# Collective efficacy's effect on attitudes towards flood safety measures: a regression analysis

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# Preface

This study is a part of a larger research project within the field of environmental psychology. The research project aims to explore what preventing action is, and how action can be promoted. In addition, it aims to understand the experiential factors that change individuals' and communities' risk perception, and lastly how such factors can be stressed for those who have not yet experienced a natural hazard. I participated along with a group of other students in the bachelor project BA01 – "What does it take to invest in protective actions? Predictors and barriers of climate change adaptation. A focus on risk communities in Norway". Other students and I were assigned to provide insights that could assist in answering the questions of the larger research project. The idea of this study is my own, but was developed through feedback and engaging discussions with the supervisors and fellow peers. This study's research question, hypotheses and predictions were based on previous research and the valuable feedback given. Specifically, the inclusion of collective efficacy and the model's structure was developed through meetings and discussions with supervisors. The methods used for the statistical analysis originated from supervisors' suggestion of using PROCESS and was later determined to be used after further research. With that said, I declare that all analyses were done by myself and that this work is my own.

I would like to thank my fellow students in the bachelor project for input and productive discussions during the development of our research questions and models. In addition, I wish to extend my gratitude towards the supervisors for their guidance and patients through the course of the project. Your valuable input and advice created a solid foundation for exploring the field of environmental psychology.

## Abstract

Research on collective efficacy in the context of climate change and natural hazards is somewhat limited. This study explores how collective efficacy affects attitudes towards flood safety measures, both directly and indirectly through the mediators; flood risk perception and place identity threat. Firstly, it was hypothesized that collective efficacy would negatively predict flood risk perception. Secondly, it was hypothesized that flood risk perception would negatively predict place identity threat due to safety measures, and positively predict place identity threat due to increasing flood hazards. It was also predicted that place identity threat due to safety measures would negatively predict acceptability of these measures. In addition, it was assumed that place identity threat due to increasing flood hazards would positively predict acceptability of the safety measures. Lastly, it was hypothesized that collective efficacy would directly predict acceptability of the safety measures. Collective efficacy was found to increase acceptance of safety measures, but no relationship between collective efficacy and risk perception was found. Additionally, none of the indirect effects through mediators were found to be significant. Results were discussed using protection motivation theory in the context of climate change and natural hazards.

# INTRODUCTION

Climate change is one of the most pressing matters facing today's society (UNEP, 2020). One of the devastating consequences of this pressing issue is the increased likelihood of natural hazards. More extreme weather patterns from rising global temperatures are resulting in an increased likelihood of floods. Previously affected cities and areas will therefore have to expect natural hazards, such as floods, to also reoccur in the future (UNEP, 2020). To counteract this issue, flood-preventive actions must be taken, such as relocating critical societal functions from flood-prone areas. However, the population in countries such as Norway may perceive floods to not be the pressing matter that it is for their communities. To counteract such perceptions, research can give critical insight into the psychological processes that make preventive actions possible. In addition to the underlying concepts that affect behavior and perceptions. For that reason, the research question in this study concerns how collective efficacy affects attitudes toward flood safety measures.

Concerns surrounding climate change and extreme weather events vary by country, but tend to be lower in industrial countries such as the United States (Brechin & Bhandari, 2011; Howe et al., 2015). This is often due to the inaccurate perception that such issues have a low probability of affecting their residential areas unless they have recently occurred, in which the probability is greatly overestimated (American Psychological Association, 2009). Extreme weather events can often result in psychological impairment such as anxiety (Chique et al., 2021), in addition to affecting interpersonal and intergroup behavior (Pearson & Schuldt, 2018). Psychological processes such as coping responses and motivational processes related to the need for security, stability, control, and coherence are often affected. Related to climate change, the media's presentation of the issue is one example of an influential factor that can affect perceptions (American Psychological Association, 2009). In research concerning behavior related to issues such as extreme weather events, psychological barriers are also important concepts to grasp. These barriers often occur due to affected perceptions and influence the behavioral-responses to the event (American Psychological Association, 2009). In addition, the scope of issues such as climate change can often lead to individuals feeling powerless in having a meaningful impact (Mackay et al., 2021). Barriers such as this can likely result in people becoming mistrustful of experts' opinions and conclusions, in addition to becoming inactive in responding to the threat of climate change.

This shows the importance of understanding the psychological processes related to extreme weather events, as it assists in more effectively addressing the issue at hand.

**Collective efficacy**

As the issue is quite comprehensive, citizen-driven initiatives may be the primary way to improve local resilience against flooding (Thaler & Seebauer, 2019). Self-efficacy can be described as the belief in one's self ability to achieve a certain outcome, which also influences behavior, motivation, and effort (Stronge et al., 2015). Collective efficacy, which has been found to increase the likelihood of pro-environmental behavior through self-efficacy (Jugert et al., 2016), may therefore be an important concept in understanding what promotes citizen-driven initiatives. Collective efficacy can be described as a group's shared belief that they can successfully work as a collective in order to accomplish specific goals (Gallagher, 2012). Citizen-driven initiatives, possibly through collective efficacy, can increase risk awareness and possible local adaptive procedures through better risk appraisal (Thaler & Seebauer, 2019). However, the dimensions of how collective efficacy affects adaptive measures may not be as clear. It could therefore be beneficial to look further into how perceptions of risk and attachment to residential areas affect this relationship. Facilitating collective action consists of both social cohesion and a component consisting of the expectations about task-specific actions. Intentions to act collectively are assumed to be primarily influenced by the sense of attachment to the community, consisting of; social cohesion, mutual trust, and solidarity (Babcicky & Seebauer, 2020). Moreover, the task-specific component is based on shared beliefs about specific actions or outcomes, which can also influence perceptions and affective responses (Babcicky & Seebauer, 2020).

In their study, Cuadrado et al. (2022) discuss the importance of collective efficacy in promoting ecological behavior. They state that we have to better understand the participation of all individuals as a whole, for social impact to be expected. In other words, we cannot only rely on the sum of individual actions to make an impact on society. In addition, another study has found self-efficacy to be less relevant for collective actions that aim to solve collective issues such as climate change (Chen, 2015). The study by Chen (2015) explains this by stating that collective efficacy is an essential part of understanding environmental behavior, as people rely on each other to find solutions to comprehensive issues. Therefore, it becomes more relevant to better understand the collective dimension rather than the individual dimension in the context of flooding.

**Risk perception**

Risk perception can be defined as how individuals think and feel about certain risks they face (Renner et al., 2015). This includes a more subjective understanding of risks and may differ from the true object risk. As mentioned, collective efficacy may affect risk appraisal and may therefore have a negative correlation with risk perception (Thaler & Seebauer, 2019). Risk perception and self-efficacy, which are closely related to collective efficacy, are important explanatory factors in individual protective behavior according to protection motivation theory. The theory tries to explain the processes that affect motivation to take protective action. This process consists of two individual cognitive processes; threat-appraisal which explains maladaptive behavior (protecting self and others) and coping-appraisal which explains preventive action against a threat (Floyd et al., 2000).

According to protection motivation theory, risk perception consists of both perceived severity and consequences of a threat. Self-efficacy is defined under this theory as the perceived ability to carry out specific actions, with the intention of reducing the negative consequences of the threat (Babcicky & Seebauer, 2020). If an individual perceives the risk of a threat as high and perceives themselves as capable of mitigating the negative consequences of the threat, the probability of the person acting on these intentions increases (Babcicky & Seebauer, 2020). Therefore, it is likely that collective action will not be taken if individuals do not perceive themselves as capable of contributing in mitigating a threat. This may highlight the relationship between risk perception, self-efficacy and collective efficacy.

**Place identity threat**

As briefly mentioned, place attachment may be quite influential for intentions to act collectively. Place identity is closely related to place attachment, one study finding evidence of the variables coinciding for native populations (Hernández et al., 2007). Place attachment has also been found to reduce coping behavior when the risk perception is seemingly high, which may also indicate a relationship between place identity and risk perception (De Dominicis et al., 2015). In addition, place attachment can also be defined as a component of personal identity, in which people describe themselves in terms of belonging to a specific place (Hernández et al., 2007). The study by Hernández et al. (2007) also states that place identity develops later than attachment, as it is created through continuous interactions with the specific place. Place identity could therefore be

defined as the identification with a specific place due to continuous interaction with the surroundings (Hernández et al., 2007).

Place identity threat has been described as a change that affects the bond between person and location, possibly leading to emotional responses such as anxiety and a sense of displacement (Devine-Wright, 2009). The threat may vary from human-induced changes, such as intergroup conflict, to ecological changes such as floods (Devine-Wright, 2009). Furthermore, the threat to place identity can be gradual, such as political change, or seemingly instantaneous in cases such as flooding. Brown and Perkins (1992) proposed a three-stage model of place disruption, which could give insight into how place identity threat can affect behavior. The model's stages consisted of pre-disruption, disruption, and post-disruption. Firstly, pre-disruption may include preparing for the change by anticipating future events. Secondly, the disruption stage includes the event itself, such as flooding, which may trigger direct negative emotional responses. The post-disruption phase involves coping with the threat, which may include processes that motivate protective action, as described by protection motivation theory.

**Protection motivation theory**

As mentioned, protection motivation theory tries to explain the processes that affect motivation to take protective action. It is separated into two cognitive processes; the threat-appraisal process and the coping-appraisal process (Floyd et al., 2000). Firstly, threat-appraisal explains maladaptive behavior, which is the act of not protecting self and others. This process is made up of maladaptive response rewards, which can be intrinsic and extrinsic, and perception of the threat, which is the degree of severity and vulnerability (Floyd et al., 2000). The maladaptive response rewards are assumed to increase the likelihood of maladaptive behavior. The meta-analysis by Floyd et al. (2000) also assumes that the perception of threat will decrease the likelihood of choosing the maladaptive response.

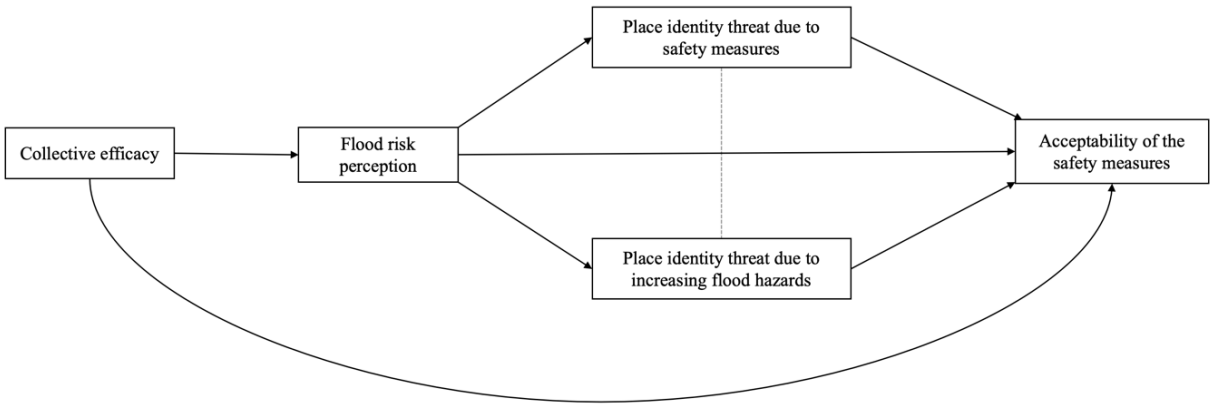
The coping-appraisal process gauges the ability to cope and to act preventively against a threat, meaning adaptive behavior. This process consists of efficacy responses and response costs. Efficacy responses consist of self-efficacy and response efficacy, which is the belief that an adaptive response will be effective (Floyd et al., 2000). The cost of responding to a threat will decrease the probability of taking preventive action. On the other hand, response- and self-efficacy will increase the likelihood of preventive action being taken (Floyd et al., 2000). As mentioned,

self-efficacy could be closely connected to collective efficacy. Previous research supports this, as collective efficacy has been found to increase adaptive intentions through self-efficacy (Jugert et al., 2016). Another study has researched the relationship between collective efficacy and risk perception, in which they have found evidence of social cohesion decreasing risk perception (Babcicky & Seebauer, 2020). This implies a relationship between risk perception and collective efficacy, as the study identified social cohesion as a subcomponent of collective efficacy. Babcicky and Seebauer (2020) hypothesized that this could be due to a strong connection to the community, which reduces concern about the danger of natural hazards. Therefore, it becomes interesting to understand how collective efficacy may affect place identity threats through the mediating effect of risk perception. This could assist in better understanding what factors affect attitudes towards safety measures, possibly giving answers to what encourages preventive action against floods.

**Hypotheses and predictions**

- **Hypothesis 1:** Collective efficacy negatively predicts flood risk perception.
- **Hypothesis 2:** There is a relationship between individuals' risk perception and place identity threat.
    - **Prediction 2a:** Flood risk perception negatively predicts place identity threat due to safety measures.
    - **Prediction 2b:** Flood risk perception positively predicts place identity threat due to increasing flood hazards.
- **Hypothesis 3:** There is a relationship between place identity threat and acceptability of safety measures in local communities.
    - **Prediction 3a:** Place identity threat due to safety measures negatively predicts acceptability of the safety measures.
    - **Prediction 3b:** Place identity threat due to increasing flood hazards positively predicts acceptability of safety measures.
- **Hypothesis 4:** Collective efficacy positively predicts acceptability of the safety measures.

**Model**




# METHODS

## Sample

The sample consisted of 293 participants who completed the survey. From the total sample, a sub-sample of 120 participants was used as a result of the included research variables in the statistical analysis. As place identity threat due to safety measures was included, only participants who had previously experienced the implementation of safety measures were used in the sample. The participants' ages ranged from 18 to 79, $M = 44.48$, $SD = 16.7$. The sample consisted of 126 men (43%), 160 women (55%), six preferring not to share their gender (2%), and one participant identifying as non-binary (0.3%). Nine participants lived in Agder (3%), 10 in Innlandet (3%), 28 in Møre & Romsdal (10%), 26 in Nordland (9%), 37 in Oslo (13%), 8 in Rogaland (3%), 25 in Troms & Finnmark (9%), 39 in Trøndelag (13%), 23 in Vestfold & Telemark (8%), 57 in Vestland (20%) and 31 living in Viken (11%). According to experts, flood-prone areas in Norway are typically located in the south and along the eastern and western coasts (Peereboom et al., 2011). This could generally include Viken, Vestfold & Telemark, south of Innlandet, Rogaland, Trøndelag, Møre & Romsdal and parts of Vestland.

With that said, 191 participants answered "yes" to living in an area at flood risk (65%), with 102 participants answering "no" (35%). Six participants had a junior high degree (2%), 75 had high school degrees (26%), 11 had a year-study degree (4%), 97 participants had a bachelor's degree (33%) and 104 participants had higher degrees (36%). Furthermore, 68 participants (23%) had experienced land-use restrictions for urban and rural development in their area. In addition, 26

participants (9%) had experienced legislation that keeps structures away from flood-prone areas, and 75 participants (26%) had experienced the implementation of defense structures. A total of 174 participants (60%) had not experienced any of the safety measures mentioned above.

**Procedure**

The participants were recruited through advertisements on the social media platform; Facebook. The sample mainly consisted of participants recruited through the advertisements, in addition to other students, friends, and family who were personally asked to participate. Participants were also asked at the end of the survey to forward it to others, possibly leading to a snowball sampling effect in some cases. Data-collecting consisted of a digital survey with results being automatically registered in Nettskjema. Measures used in the survey were translated from English to Norwegian, and back-translated to ensure validity. The ethical aspects of the survey and study were approved by the Norwegian center for research data (NSD) on the 8th of March 2021. The survey stated that participants could withdraw their participation at any time and that data would be anonymous, in which no personal data would be used. Participants were also required to give their consent before answering the survey.

**Measures**

*Collective efficacy*

This variable was measured through an adaptation of collective efficacy scales from van Zomeren et al. (2010) and Caprara et al. (2003), and included 3 items. Participants were asked to indicate to what extent they agreed with statements related to perceived collective efficacy in their communities on a 7-point Likert-type scale (from 1 = "not at all" to 7 = "very much"). Items included were; "Your community can jointly prevent the negative consequences of possible floods," "Your community can jointly reduce the negative consequences of possible floods," and "Your community is capable to do something against possible flooding, even in the face of unexpected challenges and problems."

*Flood risk perception*

This variable was measured through a risk perception scale adapted from Wilson et al. (2018) and consisted of 8 items. Participants were asked to indicate to what extent they agreed with

statements related to the risk of floods on a 5-point Likert scale (from 1 = "not at all" to 5 = "very much"), e.g., "When you think about floods, to what extent do you feel worried?" and "How likely is it that a flood will occur where you live?" (view appendix for full scale).

*Place identity threat due to safety measures*

This variable was measured through scales adapted from Korf & Malan (2002), Wohl & Branscombe (2009), Droseltis & Vignoles (2010), and Vignoles et al. (2006). The scale consisted of 12 items in which participants were asked to indicate to what extent they agreed with statements related to the threat of safety measures in regards to their place-identity, on a 5-point Likert scale (from 1 = "Strongly disagree" to 5 = "Strongly agree"). The scale consisted of items such as; "I am worried that the safety measures might be incompatible with my past identity," and "I cannot visualize new safety measures that will allow this place to grow and develop" (view appendix for full scale).

*Place identity threat due to increasing flood hazards*

This variable was also measured through scales adapted from Korf & Malan (2002), Wohl & Branscombe (2009), Droseltis & Vignoles (2010), and Vignoles et al. (2006). The scale also consisted of 12 items in which participants were asked to indicate the extent they agreed with statements related to the threat of increasing flood hazards, on a 5-point Likert scale (from 1 = "Strongly disagree" to 5 = "Strongly agree"). Items were similar in structure to the ones used in the measure for place identity threat due to safety measures, but with varying source of threat, e.g., "I am worried that the flood hazards are incompatible with my past identity," and "I cannot visualize new flood hazards that will allow this place to grow and develop" (view appendix for full scale).

*Acceptability of the safety measures*

This variable was measured through scales adapted from Cooke & Horberry (2011) and Vlassenroot & Brookhuis (2014), and included 12 items. Participants were asked to indicate their attitude towards safety measures on a grid ranging from 0 to 7, with higher values being associated with more accepting attitudes towards the measures. Items consisted of a grid between two

adjectives used to describe safety measures, e.g., “Useful – Useless”, “Effective – Superfluous” and “Desirable – Undesirable” (view appendix for full scale).

**Statistical analysis**

The statistical analysis consists of a serial-parallel mediation model (serial-parallel multiple mediations; Hayes, 2018) that was tested using PROCESS version 4.1 (see SPSS, Hayes, 2018), with 5.000 sample bootstrapping technique and 95% confidence intervals. The selected model, model 81, is displayed in the diagram presented in **Figure 1**. An ordinary least-squared path analysis was used to estimate the coefficients in the model and to determine the direct and indirect effects of collective efficacy on the acceptability of safety measures. Descriptive statistics, reliability analysis, and a correlation matrix were also estimated for the research variables.

Consistently with the aim of the study, the sample was reduced to the participants who had previously experienced the implementation of safety measures in their local area. This was due to the inclusion of the variable “place identity threat due to safety measures” in the model. Consequently, the sample was effectively reduced to 120 participants. Bootstrapping can allow us to measure the statistics of interest by estimating the sampling distribution through repeated re-sampling of the data (Field, 2014, p. 871). This effectively treats the data as a larger population from which it takes repeated samples. The inclusion of bootstrapping can result in more precise estimates of statistics, such as coefficients, which is helpful when the sample size is reduced.

# RESULTS

## Descriptive statistics

**Table 1**

*Descriptive statistics and correlation coefficients for research variables (*n = *120)*

| Variable | *M* | *SD* | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|
| 1. Collective efficacy | 4.61 | 1.31 | (.92) | | | | |
| 2. Flood risk perception | 2.43 | 0.70 | .13 | (.83) | | | |
| 3. Place identity threat due to safety measures | 1.89 | 0.74 | -.12 | .39*** | (.94) | | |
| 4. Place identity threat due to increasing flood hazards | 2.12 | 0.78 | .03 | .57*** | .59*** | (.93) | |
| 5. Acceptability of the safety measures | 4.41 | 1.27 | .38*** | -.04 | -.38*** | -.13 | (.95) |

*Note.* Reliability coefficients (Cronbach's Alphas) are presented in parentheses on the diagonal

*** $p < .001$.

**Table 1** reports means, standard deviations, and Pearson's bivariate correlations for the research variables. Noticeably, **Table 1** displays a rather high significant positive correlation between flood risk perception and place identity threat due to increasing flood hazards. Additionally, the table displays a significant positive correlation between flood risk perception and place identity threat due to safety measures. A significant positive correlation between collective efficacy and acceptability of the safety measures can also be observed in the correlation matrix. Furthermore, **Table 1** also displays an insignificant correlation between collective efficacy and flood risk perception. In addition, a significant negative correlation between place identity threat due to safety measures and acceptability of the safety measures can be observed.

**Relationship between variables**

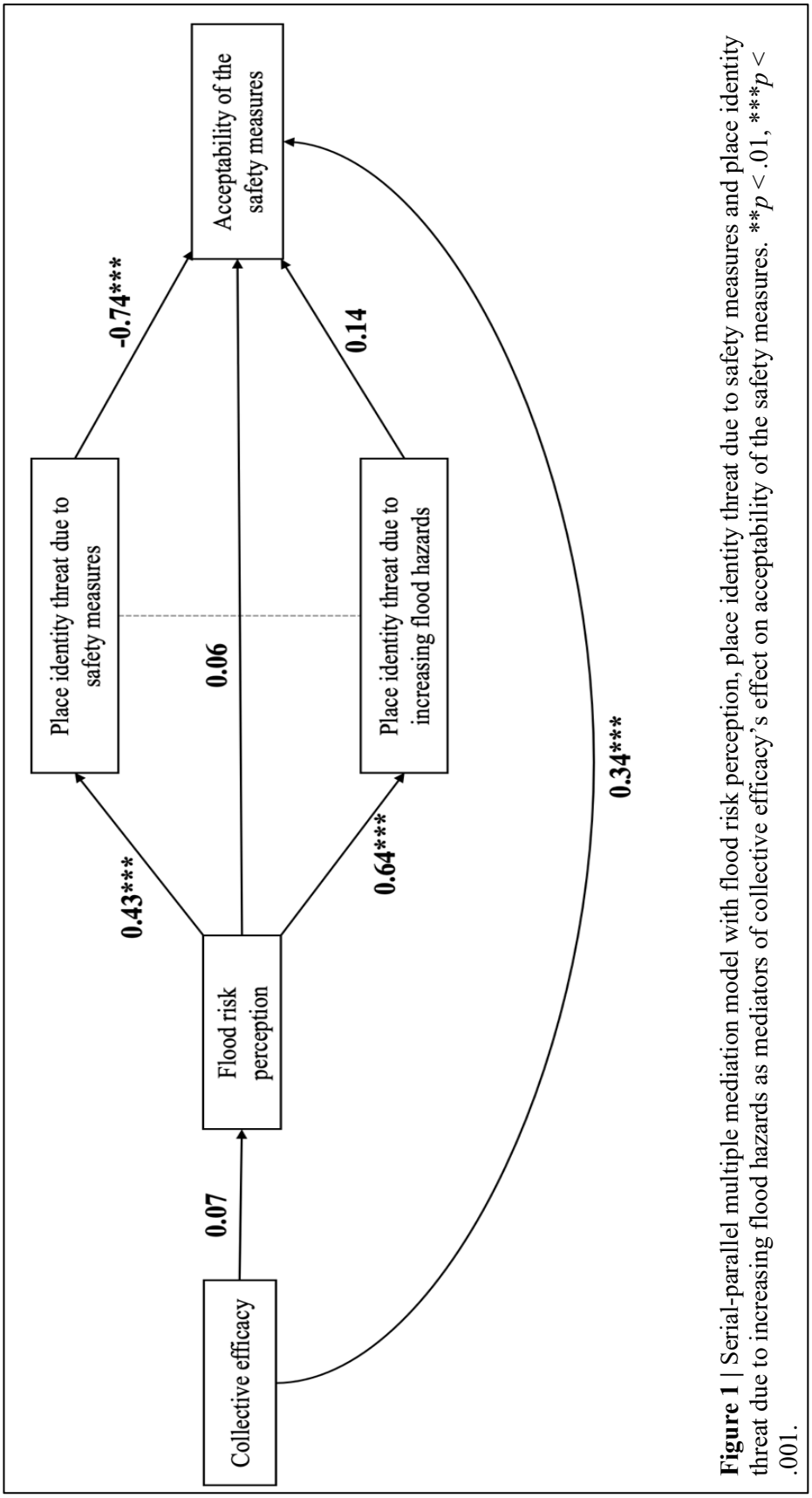



**Figure 1** | Serial-parallel multiple mediation model with flood risk perception, place identity threat due to safety measures and place identity threat due to increasing flood hazards as mediators of collective efficacy's effect on acceptability of the safety measures. $^{**}p < .01$, $^{***}p < .001$.

**Table 2 |** Regression coefficients, standard errors and model summary information of the tested serial-parallel multiple mediation model.

| | **Consequent** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***M*1** (Flood risk perception) | | | ***M*2** (Place identity threat due to safety measures) | | | ***M*k** (Place identity threat due to increasing flood hazards) | | | ***Y*** (Acceptability of the safety measures) | | |
| **Variables** | ***b*** | ***SE*** | ***p*** | ***b*** | ***SE*** | ***p*** | ***b*** | ***SE*** | ***p*** | ***b*** | ***SE*** | ***p*** |
| *X* (Coll_efficacy) | 0.07 | 0.05 | .162 | -0.10 | 0.05 | .040 | -0.02 | 0.05 | .605 | 0.34 | 0.09 | < .001 |
| $M_1$ | - | - | - | 0.43 | 0.09 | < .001 | 0.64 | 0.09 | < .001 | 0.06 | 0.12 | .738 |
| $M_2$ | - | - | - | - | - | - | - | - | - | -0.74 | 0.19 | < .001 |
| $M_k$ | - | - | - | - | - | - | - | - | - | 0.14 | 0.20 | .494 |
| Constant $j_{M1}$ | 2.11 | 0.24 | < .001 | $j_{M2}$ 1.30 | 0.29 | < .001 | $j_{M3}$ 0.69 | 0.28 | .016 | $j_Y$ 3.92 | 0.56 | < .001 |
| | $R^2 = .02$ | | | $R^2 = .18$ | | | $R^2 = .33$ | | | $R^2 = .27$ | | |
| | $F(1, 118) = 1.98, p = .162$ | | | $F(2, 117) = 12.74, p < .001$ | | | $F(2, 117) = 28.13, p < .001$ | | | $F(4, 115) = 10.35, p < .001$ | | |

**Figure 2** and **table 2** present the overall outcome and the detailed parameters of the tested serial-parallel multiple mediation model. In the first regression model [$F(1, 118) = 1.98$, $p = .162$, $R^2 = .02$], collective efficacy did not predict flood risk perception ($b = 0.07$, $p = .162$).

In the second regression model [$F(2, 117) = 12.74$, $p < .001$, $R^2 = .18$], place identity threat due to safety measures was negatively predicted by collective efficacy ($b = -0.10$, $p = .040$), but positively predicted by flood risk perception ($b = 0.43$, $p < .001$).

In the third regression [$F(2, 117) = 28.13$, $p < .001$, $R^2 = .33$], place identity threat due to increasing flood hazards was insignificantly predicted by collective efficacy ($b = -0.02$, $p = .605$), but significantly predicted by flood risk perception ($b = 0.64$, $p < .001$).

In the last regression model [$F(4, 115) = 10.35$, $p < .001$, $R^2 = .27$], acceptability of the safety measures was significantly predicted by collective efficacy ($b = 0.34$, $p < .001$) and significantly negatively predicted by place identity threat due to safety measures ($b = -0.74$, $p < .001$). In addition, flood risk perception ($b = 0.06$, $p = .738$) and place identity threat due to increasing flood hazards ($b = 0.14$, $p = .494$) were insignificant predictors of acceptability of the safety measures.

The total effect [$F(1, 118) = 19.62$, $p < .001$, $R^2 = .14$] of collective efficacy on acceptability of the safety measures was significant ($b = 0.39$, $p < .001$). On the other hand, the indirect effect of collective efficacy on acceptability of the safety measures through $M_1$ and $M_2$ [$\beta = -0.02$, $SE = 0.02$ (CI = -0.05, 0.01)] was found to be insignificant. The indirect effect of collective efficacy on acceptability of safety measures through $M_1$ and $M_k$ [$\beta = 0.01$, $SE = 0.01$ (CI = -0.02, 0.03)] was also found to be insignificant. The coefficients from the serial-parallel multiple mediation can be found in **Table 2**.

## DISCUSSION

This study explores the effects of collective efficacy on attitudes towards safety measures and possible mediators involved in this relationship, such as risk perception and place identity threat. Results are discussed in the context of protection motivation theory to theorize how collective efficacy may affect protective and preventive behavior in relation to natural hazards and climate change. Past research on collective efficacy within this topic is somewhat limited with ambiguous results as measures used and variables included vary drastically between studies. With

that said, the consensus from previous research is that collective efficacy has an impact on risk perception and coping responses (Babcicky & Seebauer, 2020; Dryhurst et al., 2020; Jugert et al., 2016; Smith & Mayer, 2018). Results in this study seem to support this claim as the statistical analysis suggests that collective efficacy has a significant predictive value on acceptability of safety measures. On the other hand, the indirect effects through the mediators; risk perception, place identity threat due to safety measures, and place identity threat due to increasing flood hazards, were found to be insignificant.

There was no evidence found that supported hypothesis 1, as collective efficacy was not found to be a significant predictor of risk perception. Additionally, the variables were also not significantly correlated when using the subsample of 120 participants. On the contrary, there has been found a connection between collective efficacy and risk perception in previous research related to COVID-19. One study found that higher levels of collective efficacy tend to reduce risk perceptions (Dryhurst et al., 2020). A possible cause for the unexpected finding could be the subsample used, as it only includes participants who have previously experienced the integration of safety measures in their community. The subsample had to be used in analysis as it was required that participants had previously experienced safety measures for place identity threat due to safety measures to be measurable.

One previous study has found that social cohesion, a component of collective efficacy, can decrease risk perception and fear (Babcicky & Seebauer, 2020). It could therefore seem probable that collective efficacy would also decrease flood risk perception. However, the items used to measure collective efficacy in the study by Babcicky and Seebauer (2020) are quite dissimilar to the measures used in this study. For one, they measure collective efficacy by distinguishing between social cohesion and task-specific efficacy beliefs. In their study social cohesion was measured through five items, such as “most people can be trusted” and “you can’t be too careful when dealing with others”. These items capture trust related to other residents as opposed to the items used in this study, which concerns belief in the community’s ability to act preventively against floods. These distinct differences in items used to measure collective efficacy could also be a possible cause for the contradicting results found.

In theory, when safety measures have already been implemented in participant’s local communities it could potentially lead to participants accepting that there is a high risk of flooding, as the necessary actions have already been taken. Supporting this, when individuals believe they

can counteract local risks through collective action it has been found that they tend to be more mindful of the risk (Babcicky & Seebauer, 2020). This could presumably result in a generally high perception of risk among the residents, which could suggest that collective efficacy only affects risk perception before responses such as safety measures have been taken. Additionally, risk perception has been found to increase intent to act preventively against the threat of climate change (Smith & Mayer, 2018). However, the results were inconsistent with this finding as flood risk perception insignificantly predicted acceptability of the safety measures.

The observed results seem to support hypothesis 2, which stated that there is a relationship between flood risk perception and place identity threat due to safety measures and place identity threat due to increasing flood hazards. The results showed that flood risk perception was a significant predictor of both place identity threat due to safety measures and place identity threat due to increasing flood hazards. However, prediction 2a was not supported by the results as flood risk perception was a positive and not a negative predictor of place identity threat due to safety measures. Previously it was hypothesized that flood risk perception would increase acceptability of safety measures. It was assumed that residents would perceive safety measures as a larger necessity when the perceived risk of floods was high, perhaps resulting in reduced place identity threat related to these measures. A previous study seems to support this assumption by including worry and preparedness as dimensions of risk perception. The study found that higher levels of worry may increase preparedness, which entailed the capability of coping and coping strategies related to floods (Raaijmakers et al., 2008). On the contrary, the findings suggest that residents previously exposed to safety measures would perceive the measures as a larger place identity threat when the perceived risk of floods increases. Protection motivation theory could give a possible explanation to the results, as risk perception is strongly connected to threat appraisal. In addition, one study has found high degrees of place identity, accompanied by strong anxiety-state related to flood risk, to be associated with passive coping strategies such as withdrawal and avoidance (Lemée et al., 2019). As mentioned, place identity involves an emotional attachment to the place of residence. If flood risk perceptions were to increase, this could result in residents choosing passive coping strategies. Moreover, residents may become avoidant of the safety measures to reduce the negative emotional responses related to the rising threat of floods. As a result, the measures may be associated with negative emotions as it affects the attachment between individuals and their place of residence. Lastly, this could result in safety measures being perceived

by residents as a greater threat to their place identity when anxiety and other negative emotions are present due to increased flood risk perception.

The findings supported prediction 2b as flood risk perception significantly predicted place identity threat due to increasing flood hazards. The results seem to be in line with protection motivation theory, as risk perception is a subcomponent of threat appraisal (Babcicky & Seebauer, 2019). This could imply that as flood risk perception increases so will the fear and worries related to flooding, which could be connected to the affective subcomponent of threat appraisal. Furthermore, this could potentially result in passive coping strategies, as previously discussed.

Hypothesis 3 was only found to be partially supported by the results as place identity threat due to increasing flood hazards was found to be an insignificant predictor of acceptability of the safety measures. Prediction 3a was however supported by the results, as place identity threat due to the safety measures negatively predicted acceptance of these measures. Previous research has found risk perception and flood-threat appraisal to have a negative relationship with coping appraisal related to flooding (Bubeck et al., 2018). Furthermore, one study showed that non-protection actions will be taken when flood-threat appraisal increases without coping appraisal being prevalent, meaning maladaptive behavior (Babcicky & Seebauer, 2019). Higher place identity threat due to flood risk perception could therefore result in maladaptive coping responses as coping appraisal declines. The increased flood threat appraisal, through place identity threat, could lead to a state of anxiety for residents and possibly result in psychological barriers. One possibility could be that residents become in denial of the necessity for flood safety measures, which could cause residents to consider the safety measures as a greater threat to their place identity. Additionally, participants could have had pre-existing negative attitudes towards the measures as they could have caused discontinuity with the past, possibly associating them with high response costs and low response efficacy. In addition, it is not surprising that the perceived place identity threat results in more negative attitudes towards the safety measures, as they are the cause of threat to place identity. On the contrary, a study on climate change has found risk perception and behavioral willingness to be significantly correlated (Xie et al., 2019). If it could be assumed that place identity threat and risk perception are related, which the statistical analysis may imply, the results could seem to contradict this previous finding.

Prediction 3b was not supported by the results as place identity threat due to increasing flood hazards did not predict acceptability of the safety measures. This is an interesting finding, as

past research has found flood threat appraisal to be strongly associated with maladaptive coping strategies (Lemée et al., 2019). It could therefore be expected that place identity threat due to increasing flood hazards would significantly negatively predict acceptability. Another possibility hypothesized was that the perceived threat of increasing floods would result in protective responses, leading to an increase in acceptability of the safety measures to reduce negative consequences of the threat. A possible explanation to the result could be that prior experience with safety measures caused the participants to have ambivalent attitudes towards the measures, as they had already been implemented. This might suggest that threat appraisal did not affect attitudes towards protective responses, as they had already been taken. It is important to note that this can only be speculated and not concluded, as the data is not sufficient.

Overall, it seems like the findings support hypothesis 4, as collective efficacy was found to be a direct predictor of acceptability of the safety measures. This is an interesting result when taking into consideration that the indirect effects through the mediators were found to be insignificant. It could seem as if other variables need to be included to precisely measure the indirect effects that collective efficacy may have on acceptability of safety measures. Perhaps the surprising finding between collective efficacy and flood risk perception is the partial cause for the insignificant indirect effects. The results seem to support previous research that has found collective efficacy to increase the intent of protective action and coping beliefs (Babcicky & Seebauer, 2020). Similarly, it is possible that collective efficacy may play a part in coping appraisal as acceptance of safety measures could be associated with protective action. Additionally, it could be speculated that the results reflect collective efficacy being based on shared beliefs in communities, as it was a significant predictor of attitudes related to safety measures. The results may also support previous research on the fear of crime in local communities, which has found collective efficacy to influence risk perception and affective responses (Gibson et al., 2006). However, the same relationship between collective efficacy and risk perception purposed by Gibson et al. (2006) was not observed in this study.

Previous studies have found collective efficacy to increase preventive behavior through increased self-efficacy, suggesting that the two may be strongly related (Jugert et al., 2016). This could imply that collective efficacy is an important component in coping appraisal as self-efficacy is strongly connected to both. On the other hand, previous research has also found social cohesion and group efficacy to not increase self-efficacy (Babcicky & Seebauer, 2020). This could suggest

that different dimensions of collective efficacy may not be connected to self-efficacy. In addition, past research has also found that collective efficacy is a stronger predictor of problem-focused coping compared to self-efficacy in collectivistic cultures, suggesting a cultural component (Chen, 2015). With that said, Norwegian culture has been considered as individualistic by previous research, which means the culture is characterized by individuality rather than group harmony and consensus (Chen, 2015; Kolstad & Horpestad, 2009). It is therefore not clear whether the results found on the direct effects of collective efficacy are due to increased self-efficacy or not. One possibility could be that collective efficacy increased coping appraisal through the perception of greater response efficacy, but future research is needed.

**Strengths and limitations**

The analysis used in this study consisted of correlation and regression analysis. Using these methods allowed for understanding complex relationships between variables. Additionally, PROCESS 4.1 allowed for a more comprehensive understanding of mediators' indirect effects on acceptability, which made analysis of the model possible. Moreover, the sample consisted of participants from different municipalities in Norway, possibly resulting in a more representative sample of the population. Furthermore, having a heterogeneous sample could have been useful for the analysis, as factors such as living in flood-prone areas would be accounted for. It is likely that if the sample only consisted of individuals from one municipality that this would have altered the results found, for example if the participants only lived in non-flood-prone areas.

The statistical analysis used in the study has limitations, such as correlation not being able to explain causality and linear regression only being fitting for linear relationships between variables. Moreover, linear regression and Pearson's correlation analysis are sensitive to outliers. QQ-plots were used to evaluate if the assumption of linearity was broken. The data was seemingly linear but not perfectly, which could have affected the results. Additionally, analysis showed that regression model 4 (including all variables) explained 27% of the variance in acceptability of the safety measures. This is not necessarily a limitation for the study but could indicate that excluded variables in the model have an explanatory value for attitudes towards safety measures, which could break the assumption of independent errors. By viewing a scatterplot for standardized residuals and predicted values, and running a Durbin-Watson test, it seems as if this assumption is

not broken as results indicate that residuals are not correlated, *Durbin-Watson value* = 2.06 (Field, 2014, p. 311).

The sample was based on the Norwegian population which could be classified as a "WEIRD" sample and therefore not globally representative (Brady et al., 2018; Henrich et al., 2010). This is important to note, as variables such as risk perception related to natural hazards and climate change vary drastically across countries (Howe et al., 2015). Survey data collection is also limited, as the survey required participants to evaluate theoretical scenarios related to flooding. As an example, the measure of collective efficacy involved participants evaluating their local community's ability to act preventively. This would mean that participants had to subjectively evaluate what they defined as "their" community and how they would act in possible theoretical scenarios, which could be challenging to answer accurately. In addition, questions related to flooding for participants living in flood-prone areas or having been previously affected, could cause distress and possibly alter the answers given.

Lastly, the measures used in this study have limited explanatory ability for behavior. Related to protection motivation theory and protective behavior, it can only be theorized and not concluded that certain variables affect protective actions. As an example, the variable "acceptability of safety measures" only measures the attitudes towards safety measures, and is not directly connected to behavior.

**Implications for future studies**

As briefly discussed, survey research and measurements through self-reporting have their drawbacks. Future studies on place identity threat related to safety measures should consider adapting corresponding measurements used in this study so as to not limit the statistical analysis through the sample. Additionally, it would be interesting for future research to include a more comprehensive measure of collective efficacy, including underlying components of the variable. This could assist in understanding which dimensions affect attitudes towards safety measures and the relationships between them. Including a more comprehensive measure and studying different populations would also be beneficial, as it could more accurately measure the relationship between collective efficacy and risk perception. The effects of collective efficacy on preventive and protective behavior are likely affected by other variables not included in this study and previous research. Future research on collective efficacy is needed to understand its full effect on protective

and preventive behavior. As such, it would be interesting for future studies to include other variables like place attachment and risk acceptance, among others, in relation to collective efficacy's effect on protective behavior.

## Conclusion

This study found that collective efficacy significantly predicted acceptability of safety measures, yet indirect effects through the mediators were found to be insignificant. Similar to previous research findings, this may imply that collective efficacy is related to coping appraisal and protective action. With that said, it is still unclear which dimensions of collective efficacy affect coping beliefs and whether self-efficacy is a mediator in this relationship. Further research on collective efficacy is therefore needed and should consider including scales that capture the underlying dimensions of collective efficacy.

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# Appendix

| **Collective efficacy**<br>(Adapted from van Zomeren et al., 2010 & Caprara et al., 2003) | |
|---|---|
| Indicate to what extent you agree with the following statements<br>(7-point Likert-type scale: From not at all to very much | |
| Coll_eff1 | Your community can jointly prevent the negative consequences of possible floods |
| Coll_eff2 | Your community can jointly reduce the negative consequences of possible floods |
| Coll_eff3 | Your community is capable to do something against possible flooding, even in the face of unexpected challenges and problems |

| **Flood risk perception**<br>(Adapted from Wilson et al., 2018) | |
|---|---|
| Indicate to what extent you agree with the following statements<br>(5-point Likert scale: From strongly disagree to strongly agree) | |
| Riskper3 | When you think about floods for a moment, to what extent do you feel worried? *(affect)* |
| Riskper2 | When you think about floods for a moment, to what extent do you feel anxious? *(affect)* |
| Riskper5 | If you did experience a flood, would it have a severe effect on you personally? *(Severity)* |
| Riskper1 | How risky are floods? *(general)* |
| Riskper4 | How likely is it that a flood will occur where you live? *(Probability)* |
| Riskper6 | If I did experience a flood, it is likely that it would negatively impact me *(Severity)* |
| Riskper7 | I am confident that a flood will not occur where I live *(Reverse) (Probability)* |
| Riskper8 | When you think about floods for a moment, to what extent do you feel fearful? *(Affect)* |

| **Place identity threat due to safety measures**<br>(Adapted from Korf & Malan, 2002; Wohl & Branscombe, 2009; Droseltis & Vignoles, 2010; Vignoles et al., 2006) | |
|---|---|
| Keeping in mind the recent implementation of the safety measures in your local area, indicate to what extent you agree with the following statements.<br>(5-point Likert scale: From strongly disagree to strongly agree) | |
| Idthreat_sm3 | I fear that this place is not going to maintain its unique identity |
| Idthreat_sm2 (cultural continuity) | I am concerned that the traditions of the place where I live will not survive |
| Idthreat_sm4 (historical continuity) | I fear that this place will lose its continuity with the past |
| Idthreat_sm1 | I may not feel proud to live here in the future |
| Idthreat_sm9 (continuity of self) | I am worried that the safety measures might be incompatible with my past identity |
| Idthreat_sm8 (belonging) | I fear that I will lose my sense of belonging to this place |
| Idthreat_sm7 (growth) | I cannot visualize new safety measures that will allow this place to grow and develop |
| Idthreat_sm5 (self-esteem) | It has become a negative attribute to live in a place with flood safety measures these days |
| Idthreat_sm6 (self-efficacy) | I fear that being linked to a place with flood safety measures will make me feel less in control |
| Idthreat_sm10 | I am worried about the future vitality of the place where I live |
| Idthreat_sm11 (quality of life) | I fear that the economic situation of this place is going to deteriorate in the future |
| Idthreat_sm12 (meaning) | I fear that this place will lose its meaning |

| **Place identity threat due to increasing flood hazards**<br>(Adapted from Korf & Malan, 2002; Wohl & Branscombe, 2009; Droseltis & Vignoles, 2010; Vignoles et al., 2006) | |
|---|---|
| Keeping in mind the growing flood hazards in your local area, indicate to what extent you agree with the following statements.<br>(5-point Likert scale: From strongly disagree to strongly agree) | |
| Idthreat_f3 | I fear that this place is not going to maintain its unique identity |
| Idthreat_f2 | I am concerned that the traditions of the place where I live will not survive |
| Idthreat_f4 | I fear that this place will lose its continuity with the past |
| Idthreat_f1 | I may not feel proud to live here in the future |
| Idthreat_f9 | I am worried that the flood hazards are incompatible with my past identity |
| Idthreat_f8 | I fear that I will lose my sense of belonging to this place |
| Idthreat_f7 | I cannot visualize new flood hazards that will allow this place to grow and develop |
| Idthreat_f5 | It has become a negative attribute to live in an at risk place these days |
| Idthreat_f6 | I fear that being linked to a place at risk will make me feel less in control |
| Idthreat_f10 | I am worried about the future vitality of the place where I live |
| Idthreat_f11 | I fear that the economic situation of this place is going to deteriorate in the future |
| Idthreat_f12 | I fear that this place will lose its meaning |

| **Attitudes: Acceptability of the safety measures**<br>(Adapted from Cooke and Horberry 2011; Vlassenroot & Brookhuis, 2014) | |
|---|---|
| Indicate in the grid below what you think of the flood safety measures<br>(E.g., land-use restrictions, legislations, and implementation of defense structures) | |
| Useful | Useless |
| Pleasant | Unpleasant |
| Acceptable | Unacceptable |
| Effective | Superfluous |
| Nice | Annoying |
| Good | Bad |
| Likable | Irritating |
| Assisting | Worthless |
| Desirable | Undesirable |
| Affordable | Unaffordable |
| Satisfying | Troubling |
| Fair | Unfair |

NSD NORSK SENTER FOR FORSKNINGSDATA

## NSD's assessment

**Project title**

What does it take to invest in protective actions? Predictors and barriers of climate change adaptation. A focus on the effects of flooding experiences in Norway

**Reference number**

564981

**Registered**

22.02.2021 av Amanda Elizabeth Lai - amanda.lai@ntnu.no

**Data controller (institution responsible for the project)**

Norges teknisk-naturvitenskapelige universitet / Fakultet for samfunns- og utdanningsvitenskap (SU) / Institutt for psykologi

**Project leader (academic employee/supervisor or PhD candidate)**

Amanda Elizabeth Lai, amanda.lai@ntnu.no, tlf: 40758436

**Type of project**

Student project, Master's thesis

**Contact information, student**

Majen Christine Bjerke, majencb@stud.ntnu.no, tlf: 46854653

**Project period**

01.03.2021 - 31.12.2022

**Status**

10.03.2021 - Assessed anonymous

**Assessment (1)**

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**10.03.2021 - Assessed anonymous**

It is our assessment that this project will not process data that can directly or indirectly identify individual persons, so long as it is carried out in accordance with what is documented in the Notification Form and attachments, dated 10.03.2021, as well as in correspondence with NSD. As a result, the project does not need an assessment from NSD.

WHAT DO YOU NEED TO DO IF YOU ARE GOING TO PROCESS PERSONAL DATA?
If the project is changed in such a way that you will process personal data, you will need to notify this to NSD by updating the Notification Form. Wait for a reply before you start processing personal data.