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# Exploring Changes in Hydrogeological Risk Awareness and Preparedness over Time: A Case Study in North-eastern Italy

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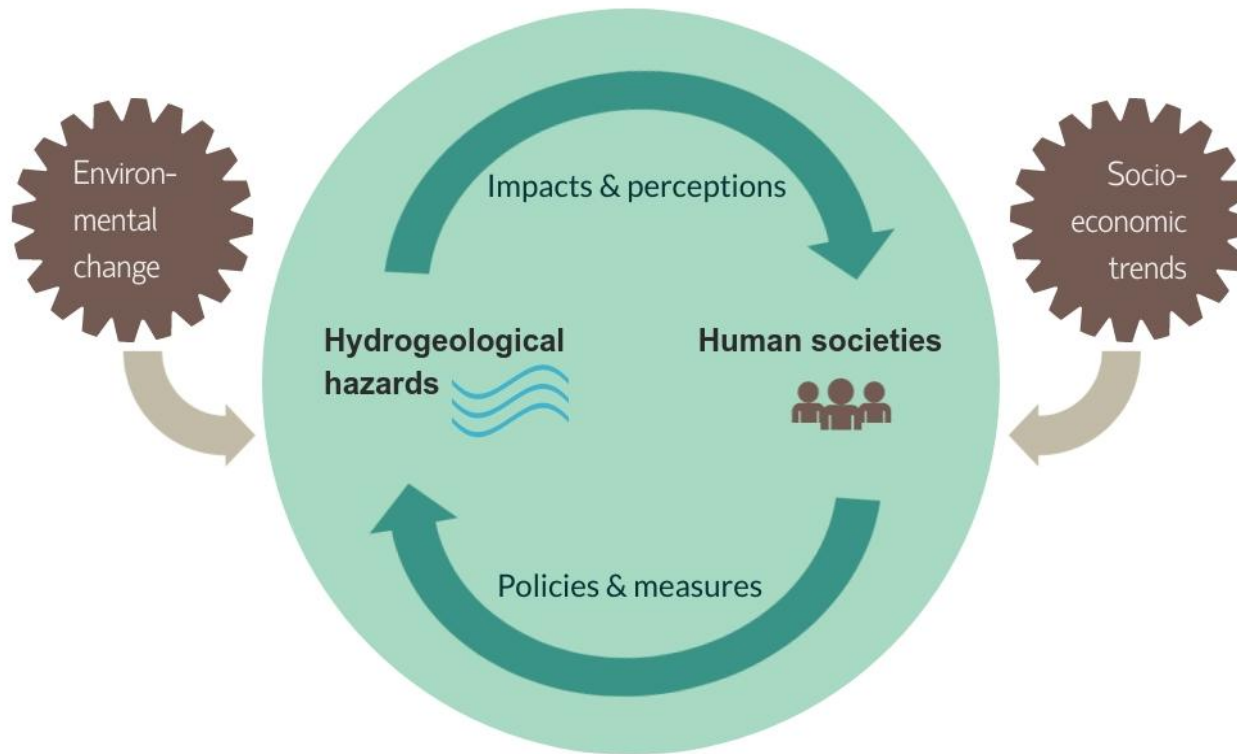
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## Outline:

1. Societal response to flood hazards and risk
2. Perception is changing with time: how?
3. A longitudinal study in Vermiglio and Romagnano (Trentino, Italy)

## Interplay of flood hazards and society



# Surveying flood risk perception: challenges

1. Much research regarding the perceptions, preferences, behaviour, and responses of people exposed to flooding
2. Cross-sectional surveys have been the predominant method applied in such research
3. However, many important research questions relating to dynamic processes, such as **changes in risk perceptions, adaptation behaviour, and resilience** cannot be fully addressed by cross-sectional surveys

# Longitudinal surveying of flood risk perception

1. Much research regarding the perceptions, preferences, behaviour, and responses of people exposed to flooding
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3. However, many important research questions relating to dynamic processes, such as **changes in risk perceptions, adaptation behaviour, and resilience** cannot be fully addressed by cross-sectional surveys

# Longitudinal surveying of flood risk perception

Surveys that capture the temporal dimension can answer questions that may otherwise be impossible to answer. For example:

1. Risk perceptions and psychological impacts are different in the months immediately after an event than before
2. Studies indicate that flood experiences strongly influence preparedness behaviour, which in turn considerably reduces flood impacts during subsequent events.

# Longitudinal surveying of flood risk perception

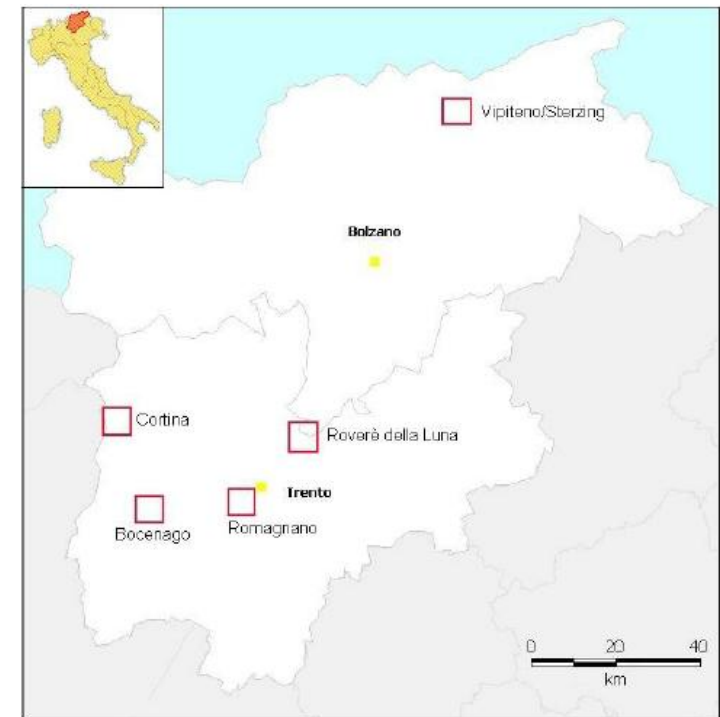
To better understand the dynamics of human behaviour in relation to flooding, calls for **longitudinal studies - a specific survey is repeated on the same sample population at least two times.**

Key also to integrate the human behaviour in flood risk modelling, which will require detailed records of behaviour over time and in response to flood events

# Case study: Trentino 2005-2018

**Survey 2005: Vermiglio (Cortina), Bocenago, Roverè, Romagnano, Vipiteno**

**Survey 2018: Vermiglio (Cortina), Romagnano**





## Case study: Romagnano

Suburb of Trento - 1272  
inhabitants

Most important flood/debris  
flow event:  
nov 2000.  
Evacuation of 500 people



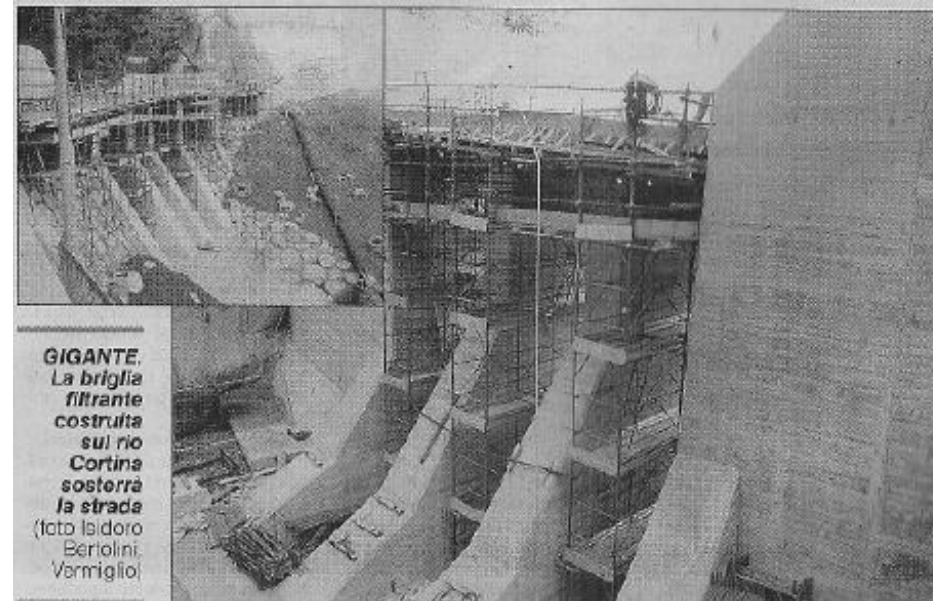
# Case study: Cortina (Vermiglio)

367 inhabitants

Most important flood/debris flow event:

nov 2000 - 2002.

Evacuation of 100 people



**GIGANTE.**  
La briglia filtrante costruita sul rio Cortina sosterrà la strada (foto Isidoro Beriolini, Vermiglio)

## LE ULTIME QUATTRO ALLUVIONI, DAL 1960 AL 2002

**VERMIGLIO** - Sono quattro, nell'ultimo mezzo secolo, le alluvioni documentate verificatesi lungo il rio Cortina, sul quale fra il 1959 e il 1963 furono costruite 29 briglie, seguite dal cuneitone realizzato fra il 1984 e il 1989.

Una colata di detriti, innescata da franamenti in quota, danneggiò i ponti, ma non le abitazioni, nel settembre del 1960. Ventitré anni dopo, nel maggio 1983, a quota 1.500 il franamento di una strada forestale fu causa prima di una colata detritica che coinvolse l'abitato di Cortina. Nel novembre 2000, nei giorni del collasso della strada a Mostiz-

zolo, quattro colate accumularono circa 1500 metri cubi di materiale nel tratto terminale del rio.

E già due anni dopo (il 14 novembre del 2002) ancora una volta durante piogge prolungate, l'abitato di Cortina fu colpito: 17 famiglie furono evacuate a titolo prudenziale. La colata, molto veloce e innescata da piccoli distacchi sopra i 1.700 metri, causò l'esondazione del rio: l'opera di difesa che era stata costruita l'anno prima fu superata dalla discesa del materiale detritico. Cessato l'allarme, la giunta provinciale decise di finanziare in somma urgenza la nuova briglia filtrante.

# 4 study hypotheses:

- H1. The level of risk awareness is lower in 2018 compared to 2005;
- H2. The perceived preparedness is lower in 2018 compared to 2005;
- H3. The general feeling of safety is inversely correlated with risk awareness at the individual level;
- H4. The presence of protection works is associated with lower risk awareness;

# Stats

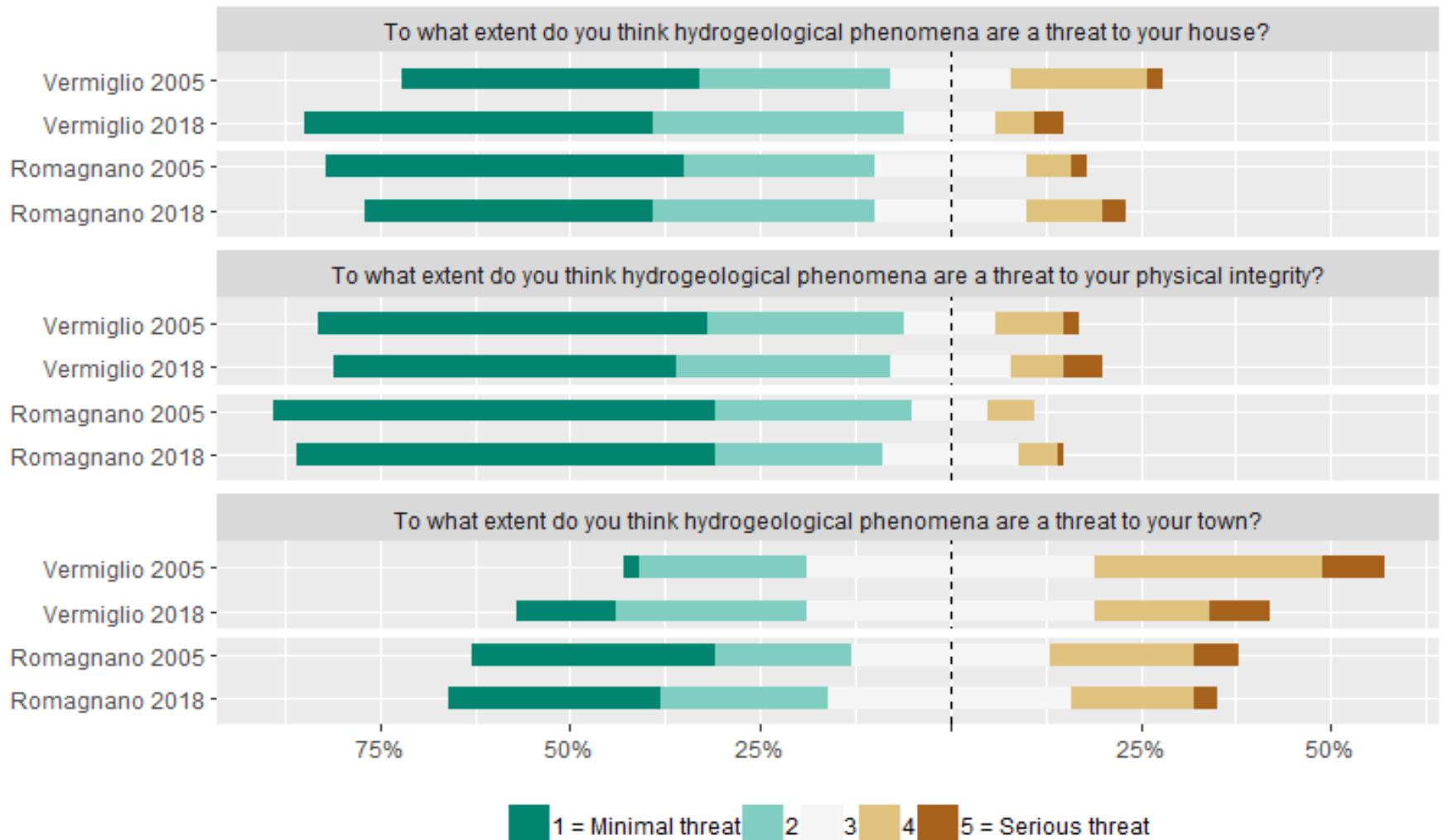
	Age					Gender	
	n	M	SD	Min	Max	Females	Males
<b>Vermiglio 05</b>	100	46.1	17.9	19	85	54.0%	46.0%
<b>Vermiglio 18</b>	122	50.4	17.8	18	91	51.6%	48.4%
<b>Romagnano 05</b>	100	47.8	16.9	18	85	55.0%	45.0%
<b>Romagnano 18</b>	135	50.0	17.5	18	93	52.6%	47.4%

Three variables were selected to interpret **flood risk awareness**:

feeling of danger caused by hydrogeological phenomena relative to

- (i) the house,
- (ii) the town,
- (iii) one's physical integrity.

# Feeling of danger – optimistic bias!

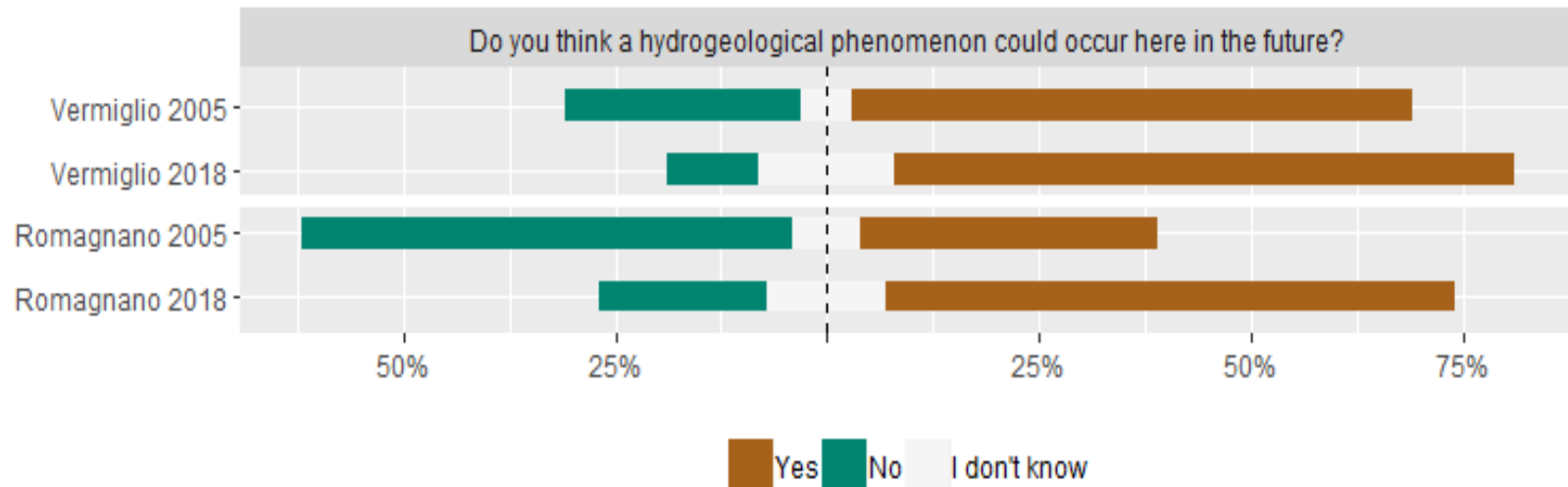


# Feeling of danger

	Feeling of danger – Town	Feeling of danger – House	Feeling of danger – Physical integrity
Vermiglio (2005 vs 2018)	(18.83)**	(11.92)*	(2.27)
Romagnano (2005 vs 2018)	(3.12)	(2.85)	(1.16)
2005 (Vermiglio vs Romagnano)	(34.18)***	(4.68)	(0.82)
2018 (Vermiglio vs Romagnano)	(11.56)*	(6.74)	(5.91)
$\chi^2$ values in brackets Significance codes (P-values): < 0.001 '***' < 0.01 '**' < 0.05 '*'			



# Perceived likelihood of floods' – increases!

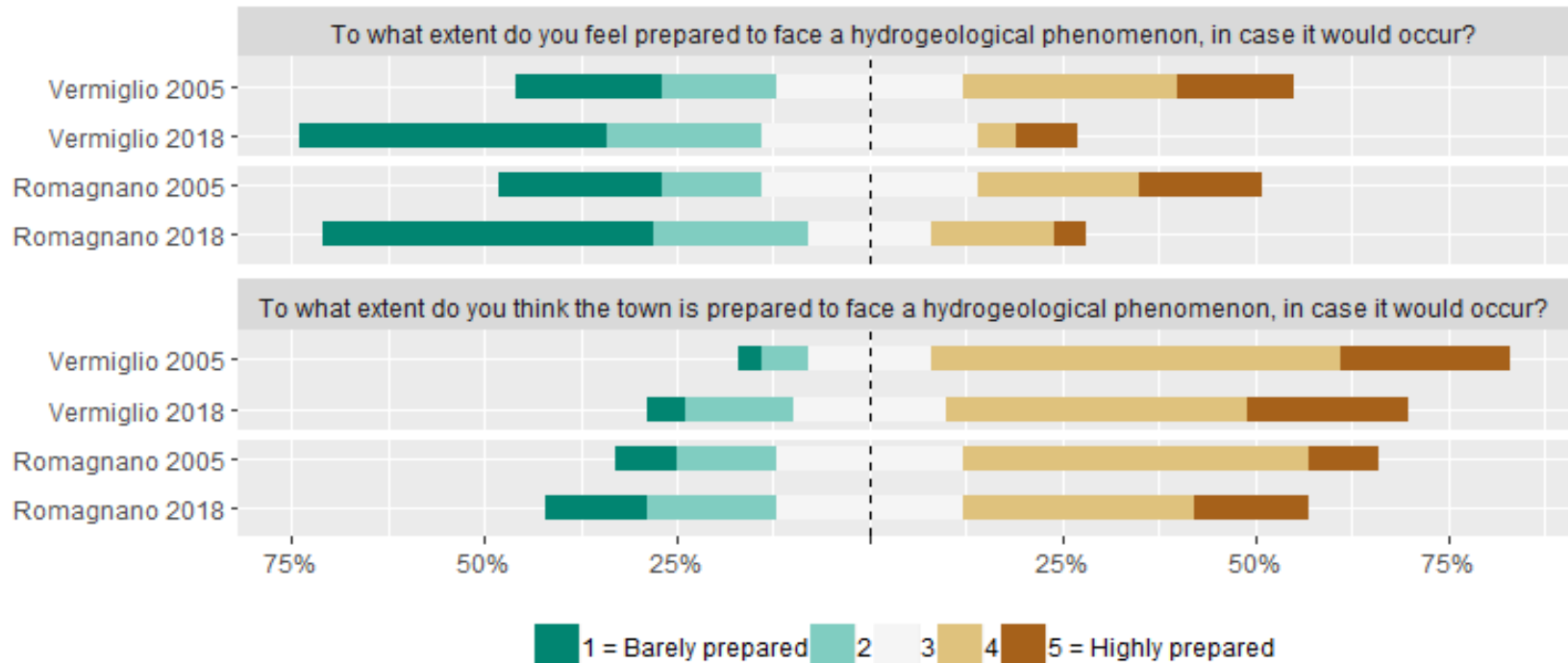




# Perceived likelihood of floods

	Perceived likelihood of hydrogeological phenomena
Vermiglio (2005 vs 2018)	(9.28)**
Romagnano (2005 vs 2018)	(34.45)***
2005 (Vermiglio vs Romagnano)	(20.06)***
2018 (Vermiglio vs Romagnano)	(2.33)
$\chi^2$ values in brackets Significance codes: < 0.001 '***' < 0.01 '**' < 0.05 '*'	

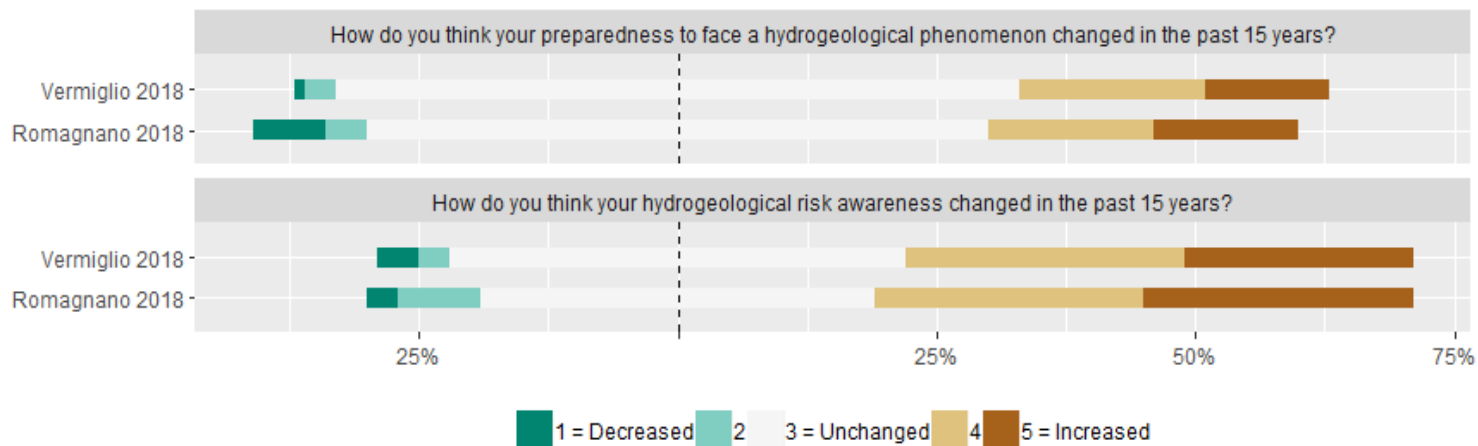
# Preparedness



# Preparedness

	Perceived individual preparedness	Perceived town preparedness
Vermiglio (2005 vs 2018)	(29.03) <sup>***</sup>	(8.82) .
Romagnano (2005 vs 2018)	(20.07) <sup>***</sup>	(6.90)
2005 (Vermiglio vs Romagnano)	(2.72)	(13.89) <sup>**</sup>
2018 (Vermiglio vs Romagnano)	(12.44) <sup>*</sup>	(5.76)
$\chi^2$ values in brackets Significance codes: < 0.001 '***' < 0.01 '**' < 0.05 '*'		

# Preparedness



## ***Conclusions - 1***

First, we hypothesised that flood risk awareness would decrease over time in the absence of events (H1).

This assumption found support in our data:

the lack of hydrogeological events in a long time and the also difficulties of the existing risk communication strategies in reaching their target might be the cause of such decrease in awareness.

Similarly, the data provides backing for the hypothesised decrease in preparedness (H2). Here too, the reasons can be attributed to the lack of events.

## Conclusions - 2

*Both results can also be partially explained by the fact that respondents who generally feel safe living in their area do not seem to be worried about floods (H3).*

*The fourth hypothesis (H4), that the presence of protection works is associated with lower risk awareness, is partly supported by our data, given the characteristics of structural protection measures in the two locations.*



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