



wege entstehen, indem wir sie gehen
paths emerge in that we walk them

Wegener Center



Economics of Climate and Environmental Change Research Group

EconClim

Burying the head in the sand, and hoping for the best? The role of non-protective responses in private adaptation to flood risk

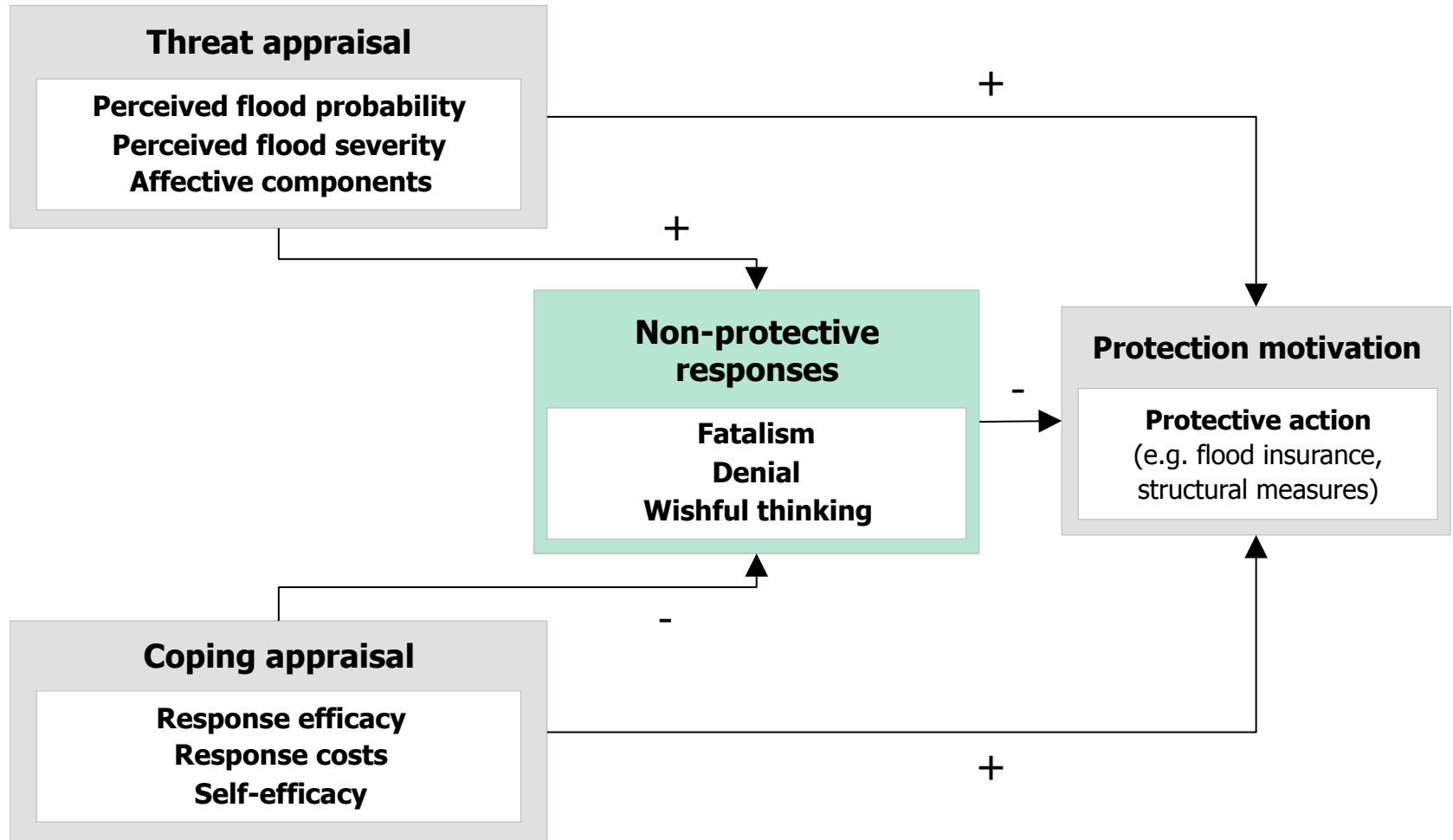
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SRA-E Conference, 20-22 June 2016, Bath

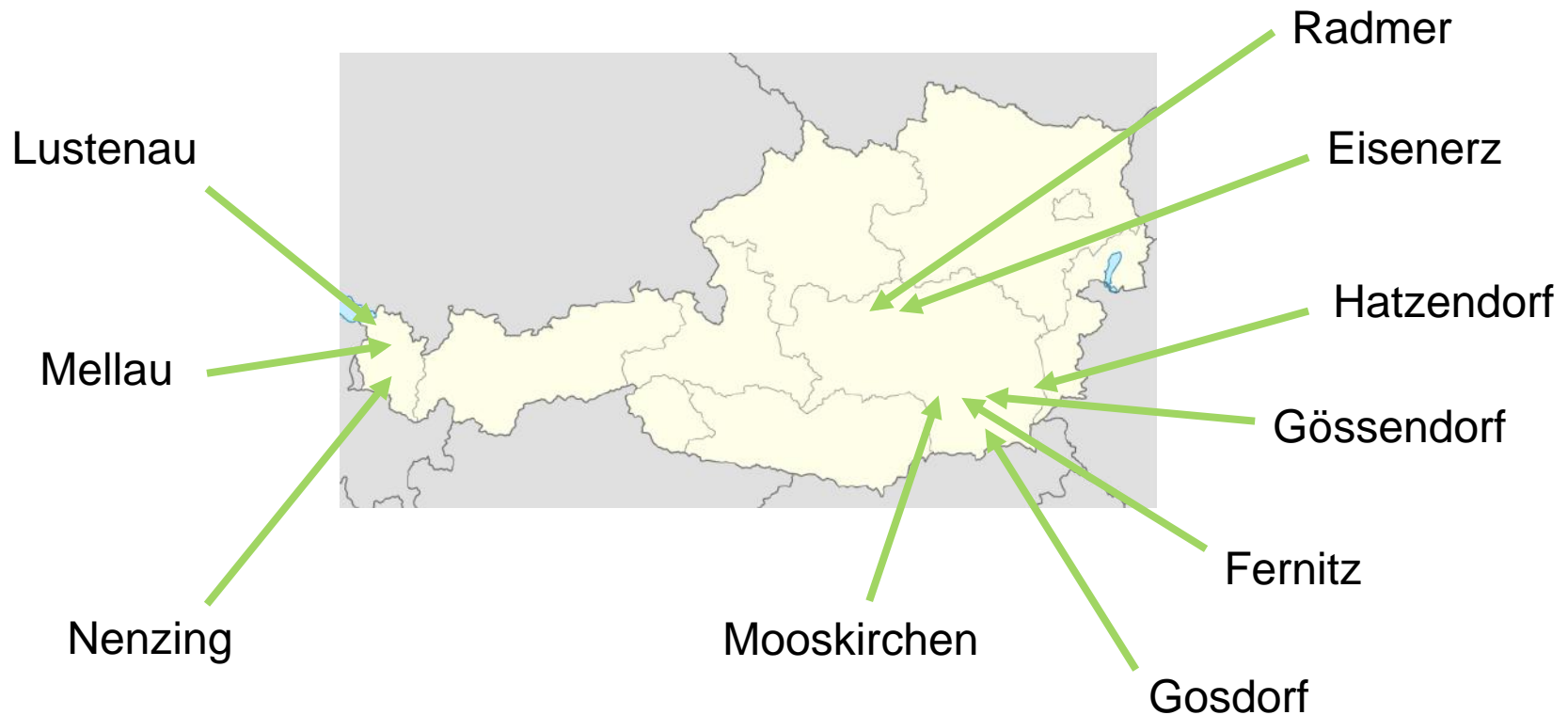
- Fundamental changes in flood risk management
 - Shared responsibility state/private actors (European Flood Directive 2007/60/EC)
 - 82% of losses: private households (Feyen and Watkiss 2011)
- Key for integrated flood risk management
 - Understand how households can be encouraged to increase flood resilience
- Protection Motivation Theory (PMT)
 - Communication and health theory (Rogers 1975)
 - Describes the cognitive processes of how fear appeals motivate people to change their behaviour
 - Awareness campaigns that use fear as a positive trigger

- Protection Motivation Theory: model components



- Classic examples
 - Fatalism
 - Denial
 - Wishful thinking
- Flood risk specific non-protective responses
 - Reliance on public flood protection
 - Reliance on social support

- 10 flood-prone municipalities in Austria
- October 2014 – January 2015



- Postal survey among all private households in case study regions
- Questionnaire enclosed in municipal newspapers
 - + Prepaid return envelope
 - + Identical online survey
- Overall response rate
 - $r = 13\%$
- Complete sample
 - $n = 2,014$ cases



Ihre Meinung zum Thema Hochwasser Marktgemeinde Lustenau

Bitte beziehen Sie sich bei allen Fragen auf Hochwasser in Ihrer Ortschaft. Wenn Sie gewerblich oder landwirtschaftlich tätig sind, beziehen Sie sich bitte nur auf Ihre Wohngebäude und könnenem gewerbliche bzw. landwirtschaftliche Gebäude und Flächen aus. Mit Gebüde ist Ihr Wohngebäude gemeint; wenn Sie in einem Erdgeschoss wohnen, dann zählt auch das umliegende Privatgrundstück dazu (z. B. Carport, Gartenhaus). Wenn ehrenamtliche Einsatzkräfte genannt werden, so sind damit Personen gemeint, die freiwillig und unentgeltlich in einer Einsatzorganisation (z. B. Feuerwehre, Rotes Kreuz, Wasserrettung) mitarbeiten. Sämtliche personenbezogene Bezeichnungen beziehen sich auf Frauen ebenso wie auf Männer.

Bisherige Erfahrung mit Hochwasser

Wann Sie in Ihrem Leben schon von Hochwasser betroffen?

Nein Falls ja, wie oft? _____ Mal
Ja

Wann waren Sie das letzte Mal von Hochwasser betroffen? Im Jahr: _____

Einschätzung zukünftiger Hochwassergefahren

Für wie wahrscheinlich halten Sie das Auftreten eines schweren Hochwassers innerhalb der nächsten 10 Jahre in Ihrer Gemeinde?

sehr wahrscheinlich (10) sehr unwahrscheinlich (1)

10	9	8	7	6	5	4	3	2	1
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Für wie wahrscheinlich halten Sie das Auftreten eines schweren Hochwassers innerhalb der nächsten 10 Jahre bei Ihrem Gebäude?

sehr wahrscheinlich (10) sehr unwahrscheinlich (1)

10	9	8	7	6	5	4	3	2	1
----	---	---	---	---	---	---	---	---	---

Wie große Schäden erwarten Sie in Ihrer Gemeinde im Fall eines schweren Hochwassers?

sehr wahrscheinlich (10) sehr unwahrscheinlich (1)

10	9	8	7	6	5	4	3	2	1
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Wie große Schäden erwarten Sie, wenn Ihr Gebäude von einem schweren Hochwasser getroffen wird?

sehr wahrscheinlich (10) sehr unwahrscheinlich (1)

10	9	8	7	6	5	4	3	2	1
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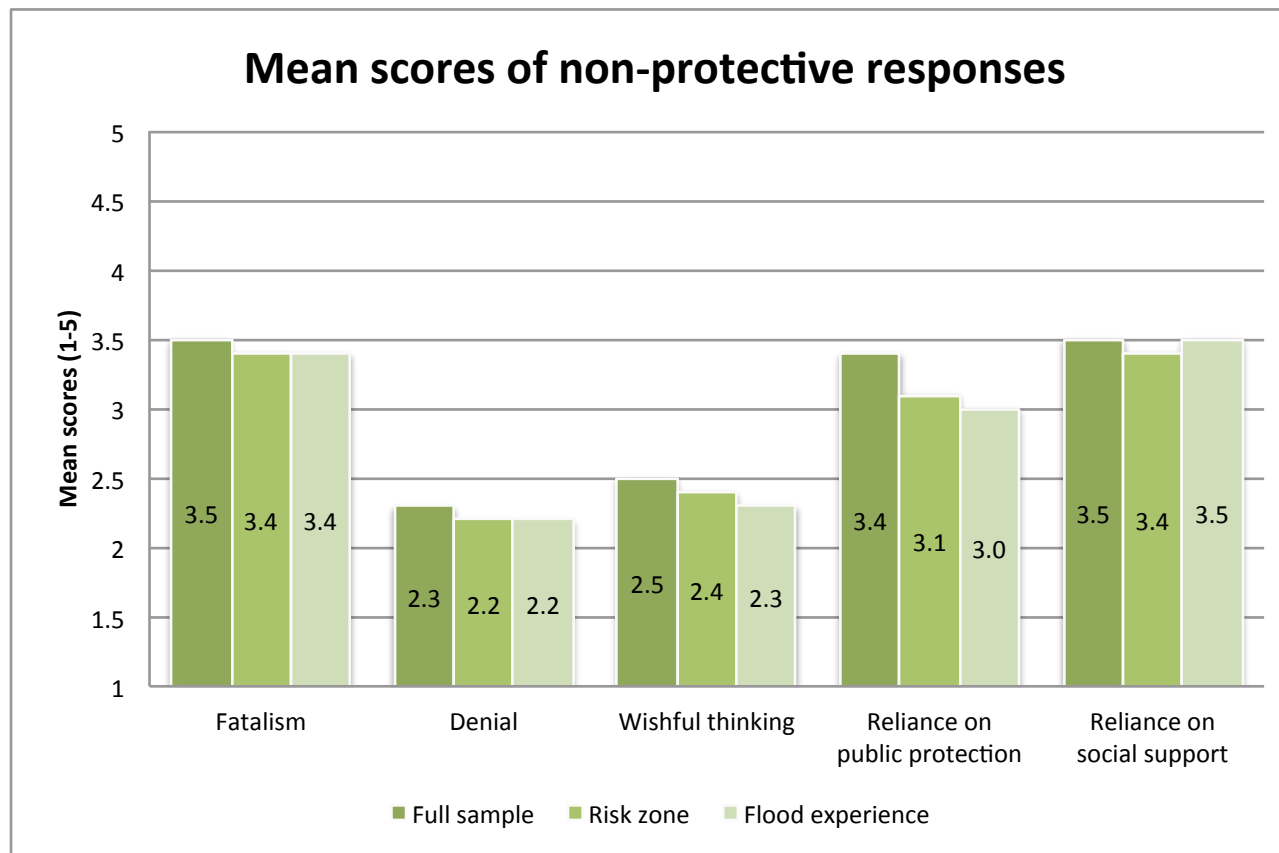
Informationen über Hochwasser

Wie wichtig sind für Sie folgende Informationsquellen, wenn es um das Thema Hochwasser geht?

Radio, Fernsehen, Zeitung
Internet
Hochwasserwarndienst (SMS, App)
Familie, Verwandte, Freunde
Ehrenamtliche Einsatzkräfte
Nachbarn
Gemeinde (Bürgermeister, Gemeindeamt)
Sonstige: _____

Informationen über Sie

- Mean scores of non-protective responses
 - Clustered by full sample, risk zone and flood experience





- **Step 1: Confirmatory Factor Analysis (CFA)**
 - To determine the measurement validity of non-protective responses
 - Excellent model fit
 - No cross loadings
 - Only moderate correlations between factors
- **Step 2: Structural Equation Modeling (SEM)**
 - To test the relationships as proposed by the PMT

• Structural model PMT

Model Fit Indices

CFI \geq .900 ✓

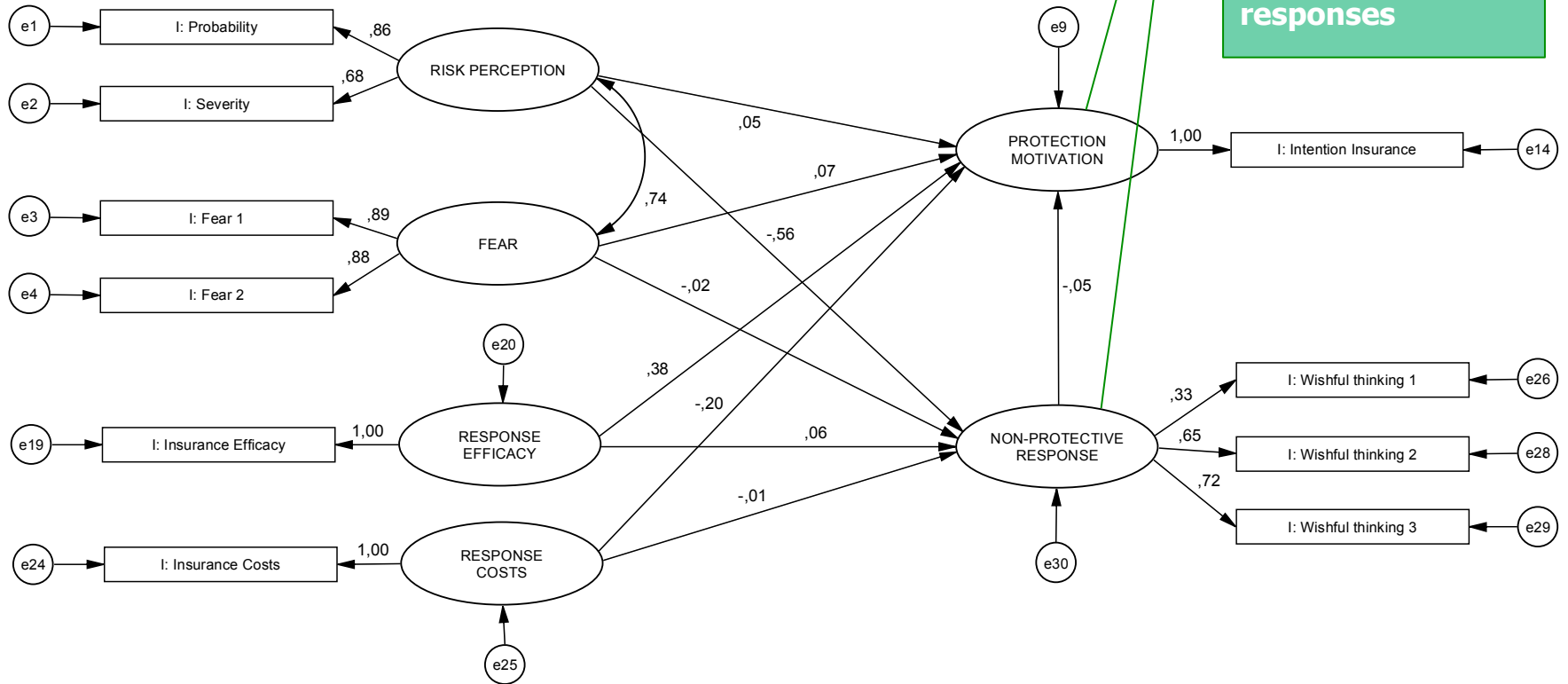
NFI \geq .900 ✓

RMSEA \leq .080 ✓

7 flood protection measures

7 x 5 = 35 models

5 non-protective responses



- Which paths can be empirically confirmed?

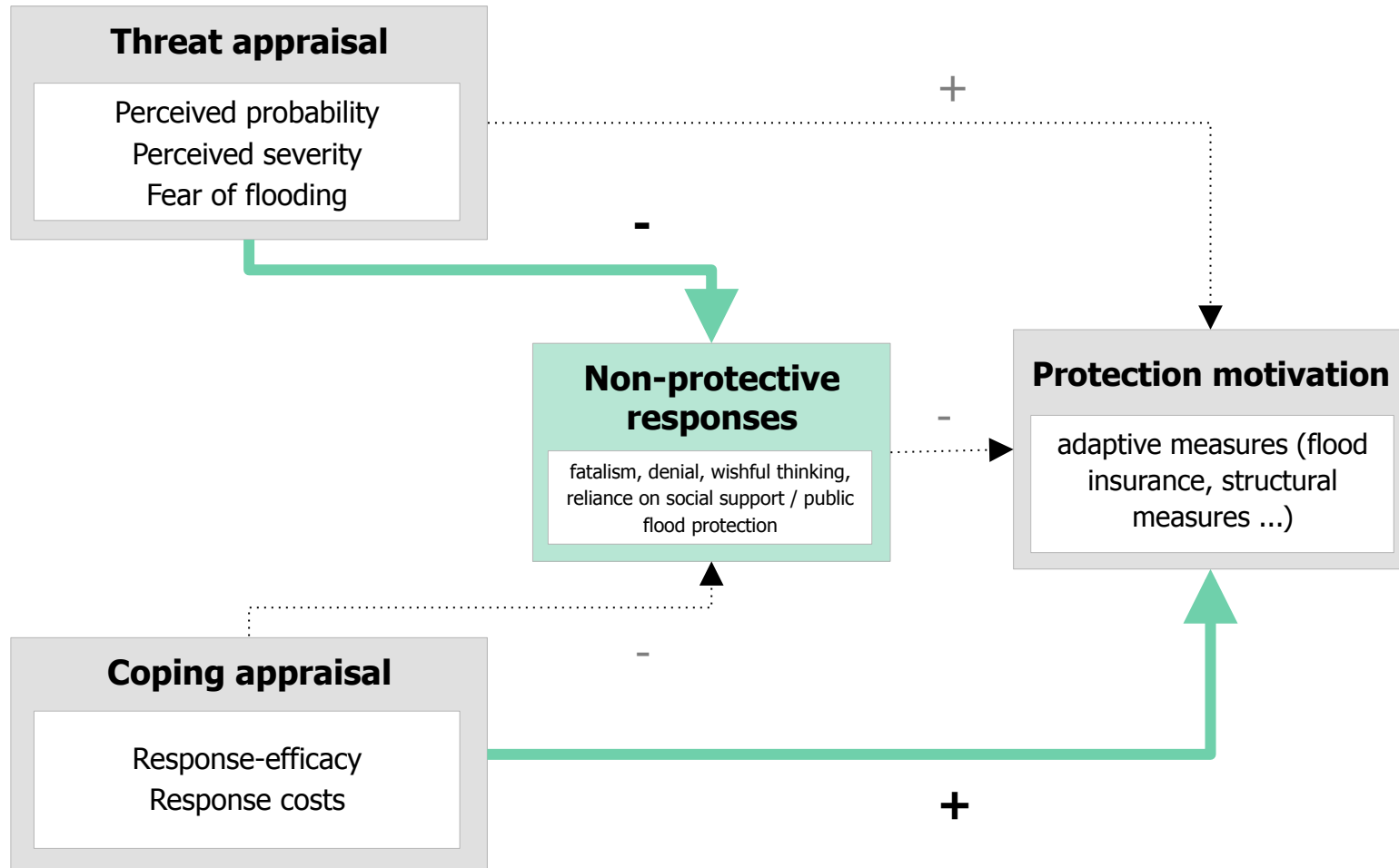
FATALISM									
Flood protection measures 1-7	Protective Motivation				NPR				
	RP -> PM	Fear -> PM	RE -> PM	RC -> PM	RP -> NPR	RP_Fear -> NPR	RE -> NPR	RC -> NPR	NPR -> PM
Flood insurance			.304 (***)	.100 (***)	.300 (***)	.305 (***)	.174 (***)		
Valuable furnishing and items upstairs									
Emergency plan for household members									
Structural measures at building									
Structural measures at parts of building									
Coordination with neighbours									
Provisional measures									
DENIAL									
Flood protection measures 1-7	Protective Motivation				NPR				
	RP -> PM	Fear -> PM	RE -> PM	RC -> PM	RP -> NPR	RP_Fear -> NPR	RE -> NPR	RC -> NPR	NPR -> PM
Flood insurance			.276 (***)	.107 (***)	.251 (***)	.101 (.040)			.073 (.040)
Valuable furnishing and items upstairs									
Emergency plan for household members									
Structural measures at building									
Structural measures at parts of building									
Coordination with neighbours									
Provisional measures									
WISFUL THINKING									
Flood protection measures 1-7	Protective Motivation				NPR				
	RP -> PM	Fear -> PM	RE -> PM	RC -> PM	RP -> NPR	RP_Fear -> NPR	RE -> NPR	RC -> NPR	NPR -> PM
Flood insurance			.276 (***)	.107 (***)	.251 (***)	.101 (.040)			.073 (.040)
Valuable furnishing and items upstairs									
Emergency plan for household members									
Structural measures at building									
Structural measures at parts of building									
Coordination with neighbours									
Provisional measures									
RELIANCE ON SOCIAL SUPPORT									
Flood protection measures 1-7	Protective Motivation				NPR				
	RP -> PM	Fear -> PM	RE -> PM	RC -> PM	RP -> NPR	RP_Fear -> NPR	RE -> NPR	RC -> NPR	NPR -> PM
Flood insurance			.276 (***)	.107 (***)	.251 (***)	.101 (.040)			.073 (.040)
Valuable furnishing and items upstairs									
Emergency plan for household members									
Structural measures at building									
Structural measures at parts of building									
Coordination with neighbours									
Provisional measures									
RELIANCE ON PUBLIC SUPPORT									
Flood protection measures 1-7	Protective Motivation				NPR				
	RP -> PM	Fear -> PM	RE -> PM	RC -> PM	RP -> NPR	RP_Fear -> NPR	RE -> NPR	RC -> NPR	NPR -> PM
Flood insurance	n.s.	n.s.	.389 (***)	-.199 (***)	-.499 (***)	-.096 (.032)	.186 (***)	n.s.	-.081 (.013)
Valuable furnishing and items upstairs	n.s.	n.s.	.368 (***)	-.404 (***)	-.511 (***)	n.s.	.074 (.001)	n.s.	n.s.
Emergency plan for household members	-.104 (.013)	.191 (***)	.561 (***)	n.s.	-.506 (***)	-.111 (.014)	.138 (***)	.044 (.052)	-.094 (.002)
Structural measures at building	n.s.	n.s.	.264 (***)	-.191 (***)	-.507 (***)	-.099 (.029)	n.s.	-.063 (.007)	n.s.
Structural measures at parts of building	n.s.	n.s.	.305 (***)	-.266 (***)	-.502 (***)	-.102 (.024)	n.s.	-.071 (.002)	n.s.
Coordination with neighbours	n.s.	n.s.	.500 (***)	-.162 (***)	-.501 (***)	-.106 (.018)	.092 (***)	n.s.	n.s.
Provisional measures	n.s.	n.s.	.441 (***)	-.168 (***)	-.505 (***)	-.102 (.022)	.115 (***)	n.s.	-.097 (.002)

Coping appraisal → protection motivation

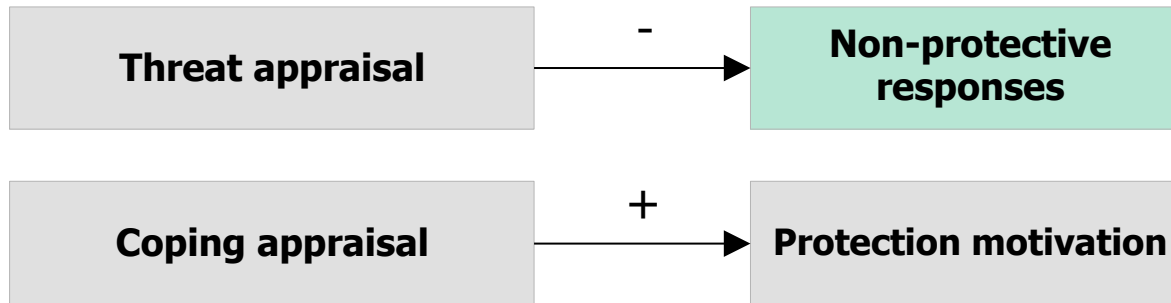
Threat appraisal → non-protective responses

FATALISM									
Flood protection measures 1-7	Protective Motivation				NPR				
	RP → PM	Fear → PM	RE → PM	RC → PM	RP → NPR	RP_Fear → NPR	RE → NPR	RC → NPR	NPR → PM
Flood insurance	n.s.	n.s.	.381 (***)	-.198 (***)	-.308 (***)	.205 (***)	.174 (***)	n.s.	n.s.
Valuable furnishing and items upstairs	n.s.	n.s.	.364 (***)	-.401 (***)	-.326 (***)	.221 (***)	n.s.	n.s.	.082 (.003)
Emergency plan for household members	n.s.	.212 (***)	.552 (***)	n.s.	-.330 (***)	.198 (***)	.090 (.003)	.086 (.005)	n.s.
Structural measures at building	n.s.	n.s.	.264 (***)	-.193 (***)	-.319 (***)	.208 (***)	n.s.	-.104 (***)	n.s.
Structural measures at parts of building	n.s.	n.s.	.301 (***)	-.264 (***)	-.334 (***)	.223 (***)	-.076 (.014)	n.s.	n.s.
Coordination with neighbours	n.s.	n.s.	.502 (***)	-.162 (***)	-.321 (***)	.205 (***)	.066 (.032)	n.s.	n.s.
Provisional measures	n.s.	.079 (.048)	.435 (***)	-.164 (***)	-.329 (***)	.208 (***)	n.s.	n.s.	-.091 (.002)
DENIAL									
Flood protection measures 1-7	Protective Motivation				NPR				
	RP → PM	Fear → PM	RE → PM	RC → PM	RP → NPR	RP_Fear → NPR	RE → NPR	RC → NPR	NPR → PM
Flood insurance	n.s.	n.s.	.376 (***)	-.197 (***)	-.354 (***)	-.101 (.040)	n.s.	n.s.	-.073 (.010)
Valuable furnishing and items upstairs	n.s.	n.s.	.371 (***)	-.402 (***)	-.359 (***)	n.s.	n.s.	n.s.	.087 (***)
Emergency plan for household members	n.s.	.203 (***)	.549 (***)	-.034 (.097)	-.361 (***)	-.102 (.037)	n.s.	.089 (***)	n.s.
Structural measures at building	n.s.	n.s.	.265 (***)	-.186 (***)	-.335 (***)	-.114 (.019)	n.s.	-.141 (***)	n.s.
Structural measures at parts of building	n.s.	n.s.	.304 (***)	-.263 (***)	-.347 (***)	-.100 (.041)	n.s.	-.077 (.003)	n.s.
Coordination with neighbours	n.s.	n.s.	.503 (***)	-.160 (***)	-.354 (***)	-.099 (.044)	n.s.	n.s.	.053 (.045)
Provisional measures	.112 (.010)	n.s.	.430 (***)	-.168 (***)	-.356 (***)	-.098 (.044)	n.s.	n.s.	n.s.
WISHFUL THINKING									
Flood protection measures 1-7	Protective Motivation				NPR				
	RP → PM	Fear → PM	RE → PM	RC → PM	RP → NPR	RP_Fear → NPR	RE → NPR	RC → NPR	NPR → PM
Flood insurance	n.s.	n.s.	.376 (***)	-.200 (***)	-.564 (***)	n.s.	.063 (.022)	n.s.	n.s.
Valuable furnishing and items upstairs	n.s.	n.s.	.368 (***)	-.402 (***)	-.567 (***)	n.s.	n.s.	n.s.	.111 (.002)
Emergency plan for household members	n.s.	.208 (***)	.548 (***)	n.s.	-.563 (***)	n.s.	.121 (***)	.084 (.002)	n.s.
Structural measures at building	n.s.	n.s.	.265 (***)	-.183 (***)	-.554 (***)	n.s.	n.s.	-.102 (***)	.099 (.014)
Structural measures at parts of building	n.s.	n.s.	.303 (***)	-.256 (***)	-.553 (***)	n.s.	n.s.	-.084 (.003)	.076 (.048)
Coordination with neighbours	n.s.	n.s.	.497 (***)	-.162 (***)	-.557 (***)	n.s.	.075 (.007)	n.s.	.075 (.036)
Provisional measures	.129 (.010)	n.s.	.427 (***)	-.167 (***)	-.558 (***)	n.s.	.056 (.043)	n.s.	n.s.
RELIANCE ON SOCIAL SUPPORT									
Flood protection measures 1-7	Protective Motivation				NPR				
	RP → PM	Fear → PM	RE → PM	RC → PM	RP → NPR	RP_Fear → NPR	RE → NPR	RC → NPR	NPR → PM
Flood insurance	n.s.	n.s.	.377 (***)	-.201 (***)	-.295 (***)	n.s.	.145 (***)	n.s.	n.s.
Valuable furnishing and items upstairs	n.s.	n.s.	.366 (***)	-.403 (***)	-.303 (***)	-.034 (.003)	.074 (.003)	-.070 (.005)	n.s.
Emergency plan for household members	n.s.	.205 (***)	.547 (***)	n.s.	-.305 (***)	n.s.	.114 (***)	n.s.	n.s.
Structural measures at building	n.s.	n.s.	.258 (***)	-.189 (***)	-.300 (***)	n.s.	.051 (.040)	n.s.	.105 (***)
Structural measures at parts of building	n.s.	n.s.	.299 (***)	-.261 (***)	-.299 (***)	n.s.	.076 (.002)	n.s.	.066 (.011)
Coordination with neighbours	.094 (.020)	n.s.	.475 (***)	-.161 (***)	-.280 (***)	n.s.	.194 (***)	n.s.	.141 (***)
Provisional measures	.121 (.005)	n.s.	.424 (***)	-.166 (***)	-.294 (***)	n.s.	.118 (***)	n.s.	.051 (.040)
RELIANCE ON PUBLIC SUPPORT									
Flood protection measures 1-7	Protective Motivation				NPR				
	RP → PM	Fear → PM	RE → PM	RC → PM	RP → NPR	RP_Fear → NPR	RE → NPR	RC → NPR	NPR → PM
Flood insurance	n.s.	n.s.	.389 (***)	-.199 (***)	-.499 (***)	-.096 (.032)	.186 (***)	n.s.	-.081 (.013)
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Provisional measures	n.s.	n.s.	.441 (***)	-.168 (***)	-.505 (***)	-.102 (.022)	.115 (***)	n.s.	-.097 (.002)

- PMT: Significant paths (35 models consolidated)



- **Non-protective responses** are primarily associated with threat appraisal
 - But the direction of the relationship raises new questions
 - No effect on intention to implement measures



- **Protective behaviour** depends on measure-specific appraisals (efficacy and costs)
 - The more effective and affordable a measure is perceived, the more likely it gets implemented
 - → *independently of level of perceived risk and fear*



- Different types of non-protective responses
 - Two specific to flood risks: Reliance on public flood protection and social support during flood events
 - Applied to a different extent
 - Not necessarily problematic as long as they are not significantly disconnected from the actual risk situation
- Risk appeals do not seem to be efficient in stimulating private flood risk reduction

- Provide information on efficacy of flood protection measures
 - Information campaigns on private measures
 - Flood risk assessment / individual flood risk consulting
 - Establishing building and product standards
 - Facilitate peer-to-peer communication
 - Bottom-up flood initiatives
- Incentivising implementation
 - Financial support (e.g. subsidies for private measures)
- Provide information on costs
 - Facilitation of cost comparison (e.g. directory of flood protection suppliers)

- Test causal direction of PMT components
 - Threat appraisal \leftrightarrow non-protective responses
 - Time series data required
 - Finalised 2nd wave of data collection



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