respondents to protect birds from pollution [70]. Demographic characteristics such as gender and age were not strongly correlated with attitudinal dimensions, which suggests that the framing of bird conservation on private lands can be consistent when working with mixed audiences.

Study limitations include the underrepresentation of non-white members of the public in the survey sample. The four questions assessing factual knowledge were also limited as a robust indicator of a person's comprehensive knowledge about birds. However, it appears that fostering positive cognitive connections between birds and private forest lands could be an effective strategy for broadening support for bird conservation overall.

5. Conclusions

A statewide web survey with psychometric scales was used to determine how attitudes towards birds and private forest lands contribute to bird conservation in Pennsylvania. Most people expressed ethical and relational perspectives about birds and bird conservation, but many lacked formal knowledge about birds in general. Relational perspectives were likely based on people's experiences with birds and may only help support conservation actions that also foster positive interactions with birds in nature. The correlation between ethical perspectives and risk perceptions was found to generate strong support for landowner assistance programs but not regulatory types of interventions, which are often used to mitigate harm to ecosystems. Abstract and negative perceptions of birds had a weak influence on attitudes towards timber harvesting and the use of regulations. These perspectives, along with limited knowledge about bird population declines, may be what promotes apathy or disinterest in addressing broader causes of impact on bird populations. More research is needed to understand the drivers of dominionistic attitudes in relation to hunting and conservation. Those who support landowner assistance programs appear to have a more sophisticated perspective of birds and may be willing to promote a more peaceful coexistence with birds. This suggests that work to conserve bird habitat on private lands, coupled with outreach and education about birds on private lands, can help move people towards a perspective of birds that is more in line with the types of conservation activities needed to protect bird populations.

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