

Factors shaping public attitude towards nature-based solutions based on theories of risk and place: the case of dike relocation projects along the Elbe River

Facteurs déterminant l'attitude du public à l'égard des solutions fondées sur la nature et basées sur les théories du risque et du lieu: le cas des projets de déplacement de digues le long de l'Elbe

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RÉSUMÉ

Les solutions fondées sur la nature (SFN) ont gagné en popularité en tant que moyen durable et efficace de gérer les risques d'inondation. Il est essentiel de comprendre les facteurs qui façonnent l'attitude du public à l'égard des SFN pour minimiser la résistance à la mise en œuvre réussie des projets. Dans ce travail, nous avons développé un cadre théorique hybride qui englobe les théories de la perception des risques et du lieu. Les concepts pertinents de chaque théorie ont été analysés à l'aide des données d'une enquête auprès des citoyens menée dans cinq villes de Saxe-Anhalt, en Allemagne, où des projets de déplacement de digues ont été réalisés. La modélisation par équation structurelle a été utilisée pour explorer les coefficients de cheminement. Pour les constructions issues des théories du risque, l'évaluation de la menace a affecté négativement l'efficacité perçue de la réduction des risques et l'attitude de soutien, tandis que la confiance dans la gestion des risques d'inondation et les co-bénéfices perçus étaient des prédicteurs positifs. En ce qui concerne les constructions liées au lieu, le lien avec la nature était un prédicteur positif de l'efficacité perçue de la réduction des risques, tandis que l'identité du lieu était un prédicteur négatif de l'attitude de soutien. L'identification de ces éléments qui façonnent les attitudes du public et de leurs relations nous permet de fournir des recommandations théoriques et fondées sur des preuves pour la réalisation des SFN.

ABSTRACT

Nature-based solutions (NBS) have gained popularity as a sustainable and effective way of dealing with flood risk. Understanding factors that shape public attitudes toward NBS are essential for minimizing resistance towards successful project implementation. In this work, we developed a hybrid theoretical framework that encompasses theories of risk perception and place. The relevant constructs from each theory were analyzed using data from a citizen survey conducted in five towns in Saxony-Anhalt, Germany, where dike relocation projects were performed. Structural equation modeling was employed to explore the path coefficients. For the constructs from risk theories, threat appraisal affected both perceived risk reduction effectiveness and supportive attitude negatively, whereas trust in flood risk management, perceived co-benefit were positive predictors. For the place-related constructs, nature-bonding was a positive predictor of perceived risk-reduction effectiveness, while place identity was a negative predictor of supportive attitude. Identifying these elements shaping public attitudes and their relations allows us to provide theory and evidence-based recommendations for NBS realizations.

KEYWORDS

dike relocation, nature-based solutions, place attachment, river restoration, risk perception

1 INTRODUCTION

Although the dominant trend in flood risk management (FRM) remains technical, a more integrative FRM that considers both natural and human systems has received more attention for its effectiveness and sustainability. Such shift conforms to the international call of Nature-Based Solutions (NBS) as a sustainable future-proof means to manage flood risks making restoration of the river and floodplain more essential. Along with this shift, a greater emphasis has been put on local participation in FRM. However, in some NBS projects, conflicts of interest and discordance between stakeholders frequently become a bottleneck (Bark, Martin-Ortega, & Waylen, 2021). Therefore, unraveling interactive relationships between diverse stakeholders' attitudes and hazard-prone places with NBS intervention is essential.

So far, some review papers about NBS (e.g. Han & Kuhlicke, 2019) and a strand of paper that streams from river restoration have identified several key determining factors for public attitude towards NBS. First, risk perception was identified as a critical factor affecting people's attitudes towards NBS. Natural elements were often perceived as less effective than infrastructural measures by people. Second, sometimes less acknowledged co-benefits are ascribed by uncertainty or negative externalities from NBS projects. Third, dynamism in place can affect individual place attachment, which ultimately maneuvers people's attitudes and perceptions.

2 THEORETICAL FRAMEWORK

We specified a theoretical framework that allows us to analyze how risk perception and sense of place affected people's attitudes towards dike relocation. The major factors that measure public attitude towards NBS for flood risk have been shown as attitudinal and behavioral acceptance, perceived co-benefits, or effectiveness of the measures in the previous literature.

For the construct 'risk perception', protection motivation theory (PMT) and protective action decision model (PADM) were shown to be important in past studies. PMT captures the individual decision-making process as a response to the risk by focusing on threat and coping appraisal. Perceived co-benefits can be operationalized as a perceived utility for other purposes as part of response efficacy through the PADM framework. Compared with PMT, the scope of response to NBS of PADM is broader and includes hazard-related attributes, including the efficacy of protection measures.

For the constructs in sense of theory, place attachment plays a role as a motivation for long-term stewardship and supporting action for conservation initiatives, therefore can be a powerful predictor of attitude towards the changes in the place. Among those, place identity that refers to a symbolic meaning a specific place confers to a person has been found significantly positive with pro-environmental behavior. Similarly, nature bonding as a high emotional attachment to nature seems to be a positive predictor for the perceived risk-reduction effectiveness of nature.

Putting all together, a hybrid theoretical framework of the 'Place-based Risk Appraisal Model' or PRAM (Figure 1) was constructed. The PMT and PADM take charge of explaining the risk-related attributes of the attitudes while SP does for the place-related attributes.

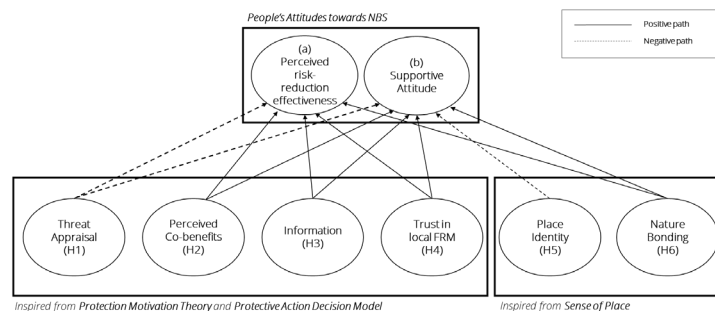


Figure 1. The PRAM framework for explaining place, risk and attitude

3 OBJECTIVE

The study aims to answer how and what kinds of risk and place-related factors influence the public attitudes towards NBS, measured by perceived risk-reduction effectiveness and supportive attitude towards NBS. We chose six constructs reflecting on our PRAM framework and formulated the hypotheses of threat appraisal as a negative predictor and communication, trust in local FRM, perceived co-benefits, nature-bonding, and place identity as a positive predictor for the attitude

towards NBS. We expected that adopting the components of both place and risk helps to unravel the dynamic different actors and constructs around the place together with the attributed place meanings.

4 DATA COLLECTION AND METHOD

We present a case study on dike relocation projects along the Elbe River in Saxony-Anhalt, Germany. The dike relocation and floodplain restoration reflect a paradigm shift from grey and technical approaches to NBS for flood risk management. The survey data was collected in July 2021 from five towns along the Elbe River, and the overall response rate was 46.7% with 304 answered questionnaires. Structural equation modeling (SEM) was employed to capture path coefficients of the constructs with better explanatory power. To increase the power of prediction, multiple imputation was employed rather than listwise deletion. As a result, the full-size sample was fitted in the model.

5 RESULT

The fitted model supported the hypotheses from the risk perception theories but supported the sense of place theory only partly (see Figure 2). For the constructs from risk perception theories, first, threat appraisal acts as a negative predictor for both perceived risk-reduction effectiveness and supportive attitude of NBS. Second, trust in local FRM shows a strong path coefficient for perceived risk-reduction effectiveness, while for supportive attitude, it was rather marginally significant. It shows that trust in local FRM could not necessarily be linked with the support for the dike relocation project. Communication and perceived co-benefit were significant for both perceived risk-reduction effectiveness and supportive attitude. When it comes to the place-related constructs, nature-bonding was a positive predictor of perceived risk-reduction effectiveness but was not significant for supportive attitude. Conversely, while place identity was a negative predictor of supportive attitude, it was not significant for perceived risk-reduction effectiveness.

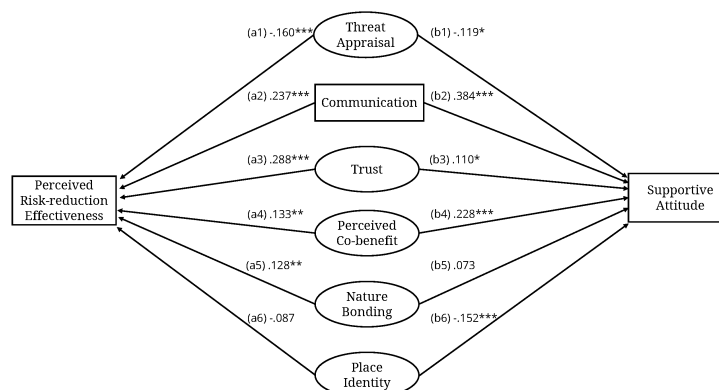


Figure 2. Structural equation model with standardized path coefficient. Ovals denote latent variables, squares denote manifest variables. *** indicate the path with significant relationship with alpha = 0.01, with alpha = 0.05, * with alpha = 0.10. Covariance coefficients are omitted. Goodness of fit: $\chi^2 = 273.050$ (190 d.f.), $p = 0.000$, CFI = 0.970, TLI = 0.962, RMSEA = 0.052, SRMR = 0.063

6 CONCLUSION

Our study validates the link between elements postulated in previous studies, such as a negative relation between threat appraisal and attitude and a positive relation between perceived co-benefits and attitude. The result sheds light on how to raise public supports for and reliance on dike relocation projects, emphasizing the importance of communication and trust-building. It also highlights the necessity of further research about the relationality and plurality of the place in relation to risk contexts in understanding public attitudes. Understanding these shaping elements and their relationship allows us to provide theory and evidence-based implications for effective NBS realizations.

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