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The "Green on Green" Conflict in Wind Energy Development: A Case Study of Environmentally Conscious Individuals in Oklahoma, USA

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Received: 7 September 2020; Accepted: 2 October 2020; Published: 4 October 2020

Abstract: Development in wind energy technology and deployment of infrastructure reduces reliance on fossil fuels and can further energy security goals. Wind energy, however, can conflict with other green interests. The goal of this research was to examine the perceptions of environmentally conscious individuals at the intersection of wind energy development and biodiversity conservation interests. A majority of respondents identified that they cared very much about both renewable energy development as well as biodiversity conservation. We found that while participants were aware of the shifting causes of mortality of bird populations, they were less aware of the implications of wind energy on bat populations. In addition, attitudes towards biodiversity conservation as well as wind energy development were statistically significant when looking at the identification of some impacts. Most participants were willing to support wind energy development considering trade-offs related to factors such as visual impacts or economic benefits if it had no impacts on biodiversity conservation. Our research shows that environmentally conscious individuals are well-informed on only some impacts of wind energy development. Results also suggest that biodiversity conservation impacts are prioritized by environmentally conscious individuals when gauging support for wind energy development. As sustainable development continues, it is important to consider this green on green conflict, as renewable energy development is not only confronted by general issues of public opposition, but also specific environmental complaints.

Keywords: wind energy; natural resources; green on green conflict; public perception

1. Introduction

Climate change and associated impacts comprise a central focus for environmental research, development, and practical work today, with scientists seeking to understand the phenomena as well as propose innovations and alternative technologies mitigating its impacts. This work has generally fostered a desire to transition to more environmentally friendly practices in society. Environmental policy is often specified to either encourage environmentally friendly practices or to mitigate and discourage detrimental practices [1]. Biodiversity conservation and renewable energy development represent only two of many interests governed by environmental policy. Both policy efforts are incredibly important in their relationship to sustainable transitions, guiding adaptation to a changing climate. However, these efforts are often at odds with one another in terms of their goals and requirements for implementation [2].

Transitioning towards renewable energy sources is a prevalent theme in green economy initiatives. Wind energy often represents one pathway to meet renewable energy goals. Wind energy development in the United States throughout the 1990s and early 2000s was generally allowed to proceed without

extensive research on environmental impact due in part to the perception that development did not carry a strong negative impact on the environment [3]. As wind farms continued to go into operation, issues arose surrounding the potential environmental impacts of wind energy development, including many related to biodiversity conservation. The "green on green" conflict moniker refers to prioritization conflicts between reduction in emissions of greenhouse gases from energy development and consumption and the prevention of environmental impacts associated with renewable energy development, including habitat loss, fragmentation, etc. [2,4]. Jackson [5] identifies this conflict between biodiversity conservation-related and renewable-energy-related policies, characterizing renewable energy as a climate change mitigation strategy that may have negative impacts on biodiversity conservation.

Examining the other half of this "green on green" conflict, it's clear that biodiversity and related conservation issues are incredibly important for a variety of reasons. Biodiversity ensures a long-term supply of material goods, supports a multitude of ecosystem services, helps ecosystems remain resilient to natural disasters, and can be utilized for everyday recreational purposes (fishing, hunting, hiking, etc.). Biodiversity conservation faces numerous concurrent threats in society however, including increased proliferation of invasive species, habitat loss or fragmentation, overexploitation, and complications due to climate change [6]. While renewable energy development can assist in alleviating the major pressures of overexploitation and climate change [3], it can negatively impact biodiversity via pressures such as habitat loss or direct/indirect animal mortality [7].

While renewable energy is seen as an environmental sustainability initiative and green alternative to fossil fuels, complications affecting biodiversity concerns at wind energy production sites are evident. Not only can wind energy operations lead to direct animal mortality due to collisions with generators, it can also render adjacent habitats unsuitable for certain species sensitive to human disturbance. Biodiversity conservation efforts, conversely, can subject green economy activities to limitations on development via policy and land protection practices. The juxtaposition of these two issues is prevalent in scientific literature, as seen in studies such as Bidwell [8] and Swofford and Slattery [2], both related to wind energy perception. Currently, however, there is a lack of research in the United States addressing and analyzing public opinion surrounding this conflict between two seemingly complementary initiatives constituent to an overall "green movement" or revolution. The purpose of this research is to address this gap.

2. Background

2.1. Conflicting Priorities in a Sustainable Transition

The idea of the "green on green" conflict or debate was coined by Warren et al. (2005), terming it a "new kind of environmental controversy". While it seems to be standard that fossil fuel projects faced environmental opposition and a lack of support from environmental groups, it was often assumed that renewable energy developers would have the support of the environmental movement [9]. Kahn [9], in describing the conflict between developers and environmentalists, says "decision makers expect environmental opposition to thermal power plants, but they are surprised to find wind, biomass, and geothermal projects under attack by erstwhile allies. No wonder environmentalists are more effective opposing renewables than fossil fuel power projects." While conflict between societal transitions and environmental impacts is not novel, this idea that there are valid "green" arguments on both sides is a more a recent development [10]. Because of this, it is important that research not only examine public perceptions directly related to wind energy development, but also more broadly examine perceptions of energy and the [2,11].

2.2. Public Perception of Wind Energy Development

This research seeks to combine this notion of the "green on green" conflict with work examining public perception in the realm of renewable energy. Research in the United States on attitudes towards

wind farm development has mainly focused on capturing broad public perception. Researchers have utilized surveys covering a range of topics including economic impacts, visual impacts, environmental impacts, and other factors associated with the expression of negative attitudes in respondents. Research has identified attitudes and lack of public participation as the main contributors to opposition of wind energy, and some work also framed results as symptomatic of the "not-in-my-backyard" (NIMBY) dynamic. NIMBY, where applied to wind energy development, refers to the phenomenon of general support for wind energy, coupled with a lack of local support, as turbines would be constructed in respondents' "backyard" [12]. While the majority of research on NIMBY acknowledges that this somewhat self-interested attitude is too simplistic to explain general opposition, the main conclusions point towards high economic expectations versus actuality [8,13], visual aesthetics [2,4,12,14–16], and lack of opportunities for public participation [2,4,14,15] as drivers of attitudes towards wind energy development. Additionally, in general the literature on public opinion does not address perceptions of those who already self-identify as environmentally conscious [17]. Environmentally conscious individuals represent a unique group whose perceptions may indicate how views on green initiatives may change where faced with green versus green conflict. Researchers acknowledge the existence of this conflict [2,4], but there is no clear evidence that environmentally conscious individuals know and understand this conflict exists or represents a potential issue.

2.3. Case Study

This research focuses on the state of Oklahoma, where turbine development has increased in recent decades. There currently exists literature based in Oklahoma on socioeconomic impacts of wind energy development [18], impacts of wind development on public schools [19], the relationship of wind power and real estate prices [20], as well as a comparison of the impacts of wind energy and unconventional gas on land use and ecosystem services [21]. At the time of this writing, however, virtually no representation of public opinion related to issues surrounding wind turbines in the state is seen in the literature. The one exception, Greene and Geisken [18], performed in-person qualitative interviews of individuals as well as distributed a survey in their town of interest, Weatherford, Oklahoma. The interviews and surveys helped to supplement the economic analysis, in providing insight into how the community views the wind energy development. In addition, a Notice of Inquiry (NOI) was submitted to the Oklahoma Corporations Commission (OCC) and the Public Utilities Division (PUD) in 2014 [22], requiring the OCC to investigate a series of questions regarding wind energy development in the state by surveying members of the public. Cited issues in the aforementioned survey included conflict with sacred/religious sites, costs of siting disputes, lack of participation by local governments or residents, and impacts on scenic highway byways. Greene and Geisken's [18] research and this NOI represent the only widely available reports exploring public perception with respect to wind energy developments in the state.

According to the US Energy Information Administration [23], Oklahoma ranked third in the country in 2018 for electricity generation via wind energy. Maps of Oklahoma provided by the Office of Energy Efficiency and Renewable Energy through the U.S. Department of Energy [24] show the highest wind speeds along with highest wind capacity (at 110 and 140 m. turbine hub height) in northwestern Oklahoma, within the panhandle of the state. The panhandle is the site of many proposed and existing wind farms in the state, but wind farm development can also be found throughout other areas in Oklahoma.

When looking at biodiversity in the state, Oklahoma is home to 12 federally listed endangered species and 7 federally listed threatened species. Federally listed species, both endangered and threatened, include four species of bat [25]. Over 800 species have been documented in the state, and 90% of these species are considered non-game species [26]. In relation to wind energy development in the state of Oklahoma, the Lesser and Greater Prairie-Chickens are often the focus of conservation concerns. Lesser Prairie-Chickens can be found in parts of western Oklahoma, while Greater Prairie-Chickens are found most commonly in the tallgrass prairie corridors in northeastern Oklahoma.

As the Lesser Prairie-Chicken is a candidate for being federally listed, the impacts of development on their success has been of interest to conservationists in the state [27]. Wolfe et al. (2016) even noted the chicken as an "icon of the prairie" (p. 299).

This study conducted a survey to explore the green on green conflict among self-selecting, environmentally conscious individuals via questions related to attitudes and trade-off between biodiversity conservation and wind energy concerns. As this is an intersection that prior research recognizes but does not directly address, the goal of this study is to add a new component to the literature by providing an avenue for further, related research efforts. Since environmentally conscious individuals may already be informed on environmental issues, but may not always realize the connection between them (e.g., whether this is a conflicting interest or where two issues can be solved with a comprehensive or unified approach), this sample group represents a unique avenue in which to examine the intersection of the two competing green interests of wind energy and biodiversity conservation. This research sought to understand how environmentally conscious individuals interpret tension between sustainability goals—clean energy and biodiversity conservation—by gathering data on attitudes and associated knowledge related to these two sustainability goals.

3. Material and Methods

3.1. Study Area

Oklahoma is a leading state in wind energy production and hosts areas of high wind energy production potential relative to national averages [23,24]. Updated projections of wind resources in the South-Central Plains also implied stability of wind resources in the region for future wind energy generation [28]. Despite this, little work has been done to understand public opinion on wind energy development (e.g., Greene and Geisken [18]). Public policy as well as success in wind energy development can be hindered by prevailing negative attitudes, so it is important to understand perceptions within the state as development continues. This research involved administering a survey to self-selected, environmentally conscious individuals in the state of Oklahoma. The survey instrument specifically targets environmentally conscious people because they may already recognize biodiversity conservation and renewable energy as two important concepts related to climate change mitigation and adaptation, but may not always realize how these two efforts can conflict. As this research focused largely on concerns related to public opinion regarding conflict among wind energy development and biodiversity conservation, more attention will be given to the environmental component.

3.2. Survey Questions

The general focus of the survey is to understand how specific components of the "green on green" conflict appear in environmentally conscious individuals in the state of Oklahoma. The survey first asks how participants value renewable energy development and biodiversity conservation, respectively. The purpose of this is to gauge where support or interest lies on either side of the conflict. Participants are then asked about their familiarity with eight impacts of wind energy development on biodiversity conservation. These specific impacts were identified in the literature review: (1) Bird collisions with turbines [7,29,30]; (2) bat collisions with turbines [30,31]; (3) internal bat injury, i.e., barotrauma [32]; (4) habitat fragmentation, largely due to associated infrastructure such as roads and transmission lines [33,34]; (5) erosion, because of plant and top soil removal [32,35]; (6) invasive species, whether planted for remediation or seed dispersal during construction [33]; and (7) changes in local climate such as temperature range and precipitation levels [32]. The goal of this section is to identify where knowledge gaps exist in a sample group that may be actively seeking out information on this topic. The survey also includes a set of questions meant to evaluate which broad impacts of wind energy development would negatively or positively impact participants' support for future energy development, comparing specific trade-offs to impacts on biodiversity conservation to try to understand what support looks like in the context of the conflict between wind energy development

and biodiversity conservation. These trade-offs were identified from the literature review: (1) Integrity of the landscape, i.e., visual impacts [13,32,36,37]; (2) human health impacts such as loss of sleep and headaches [13,15,22]; (3) economic growth and opportunity for communities [13]; (4) inclusion of public participation and opinion, which refers to issues of democratic deficit, where individuals in communities do not feel they had a choice or a say in wind energy development [2,4,13]; (5) energy costs in terms of what individuals pay on their bills [13,14]; (6) and locally accessible energy, versus energy transported to other regions of the United States [4,14].

The online platform Qualtrics was utilized to create the survey and to distribute it online via an anonymous link. Distribution was accomplished by e-mail solicitation combined with requests for responses in-person. In-person events where the survey was administered included the Oklahoma Natural Resource Conference in February of 2019 as well as many events surrounding and held in recognition of Earth Day, April 2019. For the e-mail distribution, environmental organizations affiliated with the University of Oklahoma as well as non-university affiliated environmental organizations were identified, and leaders were asked if they were willing to distribute the survey to their members. University-affiliated organizations included student organizations with an environmental focus and typically had memberships of 10 to 30. Non-university organizations included the Oklahoma chapters of both the Nature Conservancy and the Sierra Club. A social media event was also created to distribute the survey to members of participating organizations if internal organizational policy restricted distribution via e-mail listservs or equivalent alert systems.

3.3. Data Analysis

The final sample size after removing incomplete responses was 270; 41 responses were removed. Responses that were marked as incomplete (having less than a value of 100 in the associated column identifying a finished survey response) were removed. A value of 100 denotes that respondents participated in the survey until presentation of an end screen thanking them for their time—this result does not indicate respondents answered all questions, it only indicates the end of the survey was reached. Values less than 100 indicate that a respondent opted to leave the survey, and therefore their responses were removed from consideration. Typically, values less than 100 were also less than 50, indicating the respondent did not complete much of the survey during these attempts. If the response had a completion value of 100, response rate to demographic questions were then confirmed. If the participant failed to answer four or more of the questions, they were also removed from consideration. In addition, if the time taken to complete the survey was under 10 min, the responses were reviewed to ensure that a majority of the questions were completed, as the designed average time to take the survey was 15–20 min.

SAS (version 9.4) was used for all statistical analyses of the survey responses. All missing values were coded with "." to match SAS coding. After evaluating the distribution of demographic variables, race and income were re-categorized. Race was reduced from seven classes to two classes—white and non-white—as over 90% of respondents identified as white. Income was reduced from twelve classes to six classes. Intervals of $20,000 were used with a cut-off being $100,000 or above, with the income distribution being skewed enough to render the original $10,000 intervals having very few respondents in some cases. In addition, Likert scale questions were reduced to two or three categories instead of seven, based on the distribution of responses. For the research questions relating attitudes to knowledge as well as trade-off responses, the attitude questions were reduced to two categories. The highest category, "care very much", had 60% of responses in regard to biodiversity conservation and 56% in regards to renewable energy development. Attitudes and trade-off responses compared to demographic factors were reduced to three categories after review. Both had a distribution that was spread out more above and below neutral for some of the categories, which is why they were left as categories of responses below neutral, neutral responses, and responses above neutral. Chi-squared tests as well as Fisher Exact tests were run on the responses, using both attitudes towards renewable energy and biodiversity conservation as well as demographic variables to evaluate statistical significance

among various responses. Fisher Exact tests supported by a Monte Carlo simulation technique were utilized as a bootstrapping method where data violated the assumptions of Chi-squared tests and are noted as such. These tests were used to determine if attitudes or demographics impacted answers to knowledge-dependent questions and if demographics impacted the trade-offs that respondents were willing accept, associated with wind energy development. For the knowledge-dependent questions included in the survey, summary statistics were prepared, as there is no definitive literature on the frequency with which the listed impacts happen and, therefore, there is no right or wrong answer assigned to the survey's knowledge questions.

Attitudes were analyzed in relation to the knowledge questions presented because the authors were interested to know if level of "care" towards renewable energy development or biodiversity conservation impacted what respondents knew. The logic behind this was that individuals particularly interested in either topic may be more likely to seek out information on that topic and, therefore, be more well-informed. Attitudes were analyzed in relation to the trade-off questions because the authors were interested in whether or not how much individuals "cared" about renewable energy development or biodiversity conservation impacted the situations in which they would be willing to support wind energy development. The trade-offs were specifically positioned to compare various costs or benefits of wind energy development with impacts on biodiversity conservation, to connect these trade-offs directly to the "green on green" conflict.

3.4. Sample Characteristics

Participant age ranged from 18 to 82 years of age, with the average being 36 (median age is 31). 43% of respondents identified as male and 57% identified as female. 91% identified as white, with less than 1% identifying as black, 2% as American Indian, 2% as Asian, and 3% as Hispanic. 85% of respondents were residents of Oklahoma, with average years of residency being 21 years. Comparatively, according to the 2017 American Community Survey 5-year estimate by the U.S. Census Bureau, around 50% of the Oklahoma population is female and 50% is male. 73% of the population is white, 7% is black, 7% is American Indian, 2% is Asian, and 10% is Hispanic [38]. The median age of the population reported by the ACS is 36.

40% of respondents were currently enrolled in an institute of higher education, and the majority of these respondents were working on a bachelor's degree (58%). Of those no longer enrolled in an institute of higher education, a majority held a 4-year degree or higher. 48% of respondents noted an affiliation with the Democratic party, while 13% were Republican, and 27% independent. On a scale of 1 to 7, 18% of respondents said they considered themselves more conservative (1–3) and 66% considered themselves more liberal (5–7); the median response of the data was 5. 77% of respondents said they did not live near a wind turbine, whereas 51% said they did live near a protected area. Sample demographic characteristics are available in Table 1.

Table 1. Demographic characteristics of sample. (n = 270).

Average Age	**36**
Female	57% (n = 151)
Male	43% (n = 116)
White	91% (n = 241)
Non-white	9% (n = 29)
Average years of residency	21
Democrat	48% (n = 128)
Republican	13% (n = 35)
More conservative	18% (n = 48)
More liberal	66% (n = 177)
Live near wind turbines	19% (n = 52)
Live near protected area	51% (n = 136)

4. Results

4.1. Identified Attitudes towards Renewable Energy and Biodiversity Conservation

Participants were asked to answer a series of questions related to their attitudes towards energy sources as well as biodiversity conservation. Tables 2 and 3 provide descriptive statistics for the responses to attitude-based questions. Given the results, most respondents agreed that fossil fuels negatively impacted the environment (a value of 1–3) and that renewable energy development positively impacted the environment (a value of 5–7). Examining how respondents felt renewable energy impacted wildlife conservation, a majority responded that it impacted it positively (a value of 5–7), but almost a third of respondents answered slightly negative (a value of 3). When looking at how much individuals cared about biodiversity conservation and renewable energy, participants cared very much about both, with a slightly higher percentage choosing the value "7" for biodiversity conservation (61% versus 56%).

Table 2. How participants felt specific energy sources impact the environment, presented as a percentage (n = 270).

"How Do You Feel . . . "	1 (Negatively)	2	3	4 (Does Not Impact)	5	6	7 (Positively)
Fossil fuels impact the environment?	64%	18%	13%	1%	1%	1%	2%
Renewable energy impacts the environment?	1%	2%	21%	6%	24%	19%	27%
Renewable energy impacts wildlife and wildlife conservation?	3%	6%	33%	5%	20%	18%	14%

Table 3. How much participants cared about biodiversity conservation and renewable energy development, presented as a percentage (n = 270).

"How Much do You Care About . . . "	1 (Don't Care at All)	2	3	4 (Indifferent)	5	6	7 (Care Very Much)
Biodiversity conservation	0%	0%	0%	5%	12%	22%	61%
Renewable energy development	0%	0%	0%	3%	16%	25%	56%

4.2. Can Attitudes Predict Knowledge?

Participants were asked to identify whether or not certain statements about the impacts of wind energy development on biodiversity conservation were true or false. Table 4 presents descriptive statistics summarizing how many individuals thought each of the statements were true or false and how many individuals answered they did not know. Based on the results, a majority of respondents believe that wind turbines cause bird and bat mortality due to collision and that wind energy infrastructure construction leads to habitat fragmentation. A majority of respondents did not believe that wind energy development resulted in habitats unsuitable for species or that related activities lead to changes in local climate. For internal injury to bats as well as invasive species proliferation, responses were more variably distributed amongst the three response choices.

Table 4. Response numbers to impact questions, presented as a percentage (n = 270).

Knowledge Questions—"Wind Turbines Cause"	True	False	Don't Know
Bird mortality due to collision	79%	10%	11%
Bat mortality due to collisions	64%	14%	22%
Internal bat injury	43%	18%	39%
Unsuitable habitat	31%	51%	18%
Habitat fragmentation	64%	13%	23%
Erosion	21%	37%	42%
Invasive species proliferation	23%	37%	40%
Changes in local climate	22%	51%	27%

To evaluate the question "can attitudes towards renewable energy and biodiversity predict knowledge of the impact of wind energy development?", Likert scale responses related to attitudes were reduced to two categories, where "care very much" remained in a category on its own separate from the other Likert levels of response. A chi-squared statistical test was used for this analysis. The knowledge-based questions were not evaluated as being correct or incorrect, and the significance of attitudes with respect to their influence on knowledge-based responses is evaluated in terms of the impact's respondents noted as being true or false. This research was interested in understanding if particular attitudes informed the identification of impacts versus the objective truth or falsehood in responses. Attitudes toward renewable energy development were statistically significant at the 90% confidence level for answers related to bat collisions with turbines (p = 0.0718) as well as changes in local climate due to wind turbine development (p = 0.0522). Attitudes towards biodiversity conservation were statistically significant at the 95% confidence level in predicting answers to knowledge questions pertaining to development rendering habitat unsuitable for species (p = 0.0165) as well as causing fragmentation of habitat (p = 0.0228). In addition, attitude toward biodiversity conservation was also statistically significant at the 90% confidence level in predicting answers to the knowledge question pertaining to internal injuries to bats, as well as when determining what participants identified as the leading cause of bird mortality (p = 0.0952) (Table 5).

Table 5. Do attitudes predict knowledge? Evaluating how attitudes towards biodiversity conservation and wind energy development impact what individuals perceive as impacts to biodiversity conservation (n = 270).

Knowledge Questions [a]	"How Much Do You Care About … " p-Value [b]	
	Biodiversity Conservation	Renewable Energy
Bird collision	NS	NS
Bat collisions	NS	0.0718 *
Internal bat injury	0.0719 *	NS
Unsuitable habitat	0.0165 **	NS
Fragmentation	0.0228 **	NS
Erosion	NS	NS
Invasive species	NS	NS
Changes in climate	NS	0.0522 *
Leading cause of bird mortality	0.0952 *	NS
Leading cause of bat mortality	NS	NS

[a] Knowledge questions were presented with answer options "true", "false", or "don't know". [b] p-values correspond to a chi-squared test. * Significant at 0.1. ** Significant at 0.05.

4.3. Perceived Leading Causes of Bird and Bat Mortality

Figure 1 shows the leading cause of bird mortality as identified by participants. Almost 45% of individuals believe that cats are the leading cause of bird mortality, followed by collision with buildings at just under 25%. Wind turbines were the least identified leading cause of mortality, with less than 5% of respondents.

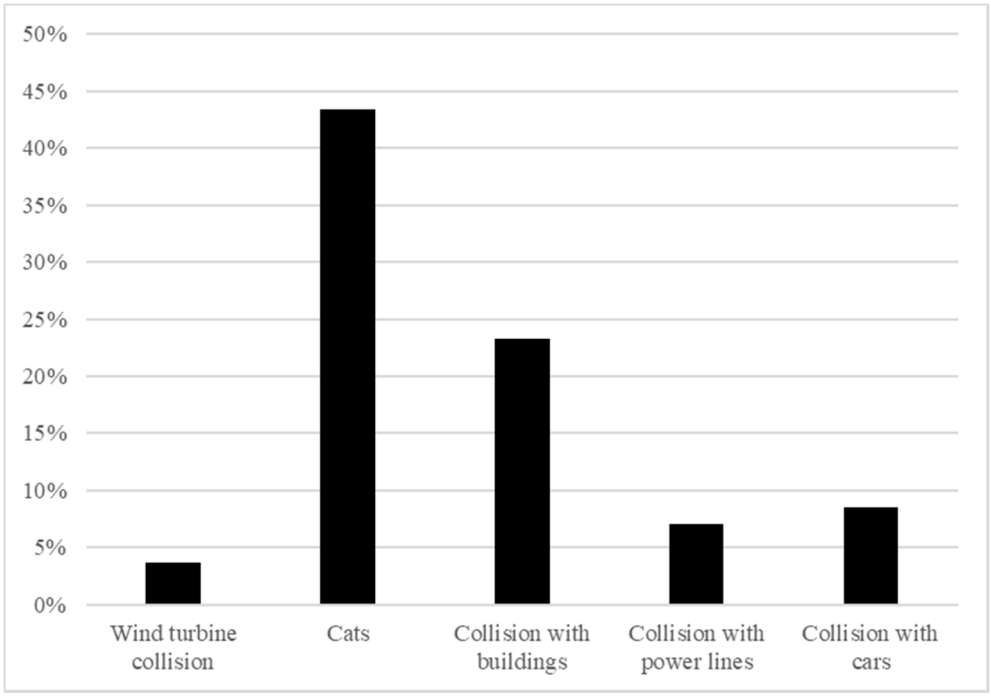

Figure 1. What do you think is the leading cause of bird mortality? Participants identified what they believed to be the leading cause of mortality from the list of potential causes provided (n = 270).

Figure 2 shows the identified leading cause of bat mortality by participants. Almost 50% of individuals believe that disease—specifically white nose syndrome, as noted in the survey—is the leading cause of bat mortality, following by almost 30% who responded they did not know. Wind turbines were again the least identified leading cause of mortality, with less than 5% of respondents.

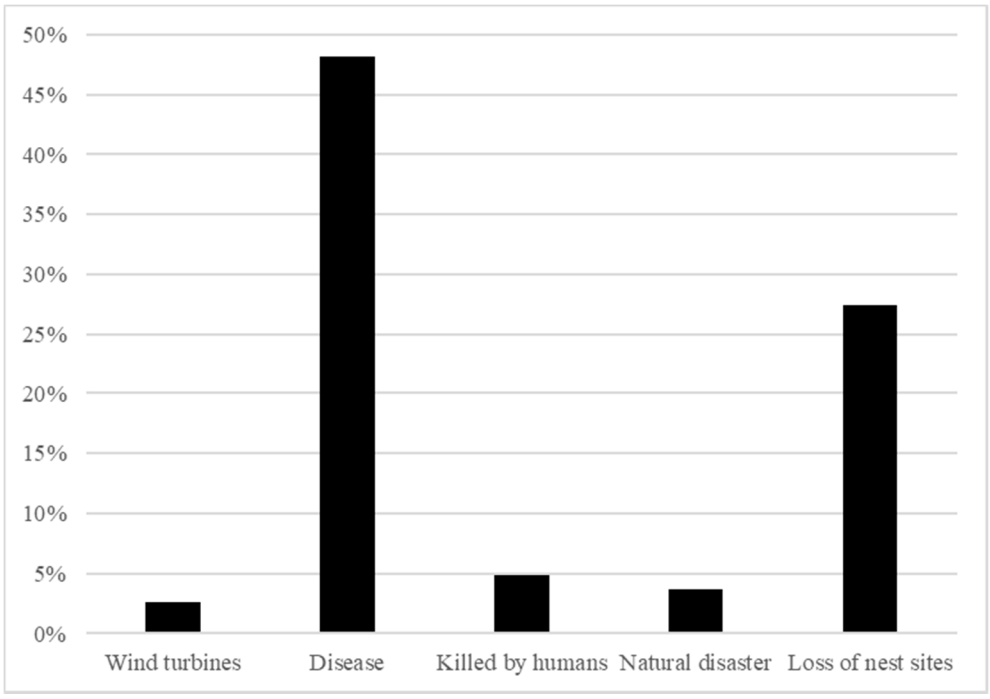

Figure 2. What do you think is the leading cause of bat mortality? Participants identified what they believed to be the leading cause of mortality from the list of potential causes provided (n = 270).

4.4. Are Attitudes Related to How Different Trade-Offs Are Supported?

Participants were asked whether they'd be more or less willing to support wind energy development given certain trade-offs between biodiversity conservation and other impacts of wind energy development. Table 6 presents descriptive statistics of how many individuals responded to each level of support for the given trade-offs. Based on the results, a majority of respondents would be opposed to development of wind energy (selecting a value of 1–3) if it had a negative impact on biodiversity in any of the trade-offs presented. However, a majority of respondents would be supportive (selecting a value of 5–7) of wind energy development if it did not impact biodiversity, even if it resulted in negative impacts on the integrity of the landscape or resulted in higher energy prices. In addition, a majority of respondents would be supportive (selecting a value of 5–7) of wind energy development near their home, with a third of respondents identifying that they would be very supportive.

Table 6. Response numbers to trade-off questions in terms of support or opposition to development of wind energy, as a percentage (n = 270).

Questions About Trade-Offs of Wind Energy Development [a]	1 (Very Opposed)	2	3	4 (Neutral)	5	6	7 (Very Supportive)
Fewer impacts on biodiversity Negative impacts on integrity of the landscape	4%	4%	15%	15%	20%	22%	19%
Negative impacts on biodiversity No impacts to human health	9%	21%	27%	12%	18%	7%	6%
Negative impacts on biodiversity Leads to economic growth and opportunity	6.0%	20%	31%	11%	25%	5%	2%
Negative impacts on biodiversity Includes public participation and opinion	7%	18%	29%	18%	21%	6%	2%
No impact on biodiversity Higher energy costs	3%	5%	12%	10%	28%	22%	21%
Negative impacts on biodiversity Locally accessible energy	7%	19%	32%	13%	20%	6%	3%
Would you support wind energy near your home?	6%	3%	6%	14%	19%	17%	34%

[a] Trade-off questions were presented on a scale of 1–7 from "very opposed to development" to "very supportive of development".

Evaluating the question "can attitudes towards renewable energy and biodiversity predict trade-offs of wind energy development?", Likert scale responses related to attitudes were reduced to two categories, where "care very much" remained in a category on its own. A chi-squared statistical test was used for this analysis. Based on the results, biodiversity conservation was statistically significant in determining support for all of the listed trade-offs except for "positively impacting biodiversity but negatively impacting the natural integrity of the landscape". Biodiversity conservation was statistically significant at the 99% confidence level, except for "negatively impacts biodiversity but positively impacts economic development in your community" and "supporting wind energy development near your home", which were statistically significant at the 95% confidence level. In addition, renewable energy was statistically significant in determining support for the following trade-offs: "A positive impact on biodiversity but negative impacts on the natural integrity of the landscape" ($p = 0.0019$) and "a positive impact on biodiversity but higher energy costs" ($p < 0.0001$). Attitudes towards renewable energy were also statistically significant in impacting support for having wind energy development near the homes of respondents ($p < 0.0001$) (Table 7).

Table 7. Evaluating how attitudes towards biodiversity conservation and wind energy development impact what trade-offs individuals are willing to make when supporting wind energy development (n = 270).

Questions About Trade-Offs of Wind Energy Development [a]	"How Much Do You Care About . . . " p-Value [b]	
	Biodiversity Conservation	**Renewable Energy**
Fewer impacts on biodiversity Negative impacts on integrity of the landscape	NS	0.0019 ***
Negative impacts on biodiversity No impacts to human health	0.0014 ***	NS
Negative impacts on biodiversity Leads to economic growth and opportunity	0.0154 **	NS
Negative impacts on biodiversity Includes public participation and opinion	0.0002 ***	NS
Fewer impacts on biodiversity Higher energy costs	<0.0001 ***	<0.0001 ***
Negative impacts on biodiversity Locally accessible energy	0.0006 ***	NS
Would you support wind energy near your home?	0.0128 **	<0.0001 ***

[a] Trade-off questions were presented on a scale of 1–7 from "very opposed to development" to "very supportive of development". [b] p-values correspond with a chi-squared test. ** Significant at 0.05. *** Significant at 0.01.

4.5. Demographic Characteristics and Trade-Off Responses

Evaluating the relationship between demographic variables and support for development based on various trade-offs, there were six trade-offs introduced in the survey for participants to consider, as well as an additional question about support for wind development near their home, and the resulting significant demographic variables for each question are presented in Table 8. Gender, race, political affiliation, and whether individuals considered themselves more liberal or conservative were all statistically significant in at least half of the trade-off scenarios presented. Whether individuals were an Oklahoma resident or not as well as demographic variables related to education and if individuals lived near a protected area were significant for only one scenario or none of the scenarios.

4.6. Demographics and Attitude Questions

For evaluating the relationship between demographic variables and various questions about attitudes toward energy production and the environment, there were three questions related to attitudes towards impacts and two questions broadly gauging attitudes towards the two topics of this research, and the resulting significant demographic variables for each attitude question are presented in Table 9. Overall, fewer demographic variables were significant in predicting attitude versus predicting trade-off support or opposition. Only whether individuals considered themselves more liberal or conservative was significant for a majority of questions, while four variables were significant for none of the questions.

Table 8. Demographic characteristics and trade-offs.

Questions About Trade-Offs of Wind Energy Development [a]	Demographics *p*-Value [b,c]											
	Age	**Gender**	**Race**	**OK Resident**	**Currently Attending Institute of Higher Edu.?**	**If Yes, What Degree?**	**If no, Highest Level of Edu.?**	**Income**	**Political Affiliation**	**More Conservative or Liberal?**	**Live Near Wind Turbines?**	**Live near Protected Area?**
Positive impacts on biodiversity Negative impacts on integrity of the landscape	NS	0.0208 **	0.0835 *	NS	NS	NS	NS	NS	0.0176 **	0.0010 ***	NS	NS
Negative impacts on biodiversity No impacts to human health	0.0088 ***	0.0494 **	0.0067 ***	NS	0.0103 **	0.0653 *	NS	0.0897 *	0.0291 **	NS	0.0649 *	NS
Negative impacts on biodiversity Leads to economic growth and opportunity	NS	0.0023 ***	NS	NS	NS	0.0186 **	NS	0.0518 *	NS	NS	NS	NS
Negative impacts on biodiversity Includes public participation and opinion	0.0550 *	0.0662 *	0.0487 **	NS	NS	NS	NS	0.0851 *	0.0087 ***	0.0882 *	0.0171 **	NS
Positive impacts on biodiversity Higher energy costs	NS	0.0566 *	NS	NS	NS	NS	NS	NS	0.0009 ***	<0.0001 ***	NS	NS
Negative impacts on biodiversity Locally accessible energy	NS	0.0950 *	0.0023 ***	NS	NS	NS	NS	NS	0.0194 **	NS	NS	NS
Would you support wind energy near your home?	0.0283 **	NS	NS	0.0906 *	NS	NS	NS	NS	0.0080 ***	0.0038 ***	NS	0.0101 **

[a] Trade-off questions were presented on a scale of 1–7 from "very opposed to development" to "very supportive of development". [b] NS = not significant. * Significant at 0.1. ** Significant at 0.05. *** Significant at 0.01. [c] *p*-value corresponds to a Fisher Exact test with simulation because of violation of assumptions if a chi-squared test was applied.

Table 9. Demographic characteristics and attitudes.

Questions related to Attitudes [a,b]	Demographics *p*-Value [c,d]											
	Age	**Gender**	**Race**	**OK Resident**	**Currently Attending Institute of Higher Edu.?**	**If Yes, What Degree?**	**If No, Highest Level of Edu.?**	**Income**	**Political Affiliation**	**More Conservative or Liberal?**	**Live Near Wind Turbines?**	**Live Near Protected Area?**
How do you feel fossil fuels impact the environment?	NS	0.0034 ***	NS	NS	NS	NS	NS	0.0092 ***	0.0018 ***	0.0071 ***	0.0963 *	NS
How do you feel renewable energy impacts the environ.?	NS	NS	NS	0.0375 **	0.0714 *	NS	NS	NS	NS	NS	NS	NS
How do you feel that renewable energy impacts wildlife and wildlife conservation?	NS	NS	NS	0.0366 **	0.0192 ***	NS	NS	NS	NS	NS	NS	NS
How much do you care about biodiversity conservation?	NS	NS	NS	NS	NS	NS	0.0662 *	NS	NS	0.0104 **	NS	NS
How much do you care about renewable energy development?	NS	0.0305 **	NS	NS	NS	NS	NS	NS	0.0018 ***	0.0127 **	0.0034 ***	NS

[a] Impact questions were presented from "negatively" to "positively". [b] Attitude questions were presented from "do not care at all" to "care very much". [c] NS = not significant. * Significant at 0.1. ** Significant at 0.05. *** Significant at 0.01. [d] *p*-value corresponds to a Fisher Exact test with simulation because of violation of assumptions if a chi-squared test was applied.

5. Discussion

5.1. Attitudes and Participant Knowledge of Impacts

Energy development and biodiversity conservation may have an influence on what participants felt were notable impacts associated with renewable energy development. The list of possible impacts was derived from a literature review of studies examining the intersections of renewable energy development and the environment, as highlighted in Section 3.2. This literature represented a broad scope of possible impacts identified by these researchers. Given that not every impact listed represents a cause–effect consensus on wind energy development in the literature—such as proliferation of invasive species or changes in local climate—this research did not seek to evaluate statistical significance of correct or incorrect answers, but was instead interested in whether feelings towards the two topics affected what impacts they identified as true versus false or that respondents maintained they did not know.

While literature exists on perceptions of wind energy development (such as Groth and Vogt [14,15] and Olson-Hazboun et al. [39]) as well as review literature on the state of knowledge about impacts of wind energy development [32,37,40], evaluations concerned with what the general public knows about impacts does not exist. The present research provides a novel evaluation of this concept, starting with a survey-based study examining the opinions of environmentally conscious individuals. As this group may be actively seeking out information related to renewable energy topics, they represent a unique opportunity to see what information may be available for individuals to access on this topic. As there is not much evidence available in literature to compare against our results, the following discussion offers an evaluation of results pursuant to an understanding of green conflict opinion among the environmentally conscious.

Reviewing the summary statistics drawn from respondents' answers in Table 4, most participants were aware that bird mortality due to collision with wind infrastructure was indeed an impact of renewable energy development. Studies have been published on the impacts of the Altamont Wind Pass farm in California as early as the late 1980's (such as Thayer and Freeman's study of perception published in 1987 [41]); the bird mortalities related to Altamont were relatively high, as Altamont was one of the first large wind farms in the U.S. While almost 80% of individuals did recognize that collision was a cause of bird mortality, less than 5% of individuals identified it as the leading cause of bird mortality (Figure 1). Collision mortality was identified as the leading cause the least often among respondents, which corresponds with the U.S. Fish and Wildlife listing of the leading causes of bird mortality [42]. It is also an interesting result to note, that almost 45% of respondents identified cats as the leading cause of bird mortality, which is correct based on current estimates. This high number of respondents selecting cats as the leading mortality cause could be attributed to recent news coverage in the past few years about the number of birds likely killed by domestic cats, spurred by Loss et al.'s publication [43] on the impact of domestic cats on birds.

A majority of individuals recognized that bat mortality can also be caused by collisions with wind turbines. While respondents were aware of the collision component, less respondents were aware of the internal injury to bats (barotrauma, where the mechanism of injury is a pressure differential along turbine blades) that can be caused by turbines, as 39% said they did not know. Considering what individuals chose as the leading cause of bat mortality, almost 50% of respondents identified disease (notated as white nose syndrome in the survey) (Figure 2). Wind turbines were identified least often as the leading cause, which contrasts with empirical understandings of the barotrauma phenomena, unlike with bird mortality. Based on recent studies, wind turbine related mortalities have the potential to negatively impact the population stability of certain bat species [31]. According to an article posted by the Wildlife Society in 2016, white nose syndrome and wind turbine related mortalities are the leading causes of bat mortality [44]. Based on this finding, it seems there may be a lack of dissemination of information about the consequences of wind turbine development on bat populations,

as participants in this survey recognized that wind turbines impacted bats, but did not identify it very often as a leading cause of mortality.

While bird and bat mortalities are the two most frequently cited impacts of wind energy development, there are other potential impacts identified in the literature that were also presented to participants. A majority of respondents said that wind energy development did not make habitats unsuitable for species. This question was related to recent studies about the impacts of turbine development on prairie chicken species in the region, which indicate that the turbine development may promote avoidance behavior and impact reproductive success [45–48]. A majority of respondents did agree that wind energy development can lead to habitat fragmentation; while not directly connected, this could relate to the general perception that wind farms impact the integrity of the landscape [13–15]. With respect to increased erosion/disturbance of drainage dynamics and invasive species proliferation, respondents' answers were more variably distributed with no clear consensus among participants, a finding aligned with a lack of treatment in the literature on these impacts. Lastly, a majority of participants said that wind energy development does not lead to changes in local climate, which is another impact that has not been studied in-depth.

When looking at which knowledge questions and attitudes had a statistically significant impact on responses, how much individuals cared about biodiversity conservation was statistically significant ($\alpha = 0.05$) in predicting how people responded to questions related to unsuitable habitat and habitat fragmentation. Attitudes towards biodiversity conservation were statistically significant ($\alpha = 0.10$) on responses to questions related to internal bat injury as well as what respondents identified as the leading cause of bird mortality. In general, an individual's attitude towards biodiversity conservation most likely influences what they know about the current threats to species in their region of interest. This, for example, could have led individuals to be more familiar with research that exists on habitat suitability and fragmentation, potentially in relation to the lesser prairie chicken in Oklahoma, and this may have impacted how they responded. In comparison, the level of how much individuals cared about renewable energy was statistically significant ($\alpha = 0.10$) in predicting how individuals responded to questions related to bat collisions and changes in local climate. These individuals may have been more exposed to how wind farms operate if they cared more about wind energy than biodiversity conservation. The statistical significance, however, could arise from individuals caring less about wind energy development; they therefore may have had less exposure to information about existing impacts.

These results emphasize the difference that exists in what environmentally conscious individuals know about the impacts of renewable energy development, particularly when it comes to the impacts on bat populations. Our results indicate that a gap in dissemination of information about all impacts of wind energy development. While many individuals no longer believe that wind turbines cause high amounts of bird mortality when compared to other causes, there is less known about the potential impact of wind turbine development on bat population success.

5.2. Attitudes and Willingness to Support Wind Energy Development Based on Trade-Offs

The trade-offs section of the survey instrument provided participants with a series of questions soliciting their valuation of sustainable energy and sustained biodiversity, respectively, to assist in evaluating what individuals would be willing to allow to happen insofar as they support wind energy development. The trade-offs presented in this component of the survey were drawn from a literature review of research on public perception; perceived negative impacts were then paired with the goals of biodiversity conservation [2,4,12,14–16,35,39,49]. Here, we compare the results of trade-off responses to themes present in the literature, to help frame under what circumstances environmentally conscious individuals would support wind energy development given their ambient (or perhaps direct) exposure to elements of public opposition to development.

First, with respect to the summarized responses to trade-off questions (Table 6), an overall trend is evident in what scenarios participants would be willing to support or would oppose and the implications of that scenario on biodiversity conservation (no impact or negative impact). A majority

of respondents indicated they would be opposed to development of wind energy if it had any sort of negative impact on biodiversity. These responses included the following trade-offs, as they were worded in the original survey: Lack of impacts to human health, economic growth and opportunity, public participation and inclusion in the process, and locally accessible energy. All of these trade-offs were listed complaints related to wind energy development identified in the literature. Despite this, environmentally conscious respondents were willing to sacrifice certain components such as economic growth or locally accessible energy if it meant there would be no impacts to biodiversity. Conversely, the majority of respondents indicated they would be willing to support wind energy development if it had fewer impacts on biodiversity, regardless of the associated trade-off. The related trade-offs for these questions were negative impacts on the integrity of the natural landscape and higher energy costs, which were again listed as complaints in literature concerned with public perception of wind energy. The summarized responses to trade-off questions indicate a potential trend in support among environmentally conscious individuals for wind energy development, provided it does not impact biodiversity. Additionally, opposition to wind energy development would be observed if negative impacts to biodiversity are evidenced. Lastly, respondents were asked if they would be supportive of wind energy near their homes, and the majority indicated they would be supportive. A third of respondents even indicated they would be very supportive of development (Table 6). Despite the possibility of increased knowledge about the impacts of wind energy development within this group of environmentally conscious individuals, 70% would support, to some extent, development near their homes.

The main goal of this portion of the survey was to confront the "green on green" conflict by providing scenarios in which respondents had to choose between reducing or increasing impacts on biodiversity or experiencing the costs or benefits of wind energy development. Ultimately, biodiversity conservation was important in predicting all the responses to the trade-off questions, except for the very first trade-off presented, where there would be fewer impacts on biodiversity, but negative impacts on the integrity of the natural landscape. The influence of how much individuals cared about biodiversity conservation aligns with the trend seen in the summarized responses of the trade-off section. There was a clear delineation in support or opposition based on what type of impact biodiversity would experience (no impact or a negative impact). When looking at how much individuals cared about renewable energy development and the trade-offs, there was a strong relationship between this attitude and three of the trade-offs presented; fewer impacts on biodiversity but negative impacts on the integrity of the landscape, positive impacts on biodiversity but higher energy costs, and whether or not individuals would be willing to support development near their home. It could be that the respondents who care about renewable energy also recognize the impacts it currently has and are willing to support developments more if those impacts were to be eliminated. When looking at the trade-off that would result in higher energy costs, for some individuals, wind farms are actually viewed as a modern and tangible sign of transition to an environmentally friendly future [13]. Viewed this way, environmentally conscious individuals may be willing to pay more or accept harsher trade-offs as wind energy represents a major option in the shift away from a fossil fuel intensive economy.

The results of this section suggest that for environmentally conscious individuals, the impacts of wind energy development on surrounding ecosystems is more important than factors such as economic development and human health impacts. This contradicts what is present in some of the literature on public perception of wind energy development, which focuses on complaints related to impacts on human health [13,40] and the integrity of the natural landscape [2,4,12,14–16] versus the implications for biodiversity conservation. This is not particularly surprising, as it makes sense that environmentally conscious individuals may prioritize protecting the natural environment compared to other benefits. Despite this prioritization of biodiversity conservation, as mentioned above, 70% of respondents said they would support wind energy development. It is possible that this support is contingent on mitigation of impacts to biodiversity. It could also be that participants recognize the

important, global implications of wind energy development on climate change mitigation and are willing to broadly support it despite potential negative local impacts to biodiversity.

Participants appeared to care more about biodiversity conservation versus other impacts, which may already exist in the state and have been experienced by individuals. For example, as shown by Greene and Geisken [18] via economic modeling, their community of interest experienced a significant economic impact due to wind farm construction, and they cite the potential for additional income in terms of economic growth and jobs in Oklahoma. In addition, research has suggested that wind power development could help stabilize school funding in the face of changing state and federal education funding [19]. These are just two examples of the benefits Oklahoma has seen due to wind energy development, but our survey suggests individuals may be willing to sacrifice these benefits if it means biodiversity will be negatively impacted.

5.3. How Do Demographics Interact with Trade-Off Support or Opposition and Attitudes?

Rand and Hoen [17] indicate in their review of the existing research on wind acceptance studies that demographic variables are not often found to be statistically significant in their influence on variation in attitudes and beliefs towards wind energy development. Groth and Vogt [14] found, in analyzing the results of their 221 respondents, that demographic variables such as age, gender, amount of time living in the county, and distance from turbines were not correlated with expressed perceptions; only land ownership contributed significantly to their findings. Bidwell [8] found that education influenced responses to the "wind caution" and that gender was marginally significant for traits such as "wind enthusiasm" and "wind caution", with 375 completed surveys. Olson-Hazboun et al. [39] had a sample size of 906 and found that only gender had a significant impact on general renewable energy attitudes in the final model. When looking at local wind energy attitudes, they found that being older and more liberal had an initial relationship with the outcomes, but this relationship diminished with additional modeling. In the final model, they found that more highly educated individuals were more likely to support development. Jacquet and Stedman [13], with a sample size of 1028, found weak correlation of age and education with wind farm attitude as well as with wind farm impacts. Lastly, Firestone et al. [50], who had a sample size of 458, evaluated a set of demographic variables and whether participants were agreeable to the look of turbines, and found no statistically significant differences among them. In context with these findings in the literature, we seek to outline the lack of relationship between demographic variables and various components of wind energy attitudes in previous research. Demographic variables should not be discounted as attitudes towards wind energy development, but rather, are understood to represent a complex set of interactions and can be highly context specific.

Given the results in Tables 8 and 9, our research suggests that, among the demographic variables, gender is statistically significant where analyzing the trade-offs individuals were willing to make. The only survey question statistically significantly affected by gender asked participants if they would be willing to support wind energy development. Gender, however, was not statistically significant when evaluating any of the attitude questions included in the survey. This aligns with findings outlined from the literature, where both Bidwell [8] and Olson-Hazboun et al. [39] found gender played a role in some of their analysis, but sometimes only a marginally significant role. In addition, political affiliation as well as whether participants considered themselves more conservative or liberal was statistically significant in predicting responses to a majority of the trade-off questions. These two variables were also highly statistically significant considering how participants felt fossil fuels impacted the environment as well as when asked how much they cared about renewable energy development. These demographic variables were not always explicitly included in prior research efforts, but could be related to questions asked about participation in the planning process and the role of local government [14,16,39]. Level of education played a significant role in some responses, including how individuals felt renewable energy development impacted wildlife conservation, but were weakly significant in line with results from prior research [8,13,39].

In comparison to the analysis of trade-off responses and demographics, relatively few demographic variables had statistical significance in predicting attitude responses. This confirms what Rand and Hoen [17] suggest in their review, although our research found 14 significant relationships among the 60 possible relationships of participant responses and demographics. As these results are characteristic of a more specific group of individuals (self-selecting environmentally conscious individuals) versus surveying the general population, there may be some uniformity among individuals' expressed opinions and their demography. Because the spread of demographic variables responses may not be quite as diverse as would be expected in the general public, this could also explain why more demographic variables presented as statistically significant in our study versus in other studies. As the questions and scale of respondents also differ from other research, this may also have had an impact on our results compared to other studies.

6. Conclusions

This research found that environmentally conscious individuals were aware of the various impacts of renewable energy development on biodiversity conservation, and that while they recognized turbines are not the leading cause of bird mortality, participants appeared to not know as much about the impacts of turbine development on bats. Participants were willing to support wind energy development projects that did not impact biodiversity and were not willing to support any wind energy development projects that negatively impacted biodiversity. In addition, attitudes towards biodiversity conservation were statistically significant in predicting in almost all of the trade-off questions, which could be why there was a strong trend presented in when individuals would and would not be willing to support wind energy development. Lastly, while previous research related to wind energy attitudes has found demographic variables largely not significant in determining attitudes, this research found that some demographic variables, including gender, political affiliation, and whether individuals identified as more liberal or conservative, were statistically significant for questions related to trade-offs as well as general attitude questions. This finding could indicate that, in certain scenarios, demographic variables may be part of the complex set of factors creating the context for attitudes to develop, with respect to societal transition strategies including as renewable energy development.

6.1. Policy Implications

Both renewable energy development and biodiversity conservation are considered priorities in sustainability and sustainable transitions. These two initiatives, however, are also often in conflict with one another both in policy implementation as well as in technology implementation. When renewable energy projects are proposed, in addition to public opposition based on common complaints cited in the literature, the projects often come up against environmental issues, whether it be related to specific species or to broad habitat implications. This is exemplified in Kahn's [9] piece, when he highlights that renewable energy represents a unique energy situation where you have environmentalists supportive or opposed to development. Although renewable energy is considered a strategy with positive environmental implications, as a climate mitigation strategy, the negative local environmental impacts are often used in opposition of policy related to development.

This research highlights where gaps in this knowledge currently exist as related to the impacts of wind energy development on the environment. The results indicate that information related to the impacts caused by wind energy is not always accessible or clear, and that while respondents were familiar with some impacts, there was still uncertainty. This research considers that environmentally conscious individuals may have more access to information to begin with, so this research lends itself to the question of what knowledge looks like in the general public based on the gaps that exist within this sample. When working to implement renewable energy projects and policy, it is important that the correct information is disseminated and done so effectively, to ensure that communities are

well-informed. Clearer distribution of scientific knowledge to the public can assist in easing concerns of citizens as it relates to the environmental impacts.

In addition, this research began to evaluate under what scenarios individuals would be willing to support wind energy development. The results showed a clear trend of prioritizing biodiversity conservation over the other perceived impacts (whether positive or negative) of wind energy development. This trend suggests that future projects and policies should continue to work to find a balance between the two, through smarter siting and continued technological innovation, to ensure that biodiversity conservation efforts are not impacted by wind farm projects. This could include continued efforts to integrate bird and bat movement models in wind farm siting and continued improvement in making turbines more visible to species, increased spacing to reduce habitat impacts, and increased usage of existing infrastructure to prevent further fragmentation. Future policy initiatives could consider ways to streamline the environmental impact assessments to prevent cumbersome and drawn-out approval processes while ensuring that specific biodiversity concerns are addressed. This could include stronger relationships between state wildlife and energy departments as well as increased involvement of environmental and energy consulting firms. Our survey results imply that as long as biodiversity conservation is not impacted negatively, respondents were willing to support wind energy development, which suggests that within this "green on green" conflict, there can be support for both the global and local implications of renewable energy development.

6.2. Future Research

Future research could include additional questions to understand the nuances of how much individuals care about biodiversity conservation and renewable energy development impact their acceptance and support of wind energy development. In-person interviews or focus groups of environmentally conscious individuals could provide some additional insight into the narratives associated with how these individuals perceive the green on green conflict and associated tensions. This research could extend this survey to the general public, to serve as a comparison between how environmentally conscious individuals responded versus the public. If a difference does exist, studying why differences present themselves could help to determine how environmental innovation is presented to the public. As our research showed, there is a lack of knowledge within this participant group of environmentally conscious individuals in regard to the impacts of wind energy development on bats. This lends itself to the question of why this gap exists. An in-depth analysis of how environmentally conscious individuals obtain their information versus how the general public do could provide insight into the best ways for local governments and developers to approach community engagement projects. The trade-offs component of this survey, in addition, provides some context describing under what circumstances wind energy development is acceptable; it would be important to see how the general public values the various components inherent to wind energy development versus environmentally conscious individuals, especially as the environmentally conscious appear to value biodiversity conservation over all else. It is possible that environmentally conscious individuals have a different conception of sustainability as a concept and are more focused on the environmental component, whereas the general public may be more concerned with the economic and social implications as well. Overall, this research provides additional context from which to analyze wind energy attitudes by further defining the notion of a "green on green" conflict. We asked respondents to identify what they knew about the implications of this conflict via the knowledge questions and specifically framed the trade-off component in terms of biodiversity conservation versus the other potential costs or benefits of wind energy development. By focusing on environmentally conscious individuals, we confronted the paradox described by both Warren et al. [10] as well as Kahn [9], in that there is an expectation that environmentalists will be proponents of wind energy development, but that is often not the case. As society continues to transition towards greener practices, it will be important to expand our understanding surrounding what individuals perceive as viable impact trade-offs for these practices.

Author Contributions: Conceptualization, C.B. and R.L.; methodology, C.B. and R.L.; formal analysis, C.B.; investigation, C.B.; resources, R.L.; data curation, C.B.; writing—original draft preparation, C.B.; writing—review and editing, R.L. and T.G.; visualization, C.B.; supervision, R.L.; project administration, C.B. and R.L.; funding acquisition, R.L. All authors have read and agreed to the published version of the manuscript.

Funding: This manuscript was supported by funding from the US National Science Foundation (NSF DGE-1545261).

Acknowledgments: The researchers would like to thank Justin Reedy, Sara Mata, and Christopher Anderson for their feedback on survey structure and content. We would also like to thank Randy Peppler for his feedback on the draft of this manuscript. We would like to thank Cody Peppler and Katie Hawk from the Oklahoma Chapter of the Nature Conservancy, Johnson Bridgewater from the Oklahoma Chapter of the Sierra Club, Ron Suttles from the Oklahoma Conservation Coalition, Buck Ray from the Oklahoma Renewable Energy Council, and all others who assisted in distributing the survey.

Conflicts of Interest: The authors declare no conflict of interest.

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