A CONCEPTUAL MODEL FOR HUMAN-WILDLIFE CONFLICT MITIGATION

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Abstract

The purpose of this study was to create a comprehensive conceptual model to explain the human-wildlife conflict (HWC) phenomenon and provide recommendations for optimal intervention strategies. There were two objectives of this study. The first objective was to conduct a secondary analysis on the dataset from the van de Water & Matteson (2018) study to test the hypothesis that those with only positive benefits from elephants were associated with more positive views on coexistence than those with both positive and negative benefits, negative benefits only, or no benefits. The results of this first objective provided a data point for the second objective, which was to qualitatively analyze the trends in preexisting research and relevant theoretical models to identify factors that modify the effectiveness of HWC strategies and to develop a comprehensive explanatory model. The results of this study suggest that HWC mitigation strategies should be informed by sociology theories (social strain theory and social capital theory), psychological factors (e.g., attitudes, internal locus of control, fear) and social-ecological models to understand the complexities of HWC and identify optimal strategies for mitigation.

Keywords: Human-wildlife conflict, biodiversity, habitat destruction, conservation, mitigation strategies

1. Introduction

Global human-wildlife conflict (HWC) is a growing and serious threat to conservation efforts, which is exacerbated by growing human populations that create a higher demand for land and infrastructure (Branco, et al., 2019; Lischka et al., 2020; Milda et al., 2020; Sayantani, et al., 2020; Schell et al., 2020). While Africa and Asia experience some of the highest rates of HWC, the phenomenon occurs across the globe. Hazards associated with HWC include destruction of property and assets (e.g., crops, livestock), spread of diseases, and fatalities. Given the nature of their work, farmers are particularly vulnerable to these conflicts (Dunnink et al., 2020; Kansky et al., 2021; van de Water & Matteson, 2018).

1.1 Human-Wildlife Mitigation Strategies and Factors Influencing Their Effectiveness

In order to mitigate HWC conflicts, local residents use various self managed tactics such as firecrackers, fires, fencing (Branco, et al., 2019; Feuerbacher et al., 2020, van de Water & Matteson, 2018) and guarding (Feuerbacher et al., 2021). Sanctioned mitigation methods might include forest restoration, ecotourism, payments, providing water sources to protected habitats, educational initiatives, community-based interventions, and patrolling (Makindi, Mutinda, Olekaikai, Olelebo, Aboud, 2014; van de Water & Matteson, 2018). Compensation programs and livestock management strategies have yielded effective results (Rashid et al., 2020), but the effectiveness depends on the level of integrity of the intervention. The level of integrity can be impacted by funding (Rashid et al., 2020), or unintentional as well as intentional acts of fraud and corruption (Hlengisizwe, 2019). Community-based interventions tend to be least effective (Rashid et al., 2020).

The context surrounding the mitigation strategy has substantial implications for its effectiveness as well (Mariki, Svarstad, & Benjaminsen, 2014). One major factor influencing the efficacy of these methods is the extent to which local residents were involved in the decision-making (Dickman, 2010; Mariki, Svarstad, & Benjaminsen, 2014). For example, when local residents are displaced to accommodate wildlife without any choice, they can become resentful and take measures into their own hands. These measures can include extreme behaviors such as collaborating with poachers (Mariki, Svarstad, & Benjaminsen, 2014), which yields the opposite effect of what was intended.

Another factor influencing intervention effectiveness is economics. For example, guarding is a costly strategy while low-cost fencing can be a much more cost effective approach (Feuerbacher et al., 2021). However, collective action may still need to be taken in order to reach economies of scale. Feuerbacher et al. (2021) suggest that an effective strategy might include investments in electronic fencing as part of a more comprehensive policy. However, one possible limitation of fencing as a HWC strategy is the potential biological implications, which require additional research. Mass-culling is another strategy that has been hypothesized to yield profitable results, but when implemented, the economic model did not yield the benefits expected (Florens & Baider, 2019).

In addition to the importance of the strategy itself, people's attitudes and degree of wildlife tolerance can moderate the effectiveness of mitigation strategies (Teixeira et al., 2020; van de Water & Matteson, 2018). Given these complexities, the strategies and contextual factors associated with HWC mitigation need to be considered in the broader context of ecological and social contexts (Rashid et al., 2020), particularly as it relates to how people's attitudes and tolerance for wildlife are impacted by the HWC mitigation strategy, their prior experiences with wildlife, their social norms and values, and their level of education and awareness. Presumably, changing attitudes and behaviors is the most effective, yet the most challenging component of a successful HWC mitigation strategy.

1.2 Factors Influencing Conservation Attitudes and Tolerance for Wildlife

The relationship between HWC outcomes, HWC mitigation strategies, and people's attitudes and behaviors towards wildlife is highly complex. In fact, this relationship has been found to be mediated or moderated by risk perceptions of wildlife (Dickman, 2010), intrinsic values and moral foundations (Lute, Navarrete, Nelson, & Gore, 2016), type of encounter with wildlife (Marino et al., 2020; van de Water & Matteson, 2018), benefits associated with ecotourism or other conservation participatory experiences (Alix-Garcia, Sims, Orozco-Olvera, Costica, Fernandez Medina, & Romo Monroy, 2018; Eshoo, Johnson, Duangdala, & Hansel, 2018; van de Water & Matteson, 2018), socio-economic factors (van de Water & Matteson, 2018), and the extent to which humans have control over the situation and/or decision-making (Bhatia et al., 2019; Dickman, 2010; Lischka et al., 2020; Mariki, Svarstad, & Benjaminsen, 2014).

In an effort to develop a framework for conceptualizing HWC and the drivers of human tolerance, Kansky et al. (2016) created the Wildlife Tolerance Model (WTM). The model contains both an inner and outer model. Based on the outer model, an individuals' experiences with a given species determines perceptions of both benefits and costs, which are associated with tolerance. The outer model was validated using partial least squares structural equation modeling (Kansky et al., 2016). The results indicated that intangible benefits and intangible costs contribute equally to one's tolerance, although surprisingly, tangible costs were not found to explain a significant amount of variance for tolerance. For intangible benefits, positive meaningful events had the strongest impact followed by negative meaningful events, and exposure. For intangible costs, exposure, negative meaningful events, and positive meaningful events yielded moderate effects. In terms of perceived costs, exposure explained the greatest amount of variability followed by negative meaningful events, and positive meaningful events. These results were replicated with a case study of farmers in rural Bangladesh who had a high degree of resource dependence (Saif et al., 2020). The lack of a relationship between tangible costs and tolerance was explained by the presence of a collective support system that could increase resiliency.

Another real-world example of the relationship between HWC and tolerance for wildlife was provided via a case study where local residents were surveyed regarding their conflict with elephants in Thailand (van de Water & Matteson, 2018). One particular finding that was surprising was that positive benefits from elephants was associated with both positive and negative views on coexistence. However, it is important to note that those with both positive and negative impacts were analyzed together as one group. If those groups are separated out, the results might show that those with positive impacts only have more favorable attitudes (e.g., more tolerance for coexistence) than those with both positive and negative impacts, negative impacts only, or no impacts. This hypothesis was tested as the first objective for the current study and the results are presented in the results section.

Attitudes about tolerance for wildlife are important to understand because attitudes translate to behaviors. For example, based on a review of 250 published articles conducted by Bhatia et al. (2019), humans' perceptions of coexistence translated into behaviors in that the more positive the attitude the more positive the behavior. Specifically, the researchers identified five types of attitudes with corresponding behavioral responses. For example, the most negative attitudes resulted in "manifested intolerance" while the most positive attitudes resulted in "stewardship" behaviors (Bhatia et al., 2019, p. 623). The researchers also concluded that the underlying attitudinal and contextual causes of human response to HWC include value orientations, social interactions, resource dependence, perceptions of risk, and the nature of the interaction with the animal. These findings are consistent with the literature and suggest that there is a need to find strategies that improve perceptions while simultaneously reducing the negative effects of resource dependence. Furthermore, community members must derive meaningful benefits from wildlife conservation (Mukeka, 2020).

Other factors to consider when understanding the complexities of HWC conflict are contextual factors such as the type of species and area in consideration. Marino et al. (2020) hypothesized that exposure to a given species and the experiences one has with that species will drive one's perceptions of the associated benefits and costs as well as level of tolerance; however, this relationship may be

moderated by the type of species and area in consideration. In their research, Marino et al. (2020) found that regardless of species or area, two recommended management strategies include increasing positive experiences and increasing intangible benefits. However, there were five management strategies that depended on the species and/or area of interest. Specifically, results differed by species only (bears versus wolves) with respect to reducing exposure, reducing tangible costs, and increasing tangible benefits. Finally, results differed by species and area with respect to reducing intangible costs and reducing negative meaningful events.

The research synthesized indicates that the phenomenon of HWC is highly complex with many social-ecological and contextual factors moderating the dynamics, creating a need for flexible approaches and strategies (Schell, et al., 2020). What is clear from the review of the literature is that a multidisciplinary approach needs to be taken that considers socio-ecological factors (Ghoddousi et al., 2021) along with psychological factors (Lischka et al., 2020). The purpose of this study was to create a comprehensive conceptual model to explain the human-wildlife conflict (HWC) phenomenon and provide recommendations for optimal intervention strategies. There were two objectives of this study. The first objective was to conduct a secondary analysis on the dataset from the van de Water & Matteson (2018) study to test the hypothesis that those with only positive benefits from elephants were associated with more positive views on coexistence than those with both positive and negative benefits, negative benefits only, or no benefits. The results of this first objective provided a data point for the second objective, which was to qualitatively analyze the trends in preexisting research and relevant theoretical models to identify factors that modify the effectiveness of HWC strategies and develop a comprehensive and explanatory model.

2. Materials and Methods

2.1 Materials

The materials used for this study include current peer-reviewed research articles on HWC, a secondary dataset obtained from the van de Water & Matteson (2018) study, and SPSS statistical software to conduct the analysis on the secondary dataset. A total of 30 peer-reviewed journal articles were considered for the qualitative thematic analysis component of this study. The articles were found by using Miami University's online library article search, and only articles that were published within the past five years were considered for the qualitative analysis. The search was not limited to a particular discipline or journal. In cases where the same author or subset of authors published multiple related articles, the most recent article was selected unless there was unique relevant information provided in an earlier publication. The primary search criterion keyword was human-wildlife conflict.

Although 30 articles were initially selected, after a more thorough review of the articles, six were eliminated given that they did not focus specifically on the characteristics of the HWC phenomenon. For example, one article focused on how cases of HWC are documented and another article focused on the percentage of animals admitted to a wildlife rehabilitation facility as a result of HWC. Therefore, a total of 24 articles were qualitatively analyzed for this study. Of the 24 articles included, the following regions were represented: Bhutan (Feuerbacher et al., 2021; Sharma et al., 2020), Nepal (Pokharel & Aryal, 2020; Sharma et al., 2020), India (Johnson, et al., 2018; Milda et al., 2020; Ramesh, et al., 2020; Sharma et al. 2020), China (Rashid et al., 2020); Kenya (Mukeka et al., 2020; Mukeka et al, 2019; Siljander et al., 2020), Botswana (Dunnink et al., 2020), Mozambique (Branco et al., 2019), Zimbabwe (Hlengisizwe, 2019; Musiwa & Mhlanga, 2020), Southern Africa (Kansky et al., 2021), Poland (Basak, et al., 2020), Italy (Marino et al., 2020), Brazil (Teixeir et al., 2020), Ethiopia (Mekonen, 2020), Thailand (van de Water & Matteson, 2018), Island of Mauritius (Florens & Baider, 2019), and the United States (Lischka et

al., 2020; Schell et al., 2020). The following articles contained a synthesis of the HWC literature that spanned across several regions (Bhatia et al., 2019; Ghoddousi et al., 2021).

Additional research articles were used for this study, which were either previously obtained for prior research purposes, or found as part of the literature search for the current research project. Therefore, while 24 articles were used for the qualitative analysis, additional articles were cited in this study to provide more context around HWC. No new literature searches were conducted to identify theoretical or conceptual models relevant to HWC. Only theoretical and conceptual models that were already known to the researcher (either through prior research or learned via the current research project) were considered for this study.

2.2 Quantitative secondary analysis methods

The dataset for the secondary quantitative analysis was obtained through a link within the publication. The data was uploaded into SPSS for processing and analysis. From the variables in the original study, a new derived variable was created. Specifically, a mutually exclusive variable with four categories was created by combining the negative impacts and positive benefits variables (no impacts, positive only, negative only, and both positive and negative). This new categorical variable and the tolerance of elephant coexistence categorical variables were included in the analysis. The analysis was conducted in SPSS, and a Chi-square test of independence was conducted to better understand the relationship between having had experiences or benefits with elephants (versus not) and levels of tolerance for elephants. Therefore, independent groups of participants were compared on their tolerance levels (eradicate, conditional, tolerate) for coexistence with elephants based on their prior experiences.

2.3 Qualitative analysis methods

The qualitative analysis was conducted manually using open coding, axial coding, and selective coding (Vollstedt & Rezat, 2019), which included the triangulation of thematic findings with pre-existing theories and conceptual models. The first stage of the qualitative analysis was to identify themes across the 24 research studies of interest using open coding and saturation. The open coding process consisted of conceptualizing and categorizing the phenomena (HWC) by breaking up the data into smaller parts to analyze the central idea and then comparing and contrasting these smaller parts to create categories as shown in Table 1.

The axial coding process consisted of exploring the themes and categories that were generated during the open coding process and triangulating them with the relevant theoretical models to identify potential relationships. The selective coding process consisted of integrating the themes and categories with the theoretical models. In this third stage, the theories and their corresponding themes were linked to generate an overall conceptual explanatory model of HWC as depicted in Figure 2. In Figure 2, the themes associated with social capital theory and social-ecological theory serve as moderators of HWC and mitigation strategy effectiveness. Social strain represents the causal conditions of the conflict. Finally, the conceptual model depicted in Figure 2 was considered further to determine potential strategies based on contextual factors (refer to Figure 3).

3. Results

3.1 Objective One

The first objective of this study was to build upon the results of Water & Matteson (2018) and test the hypothesis that those with only positive benefits from elephants are associated with more positive

views on coexistence than those with both positive and negative impacts, negative impacts only, or no impacts. To achieve this first objective, a Chi-square test of independence was conducted using SPSS based on the Water & Matteson (2018) dataset. The results in Figure 1 indicate that experiencing no impacts from elephants (positive or negative) was associated with the least favorable level of tolerance (eradicate) and having only positive impacts was associated with the most favorable level of tolerance (tolerate), $\chi^2(6) = 52.25$, $p < .001$. Therefore, the hypothesis that those with only positive benefits from elephants are associated with more positive views on coexistence was supported. This finding served as a validated data point, which helped inform the conceptual model that was developed in the second phase of this study (e.g., objective two).

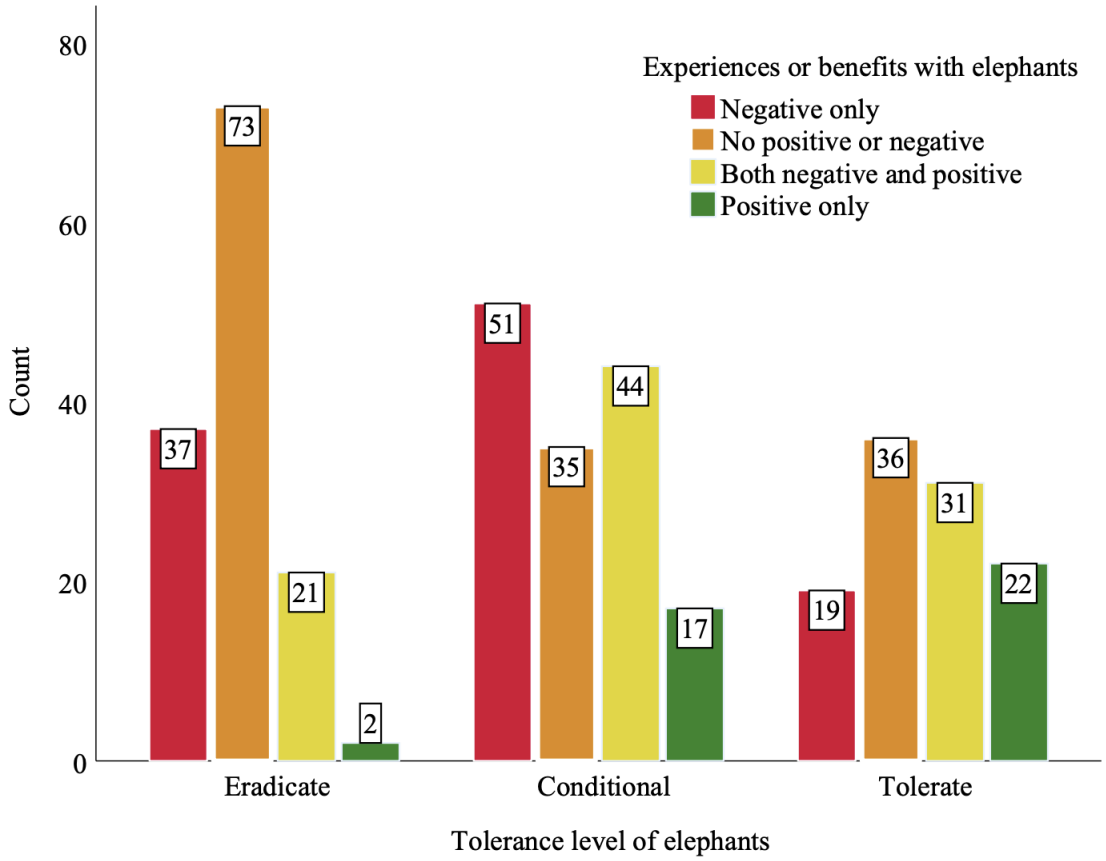

Figure 1. Chi-square test of independence results generated from secondary analysis of van de Water & Matteson (2018) research data with tolerance of elephant coexistence as the dependent variable.

3.2 Objective Two

The second objective of this study was to create a comprehensive and explanatory conceptual model. The results for the open coding analysis indicate that several HWC related categories were identified, which include hazards, causes and excellerators of conflict, intervention strategies, and moderators. The supporting themes that were classified and their associated categories are outlined in Table 1. The number of articles that referenced each theme is provided, although a higher number of mentions does not necessarily indicate higher importance.

Table 1
Thematic Analysis Categories and Themes (N indicates the number of articles where the component of the theme appeared)

Theme	Components of theme	*N*
HWC hazards	Livestock depredation	16
	Crop loss	16
	Property damage or property intrusion)	9
	Animal-vehicle collisions)	4
	Zoonotic diseases	2
	Severe injuries or fatalities	13
	Biodiversity loss	11
Causes and accelerators of conflict	Growing human populations / high human populations	11
	Habitat destruction and/or fragmentation	12
	Climate (e.g., rainfall patterns) and seasonality	10
	Proximity or accesibility to protected areas, lack of protected areas	10
Interventions and strategies	Fences/ barriers	7
	Herding, guarding, or scaring (e.g., firecrackers, scarecrows)	10
	Policies, ordinances, regulations	9
	Violence (mass-culling, snares, bombs, poisoning, etc.)	5
	Community-based education / awareness programs	7
	Payments / compensation	7
	Protected areas and corridors	5
Moderators of HWC and strategy effectiveness	Epathy / compassion	2
	Decision rights/ local community involvement, internal locus of control	6
	Income level / resource dependence	10
	Benefits gained or type of experiences (positive, neutral, negative)	7
	Frequency and severity of HWC	3
	Human perceptions and attitudes regarding wildlife	11
	Species of animal	11
	Landscape type / spatial	10
	Values or social norms	4
	Intervention budget, costs, and returns	9
	Level of corruption / relationships with authorities	3

In addition to the generation of themes based on the literature (n = 24) through the open coding process, pre-existing theoretical and conceptual models were considered and integrated with these concepts as part of axial and selective coding to create a new comprehensive explanatory model. It is important to note that the WTM (Kansky et al., 2016) provided a conceptual framework for several of the studies that were analyzed in the current study and therefore the WTM is inherently represented by many of the themes that emerged from the qualitative data analysis.

Social-ecological models were considered for this study given that they are grounded in the social-ecological theory, which provides an excellent framework for environmental management phenomena (Virapongse et al., 2016). Social-ecological models consider how we think about the role of human and ecological components, social and ecological processes, as well as the integrations between them as it relates to environmental management. One example of a social process that was identified as a theme from the article reviewed was the concept of having a voice and an influence on the HWC solution. In this case, the concept of internal versus external locus of control becomes relevant. Internal locus of control pertains to the extent to which people believe an outcome of their behavior is a result of their own personal characteristics or behaviors versus due to factors outside of their own control (Rotter, 1966). I hypothesize that having a strong sense of internal locus of control is a critical antecedent and catalyst for positive change to occur within the social-ecological ecosystem (Bhatia et al. 2020). Positive change that scales across geographies and time can only occur if people believe that they have the power and control to influence their environments and themselves.

Another relevant theory is social strain theory (Merton, 1938), which was later refined to be called general strain theory by Agnew in 1992. General strain theory comprises three types of strain. The first type of strain, which is considered classic strain theory, results from an inability to achieve positively valued goals. The second type of strain occurs as a consequence of stressful life events, which can be exacerbated by a lack of resources. The third and final type of strain emerges as a response to chronic emotional and/or physical abuse. It is the second type of strain that is hypothesized to be relevant in HWC. One example supporting this hypothesis comes from a meta-analysis conducted on predictors of child physical abuse where the most significant predictor was resource availability (Shutay, 2009). Resource availability explained 34% of the variance, on average, across the studies in the meta-analysis. This focus on resources is consistent with one of the causes of human response to HWC being resource dependence (Bhatia et al., 2019). A lack of sufficient resources can create significant strain leading to ineffective response strategies. Therefore, a lack of resource availability must be addressed before successful HWC mitigation strategies are put in place or it must be part of the strategy.

A third and final theory to consider is social capital theory (Putman, 1995), which purports that civic engagement and other prosocial types of behaviors are facilitated through trust in others contributing to the greater good. This theory was supported by the themes in the literature that were identified as moderators of HWC and strategy effectiveness. For example, having trust in authority (no corruption), having a voice, and being part of the solution all relate to the tenets of social capital theory.

Based on the triangulation of the axial coding results from the themes and categories with the theories and concepts represented in the literature, a conceptual explanatory model was created and is presented in Figure 2. The conceptual model demonstrates how moderators of HWC mitigation strategies are associated with social-ecological factors as well as social strain and social capital components. Also, this model is based on the assumption that varying levels of hazard severity will be associated with varying levels of social strain. Finally, the WTM is represented within the social-ecological theory via the following themes: (1) prior experiences with species, (2) perceptions and attitudes, and (3) values and social norms.

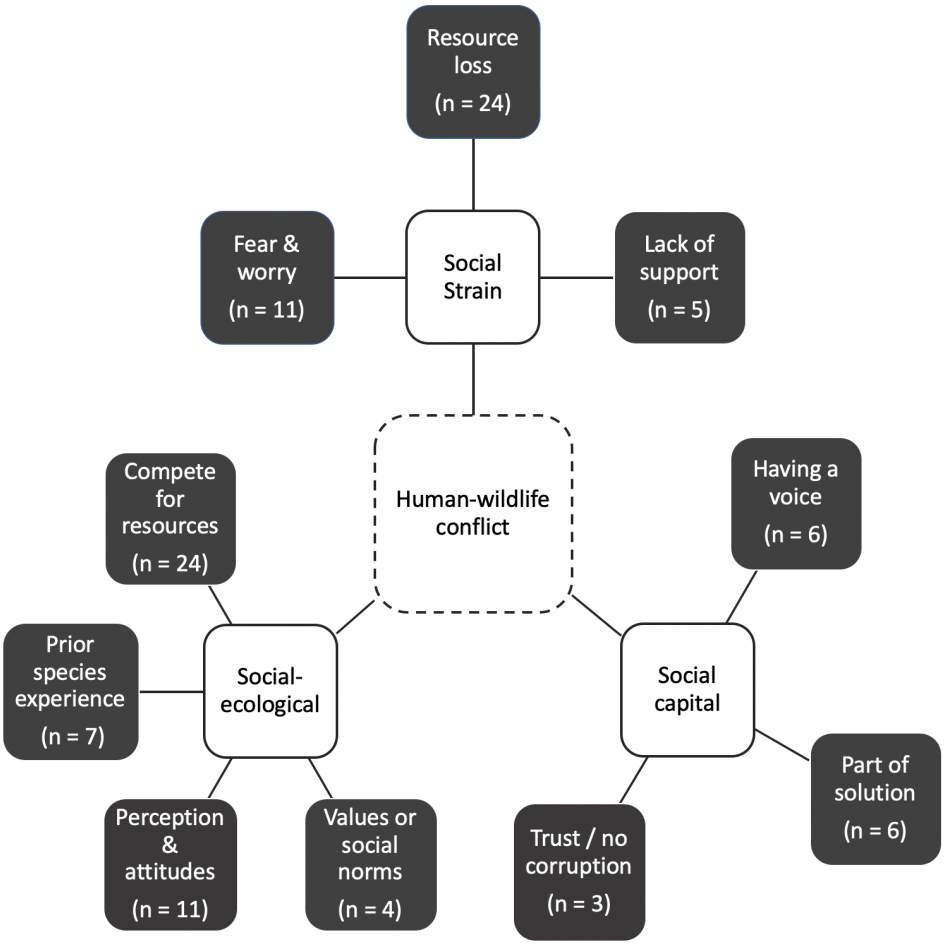

Figure 2. Linkage between HWC mitigation strategies and theoretical and conceptual models (n indicates the number of articles where the concept appeared).

4. Discussion

The first objective of this study was to build upon the results of Water & Matteson (2018) and test the hypothesis that those with only positive benefits from elephants are associated with more positive views on coexistence. These results of the analysis support the hypothesis and are consistent with the WTM proposed by Kansky et al. (2016). These results suggest that those without exposure to elephants are less likely to feel a sense of care or have empathy for such animals (Kansky et al., 2021). Perhaps exposure through education might be most beneficial for this subpopulation. Those who experienced only negative impacts were most likely to have conditional tolerance, which makes sense since they require mitigation strategies to minimize the conflict. Those with positive benefits are most tolerant, particularly those with higher incomes or support systems that help offset resource loss. Perhaps ecotourism or participation in conservation efforts could be most effective for this subpopulation.

The second objective of this study was to create a conceptual model based on the triangulation of the themes found from the 24 articles and insights generated from relevant theoretical models. Based on the results of the qualitative analysis, the importance of socio-ecological dynamics becomes apparent as well as the role of internal vs. external locus of control and social strain theory. For example, certain contextual factors must precede the implementation of any given strategy whereby those who are stakeholders of the implementation should feel that they have a voice in the solution (e.g., need for

internal locus of control), and social contexts must be put into place to reduce the strain associated with a lack of resources (e.g., payments or other types of compensation). In some cases, having a collective support system to help drive resilience and lower dependency on one's resources can offset the need for formal payment mitigation strategies (Saif et al., 2020).

4.1 Recommendations for practice

Based on the interpretation of the findings from the qualitative analysis, a decision tree for selecting a mitigation strategy based on contextual factors is proposed and represented in Figure 3. Please note that hazard severity will depend on factors such as species type, seasonality, proximity to protected areas, etc. For example, it is important to note that the species of the animal will likely play a role in the level of hazard severity, and the amount of intervention required (e.g., efforts and associated funding) will depend on climate-related factors and landscape-related factors. Also, in order for these strategies to work, the local residents who are impacted by HWC will need to have a voice and be part of the decision-making process. Finally, all possible measures should be taken to minimize corruption and fraud, particularly when the strategies depend on monetary requirements.

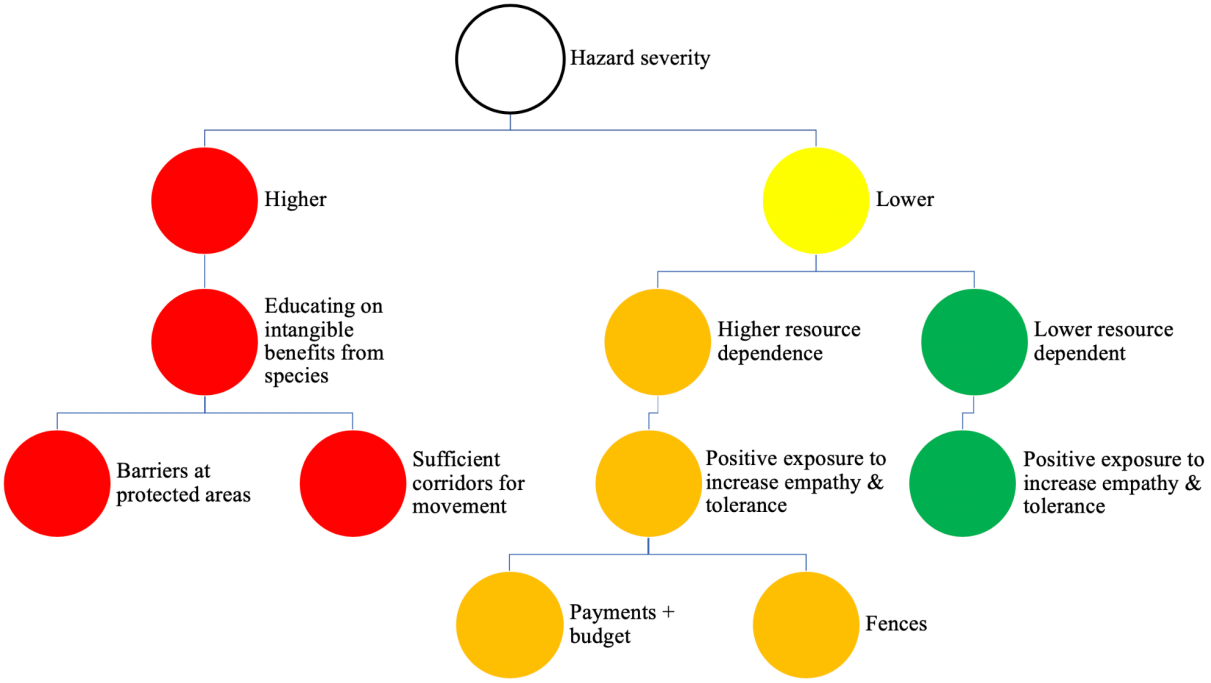

Figure 3. HWC mitigation strategy decision tree.

The diagram in Figure 3 indicates that higher severity instances (red) require efforts that stop the species of interest from entering areas that are populated by local residents. These types of solutions include installing barriers between protected areas and non-protected areas, creating corridors for the species to have sufficient movement within and between habitats, and possibly even relocating either the residents or the protected area. If the severity is lower, but there is a high degree of resource dependence, then compensation supported by sufficient funding is the suggested strategy along with fences to minimize the conflict. If resource dependence is low or non-existent, then identifying opportunities for local residents to have positive exposures to the species can help increase empathy and tolerance, helping to alleviate the conflict. If it is possible to have residents observe these animals through structured and

governed programs, that would be ideal. If live observation is not possible, educational programs could be developed where residents are exposed to content that highlights the importance of these animals in our ecosystem with video content showing them in a favorable light (e.g., taking care of their young, playing together). To help motivate residents to participate, perhaps a small monetary incentive would help and/or provide residents with a certificate of completion demonstrating their knowledge. Those that are extrinsically motivated by money or by formal acknowledgement for their efforts would be encouraged to participate.

4.2 Study limitations

One limitation of this study is that the validity of the conclusions from each article analyzed was not evaluated. The conclusions were taken on face value. It is possible that some conclusions were more or less supported based on the robustness of the data and methodology employed. Another limitation of this study is that the conceptual model is purely theoretical. Additional research is required to test the model using structural equation modeling. Finally, the strategy recommendations provided require a significant amount of domain expertise to implement, particularly around species type, landscape type, and seasonal influences on HWC given that specific recommendations based on these factors are not provided.

5. Conclusions

The purpose of this study was to create a conceptual model to explain the HWC phenomenon and provide recommendations for optimal intervention strategies. The results of this study suggest that HWC mitigation strategies should consider psychology concepts (internal locus of control) and sociology theories (strain theory and social capital theory) in combination with social-ecological models to understand the complexities of HWC and identify optimal strategies for mitigation.

The results of this study also provide several specific insights. For example, people need to have a voice and be part of the decision making process to increase the effectiveness of the HWC mitigation strategy (Dickman, 2010; Mariki, Svarstad, & Benjaminsen, 2014). People also need to have positive experiences with or receive benefits from wildlife to develop tolerance and to have more favorable attitudes about conservation (Teixeira, et al., 2021; van de Water & Matteson, 2018). In fact, intangible benefits are more influential than tangible in developing tolerance (Kansky et al., 2021; Kansky et al., 2016; Saif et al., 2020). This may be particularly important for situations where farming is involved given the impacts of HWC on one's livelihood.

Another insight that emerged from this research is that using payments as a mitigation strategy is only a short-term solution because payments do not change attitudes or tolerance for coexistence, although they can be effective if they offset financial burdens caused by HWC (Pokharel & Aryal, 2020). Payments as a HWC mitigation strategy are likely the most effective approach when the hazard severity is not high (e.g., no likelihood for significant injuries or death) and there is a heavy reliance on resources. However, optimal strategies are those that change attitudes and behaviors and therefore focusing on intangible benefits in combination with payments has the potential to be even more effective (Kansky et al., 2021; Kansky et al., 2016; Saif et al., 2020).

The role of education as a mitigation strategy (Mekonen, 2020; Pokharel & Aryal, 2020) is a prerequisite, but likely not sufficient to change attitudes and behaviors. While education should be a component of every strategy, education programs must focus on the intangible benefits associated with wildlife and coexistence in order for them to be effective, and the other contextual factors must be in place to support the effectiveness of education as a strategy. In other words, if there is no support or no

sense of internal locus of control for residents who experience HWC, educational efforts are not likely to be effective.

Finally, what gets financed gets done. The budgets and resources set aside for implementing HWC mitigation strategies need to be sufficient to support the initiatives (Rashid et al., 2020). This is particularly important when tangible or monetary strategies, such as payments or compensation, are implemented to overcome the strain associated with resource losses from HWC.

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