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Spinning in circles? A systematic review on the role of theory in social vulnerability, resilience and adaptation research

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1 Abstract

2 An increasing number of publications focus on social vulnerability, resilience, and
3 adaptation (SVRA) towards natural hazards and climate change. Despite this
4 proliferation of research, a systematic understanding of how these studies are
5 theoretically grounded is lacking. Here, we systematically reviewed 4432 articles that
6 address SVRA in various disciplinary fields (e.g. psychology, sociology, geography,
7 mathematics) for various hazards, including floods, droughts, landslides, storm surges,
8 wildfires, tsunamis, earthquakes, and volcano eruptions. We focus on the extent to which
9 these studies explicate the frameworks, theoretical constructs or theories they rely on.
10 Surprisingly, we found that about 90% of the reviewed studies do not explicitly refer to
11 a theoretical underpinning. Overall, theories focusing on individuals' SVRA were more
12 frequently used than those focusing on systems, society, groups, and networks.
13 Moreover, the uptake of theories varied according to the hazard investigated and field of
14 knowledge, being more frequent in wildfire and flood studies and articles published in
15 social science journals. Based on our analysis, we propose a reflexive handling of theories
16 to foster more transparent, comparable, and robust empirical research on SVRA.

17 **Keywords:** natural hazards; preparedness; adaptive behaviour; coping; inductive
18 research; deductive research; theorising

19

20 1. Introduction

21 Over the last decades, social vulnerability, resilience, and adaptation (SVRA) and related
22 concepts¹ have been increasingly called upon to address natural hazard risk and
23 adaptation to climate change (Mochizuki et al., 2018). Indeed, to effectively understand
24 how hazards become disasters, it is widely accepted that we need to consider (1) people's
25 behaviours and capacities, (2) collective norms and values, and (3) how resources and
26 power are distributed (Wisner et al., 2012). The importance of these factors is highlighted,
27 among others, by the Intergovernmental Panel on Climate Change (IPCC, 2022) and the
28 Disaster Risk Management Knowledge Center of the European Commission (DRMKRC,
29 2020, 2017). Also, on the policy level, initiatives such as the Sendai Framework for

¹These include concepts such as adaptive and coping capacity, adaptive and protective behaviour, preparedness, among others.

30 Disaster Risk Reduction (UNISDR, 2015) and a growing number of on-the-ground
31 initiatives (e.g. Rockefeller Foundation, African Development Bank) invoke the relevance
32 of individual and collective actions in building resilience. Similarly, frameworks such as
33 ‘Making Space for Water’ (UK; DEFRA, 2005), ‘Space for Rivers’ (PKRR, 2006), ‘German
34 Federal Water Act’ (WHG, 2009), the ‘US National Flood Insurance Programme’
35 (Shaeffer, 1960), and the ‘Canadian National Disaster Mitigation Program’
36 (Thistlethwaite et al., 2018) encourage or demand individuals to take adaptive actions to
37 mitigate future risks (Kuhlicke et al., 2020).

38 The growing relevance of SVRA research is associated with a multiplicity of definitions
39 of key terms, resulting in a Babylonian babble of voices (Vogel, 2006). The reasons for this
40 include, among others, the considerable number of research domains involved. Each of
41 these originates from different disciplines, including sociology, psychology, geography
42 and mathematics, among many others, with varying backgrounds and interests
43 (Alexander, 2013; Janssen et al., 2006; Reghezza-Zitt and Rufat, 2019). Although several
44 authors suggest ways to specify the interrelations of key concepts (Gaillard, 2010; Lei et
45 al., 2014; Reghezza-Zitt and Rufat, 2019; Wisner et al., 2012), SVRA research is still highly
46 fragmented (Kuhlicke et al., 2020; Rufat et al., 2020). Even when considering single
47 concepts like vulnerability and resilience, numerous, sometimes inconsistent,
48 frameworks exist (Brand and Jax, 2007; Cutter, 2018; de Brito et al., 2017; Gallopín, 2006;
49 Rufat et al., 2019).

50 While various reviews systematise SVRA terminology (e.g. Otto et al., 2017), methods
51 (e.g. Siders, 2019), and case study applications (Ford et al., 2018; Moreira et al., 2021), few
52 systematic reviews investigate the extent to which SVRA research is based upon
53 theoretical constructs and frameworks. The exceptions are studies that address the use of
54 theories but with a narrower focus than here, such as flood risk perception (Kellens et al.,
55 2013), coastal adaptation (Koerth et al., 2017), and individual preparedness (Paton, 2019).

56 Here, we provide a base for substantiating the discussion on the role of theory in SVRA
57 research. Although this field was, from its very beginning, underpinned by a strong
58 pragmatic perspective (Wescoat, 1992), we argue that an explicit engagement with
59 underlying assumptions and epistemological questions is relevant for ensuring scientific
60 soundness, cumulative knowledge production as well as practical usefulness (Corley and
61 Gioia, 2011). We consider that all SVRA research is based on a set of basic assumptions

62 about causes and effects and, hence, it is inherently based on a “theory”, whether
63 explicitly stated or not. Research is, therefore, never theory-free. However, publications
64 often fail to explicitly articulate their assumptions, limiting the development of robust
65 evidence on SVRA. We contend that this is a shortcoming of SVRA research.

66 Therefore, in this study, we reviewed 4432 scientific publications on SVRA that address
67 different natural hazards (i.e. floods, droughts, heatwaves, landslides, storm surges,
68 wildfires, tsunamis, earthquakes, and volcanic activity) and, by doing so, attempted to
69 answer the following questions: (1) To what extent is the theoretical underpinning of
70 SVRA research made explicit? (2) Which explicated theories are more popular and which
71 are less often referred to? (3) If theories are made explicit, how are they used in empirical
72 studies? Are they used to ‘test’ theories (e.g. deductive approach), or do they rather help
73 to conduct theoretically informed in-depth case-study research (e.g. inductive approach)?
74 (4) If theories are made explicit, are there differences in their use according to the field of
75 knowledge and natural hazard investigated? Drawing on the findings, we aimed to
76 encourage researchers engaged in SVRA to become more explicit and reflexive about the
77 role of theory in their studies.

78 **2. Methodology**

79 A systematic review was conducted to synthesise the use of theories in empirical SVRA
80 research following the PRISMA guidelines (Page et al., 2021). As the boundary of this
81 field of research is hardly defined, we identified relevant papers through keyword
82 searches containing SVRA and hazard-related keywords (Box 1) based on previous
83 similar searches (Ejeta et al., 2015; Oktari et al., 2020).

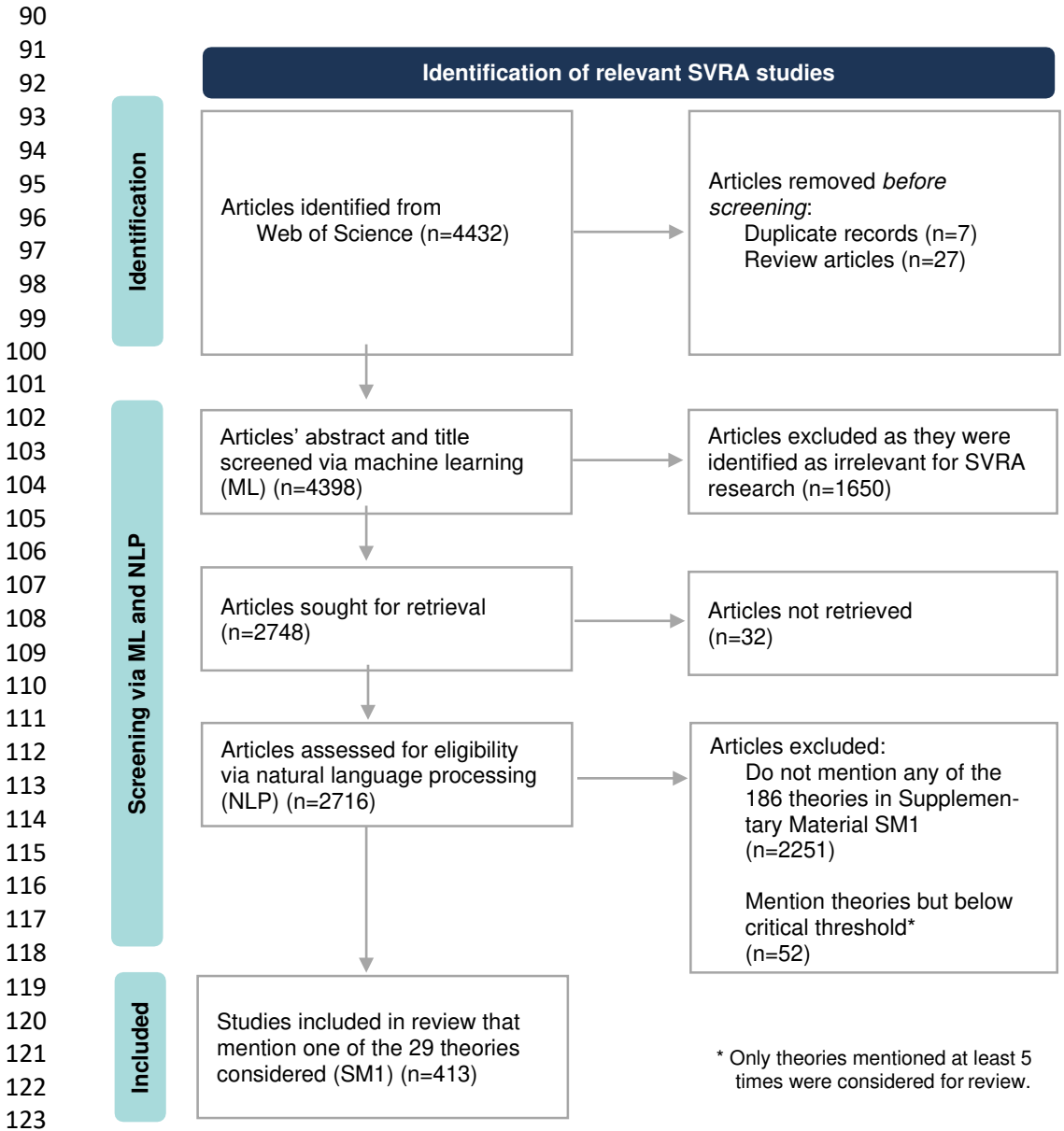
84 *Box 1: Search string used to retrieve relevant articles in Web of Science*

Topic=(“coping capacit*” OR “adaptive capacit*” OR “social resilience” OR “adaptive
resilience” OR “community resilience” OR “household resilience” OR “adaptive behavio*”
OR “social vulnerab*” OR preparedne*)

AND

Abstract, Title or Author keywords =(flood* OR inundation OR "storm wave*" OR "storm
surge*" OR "tidal surge*" OR "storm tide*" OR "hurricane tide*" OR "tropical surge*" OR
drought* OR heatwave* OR "heat wave*" OR "extreme heat" OR landslide* OR mudslide* OR
mudflow* OR rockslide* OR "debris flow" OR lahar* OR earthquake* OR tsunami* OR
“seismic sea wave” OR bushfire* OR wildfire* OR “forest fire*” OR “volcanic eruption*” OR
“volcanic ash*” OR magma* OR lava OR volcano* OR “volcanic hazard”)

85 The search was restricted to peer-reviewed articles written in English that included the
 86 search keywords in their title, abstract, or keywords. No lower boundary time constraints
 87 were used, but only articles published until December 31st 2020 were considered. Review
 88 articles, commentaries, and opinion pieces were excluded. Based on these criteria, 4432
 89 records were retrieved from the Web of Science (WoS) database (Fig. 1).



123
124 *Figure 1: PRISMA flowchart with the underlying review process*

125
126 **2.1 Article screening using manual coding, machine learning, and natural language**
 127 **processing (NLP)**

128 Article screening was done first at the title and abstract level following three inclusion
129 criteria: (1) SVRA are assessed either qualitatively or quantitatively, or specific attention
130 is given to their understanding, (2) the research is applied to natural hazards in general
131 or to specific hazard types (floods, droughts, heatwaves, landslides, storm surges,
132 wildfires, tsunamis, earthquakes, and volcanic activity), and (3) the research reports on
133 analyses of empirical data (i.e., data derived from statistics, texts, self-reports,
134 observation or experience). Articles whose contributions are primarily conceptual were
135 treated as non-empirical and therefore excluded.

136 Screening entailed manual coding and supervised machine learning to determine
137 whether the articles should be included. Following this criteria, a random sample of 1000
138 abstracts was read by the co-authors and classified as relevant or irrelevant. Then, a
139 multinomial naïve Bayes model was built by splitting the labelled data into a training
140 (80% of the articles) and a test set (20%). An accuracy of 0.89 was obtained. The model
141 was then applied to classify the remaining articles. A random sample of 200 articles
142 predicted as ‘irrelevant’ was read to verify if they could potentially be relevant. Among
143 this group of articles, only two were found to be relevant. Given the low number of
144 additional relevant articles identified, we concluded that the benefits of additional
145 screening would be low. Hence, we considered the machine learning predictions for
146 labelling the remaining articles.

147 Results indicated that potentially 2748 articles could be relevant for our analysis. Of these,
148 2716 were downloaded, and 32 were unretrievable. A total of 2716 articles thus
149 constitutes the sample of potentially relevant articles included in our analysis.

150 In order to filter for the articles that mentioned theories, we used a series of NLP tools.
151 First, the articles were converted from pdf files into plain text and tokenised into
152 sentences with lowercase letters. The article’s references were removed from the corpus
153 to avoid bias. Then, we extracted 3-, 4- and 5-word strings that included the terms
154 “theory”, “model*”, and “framework*”. Although not labelled theories, we considered
155 frameworks or models also as theories granted that they explicate “why empirical
156 patterns were or are expected to be observed” (Sutton and Staw, 1995, p. 374) and, by
157 doing so, help to show “how and/or why a phenomenon occurs” (Corley and Gioia, 2011,
158 p. 12). Results were sorted by their number of occurrences. This allowed us to identify
159 relevant theories to be considered. Additional theories were identified based on previous

160 reviews (Kuhlicke et al., 2020; Kwon and Silva, 2020). In the end, a list with 186 potentially
161 relevant theories was compiled (see Supplementary Material SM1).

162 Pattern matching (de Brito et al., 2020) was used to identify articles that mentioned any
163 of these theories. 465 articles mentioned at least one of the 186 theories. However, many
164 of these theories were considered only by one article (SM1). As such, to refine our
165 analysis, we considered only the theories cited in at least 5 papers (n=29 theories) for
166 further analyses. After this process, 413 articles were deemed eligible for a closer reading
167 as they mentioned at least one of the considered 29 theories within the actual text body,
168 excluding references.

169 **2.3 Close reading of articles mentioning theories**

170 The remaining articles (n=413) were scrutinised in-depth to understand the role of theory
171 in these studies. They were distributed among co-authors for close reading (de Brito et
172 al., 2021). The co-authors come from diverse fields, including sociology, engineering,
173 geography, psychology, and economics. Each article was read by at least two persons.
174 Co-authors were given the option to respond ‘in doubt’ to any of the classifications in
175 cases of uncertainty. In case of discrepancies, a third person read the article and the final
176 classification was decided based on a discussion between the first authors. Reasons for
177 the classification were documented.

178 The articles were coded across a set of questions, including: (1) if the theory was used
179 deductively (e.g. testing a theory) and/or inductively² (e.g. developing a theory based on
180 empirical observations) (Fig. 2); (2) the study design (e.g. experimental, longitudinal); and
181 (3) the data collection methods (survey, interview, focus group or workshop, participant
182 observation, document analysis, indicator-based-approaches, and computer modelling).
183 The data collection methods were selected based on the co-authors’ experience.
184 Information on the investigated hazards and mentioned theories were extracted using
185 text pattern matching. Results were supplemented and validated by the co-authors.

186 In addition, we pragmatically grouped theories according to their foci, including (1)
187 theories with a focus on individual decision-making processes stemming mostly from

² We are aware that this differentiation is coarse and that many different, more blurred forms are possible and probably the reality of doing research.

188 behavioural sciences, economics, and psychology (e.g. bounded rationality and prospect
189 theory); (2) theories with a focus on micro-macro processes, groups and/or networks
190 often referred to in sociology, anthropology and human geography (e.g. PAR, networks
191 and social capital, Cultural Theory etc.) and (3) theories with a focus on social-ecological
192 systems (e.g. resilience, complex systems etc.).

Deductive reasoning

Goal: testing of hypotheses

Variables are developed based on hypothesis, theory or existing frameworks

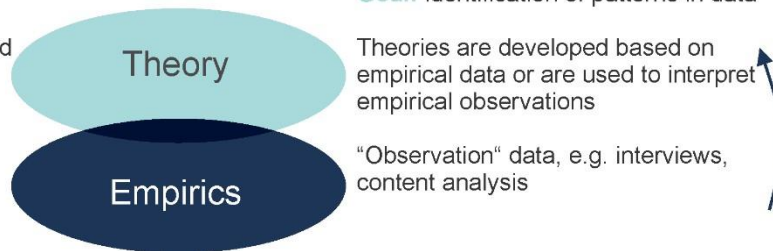
Results support or reject the hypothesis based on the obtained (standardized) data

Inductive reasoning

Goal: identification of patterns in data

Theories are developed based on empirical data or are used to interpret empirical observations

"Observation" data, e.g. interviews, content analysis



193

194 *Figure 2. Differences between deductive and inductive reasoning. Here, deductive reasoning*
195 *implies a process of translating theories (or parts of them) into hypotheses that are tested through*
196 *specific variables; inductive reasoning implies starting from specific observation towards more*
197 *general conclusions without making a priori assumptions about the interrelations among the*
198 *variables.*

199 2.4 Statistical analyses

200 The use of theories according to the hazard investigated, and the WoS field of knowledge³
201 (e.g. Arts & Humanities, Social Sciences) were summarised with frequencies and
202 percentages using the Clopper-Pearson methodology to calculate 95% Confidence
203 Intervals (CI). Rates of theory use (e.g. the % of theory use in a subset of articles) were
204 compared with pairwise comparison using Fisher's exact test.

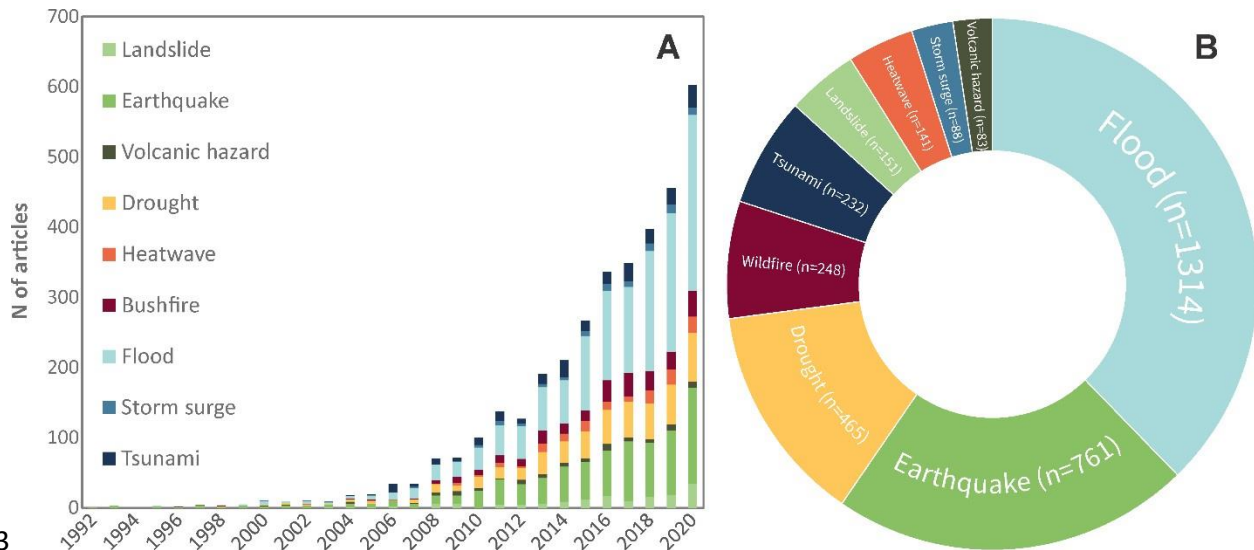
205 3. Results

206 3.1. Trends in SVRA research

207 A total of 2716 potentially relevant articles addressing SVRA were retrieved by our search
208 (Fig. 1). Since 1992, the number of SVRA articles has increased by more than two orders
209 of magnitude (Fig. 3A). This increase is exponential even when normalising the data by
210 the yearly number of all articles included in the WoS database. Regarding the hazard

³ WoS research areas: https://images.webofknowledge.com/images/help/WOS/hp_research_areas_easca.html

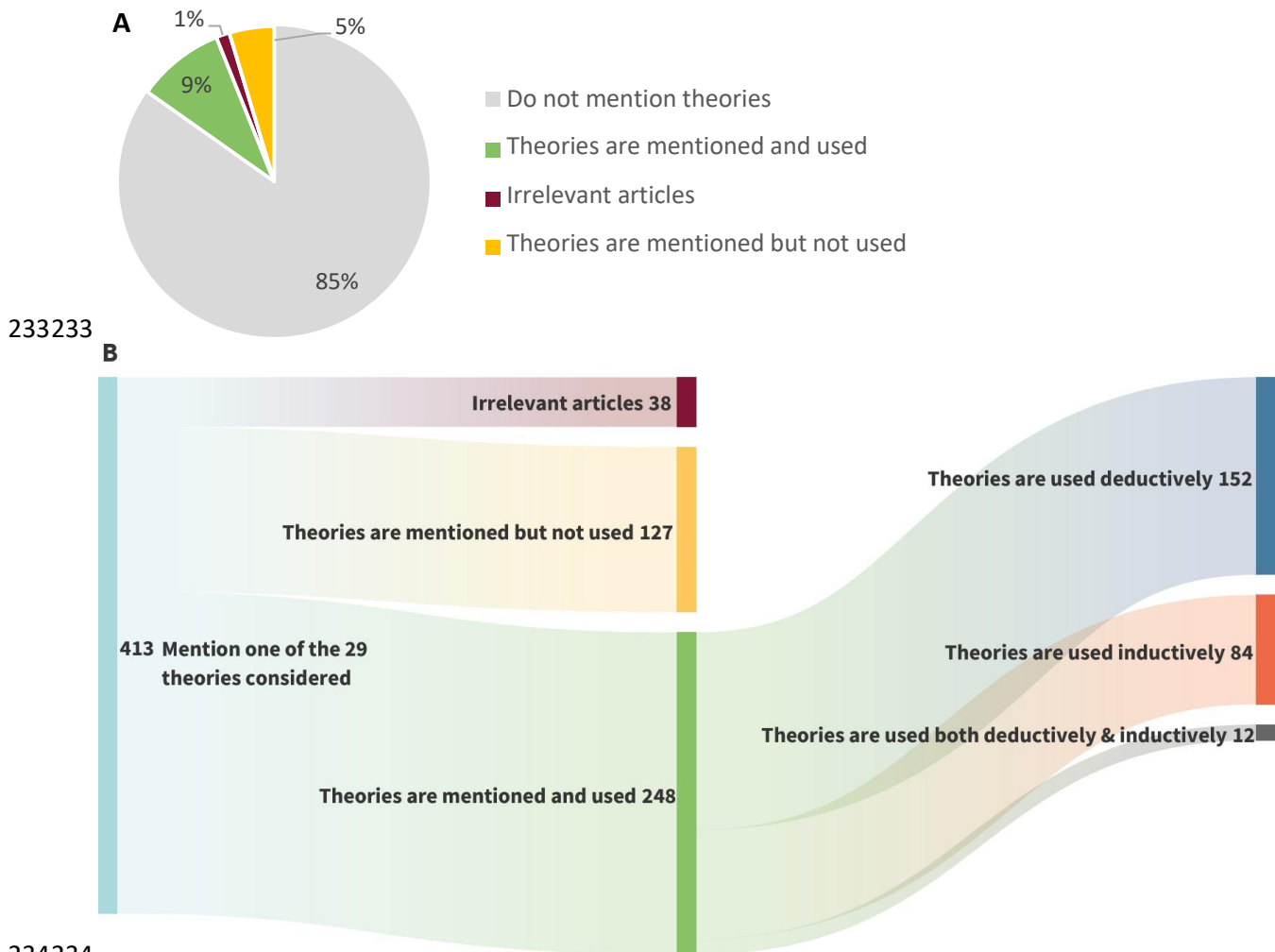
211 types, most articles addressed floods (47.9%), followed by earthquakes (27.8%) and
 212 droughts (17.0%) (Fig. 3B).



213
 214 *Figure 3. Distribution of the retrieved SVRA articles (n=2716) according to their (A) year of*
 215 *publication and (B) type of hazard addressed. Some articles tackled more than one hazard,*
 216 *totalling 3483 entries.*

217 Out of the 2716 potentially relevant articles, 413 (15.2%, 95% CI [13.8%, 16.6%]) mentioned
 218 at least one of the 29 theories investigated (i.e. theories mentioned in 5 or more articles -
 219 SM1) (Fig. 4). We considered a paper as theoretically grounded only if the authors
 220 specifically mentioned that they used or tested a theory. By manually screening these 413
 221 articles, we found that 38 were not empirical studies. Furthermore, 127 referred to
 222 theories in the text without applying or testing them. This was observed in articles that
 223 cited a theory in the introduction or the literature review sections, but the authors did not
 224 make explicit how the theory informed the empirical analysis (e.g. cases where a specific
 225 hypothesis was based on the theoretical framework or a theory informed the thematic
 226 coding).

227 Thus, only 9.1%, 95% CI [8.7%, 10.2%] (n=248) of the 2716 potentially relevant articles
 228 used theories to inform their empirical analysis and explicate the relationship between
 229 theory and empirical analysis (Fig. 4A). This implies that around 90% of the reviewed
 230 studies have no explicit theoretical underpinning. No temporal differences were
 231 observed in the use of theories (SM3), meaning that the share of theoretically-based
 232 studies did not increase over time.



234234
 235 *Figure 4. Results of the close reading screening process. (A) Distribution of the reviewed SVRA*
 236 *articles (n=2716) according to the use of theories. We considered that a study used a theory when*
 237 *the authors explicitly mentioned that they had considered a theory. (B) Sankey plot with the*
 238 *steps of the screening process.*

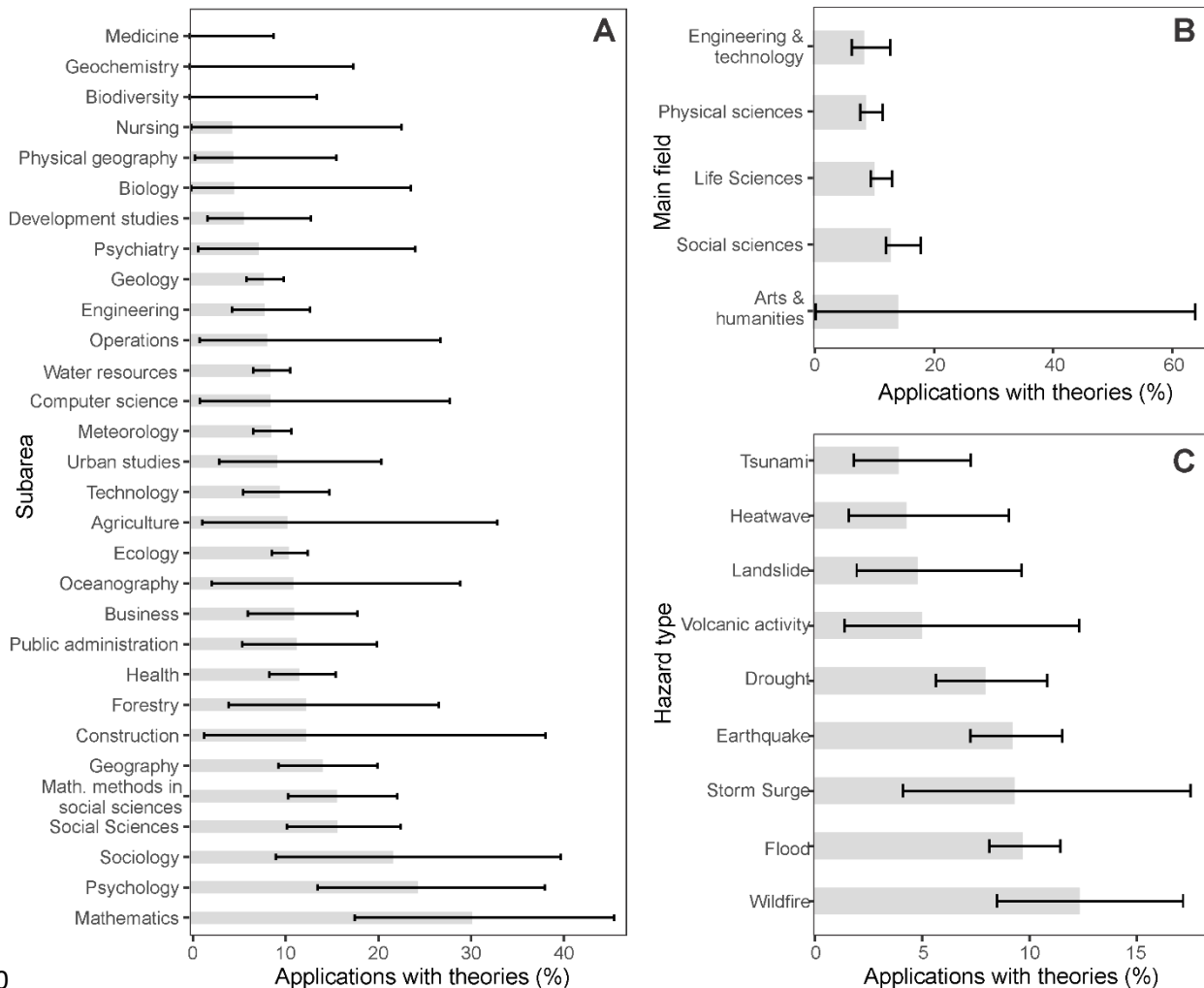
239239

240 **4.2. Use of theories in SVRA research according to different fields of knowledge and**
 241 **hazard types**

242 We compared the articles that used theories (n=248) against those which did not mention
 243 (n=2303) or use them (n=127). Results showed clear patterns in the use of the theories
 244 according to the journal' subareas of knowledge (p = 0.0004, Fisher's exact test), main field
 245 of knowledge (p = 0.0324, Fisher's exact test), and natural hazard type (p = 0.0069 Fisher's
 246 exact test) (Fig. 5). Studies published in 'Social Sciences' journals used theories more often
 247 than 'Engineering & Technology' and 'Physical Sciences' ones (Fig. 5B). In some subareas,

248 the percentage of articles that used theories was close to 0% (e.g. ‘Medicine’,
 249 ‘Geochemistry’ and ‘Biodiversity’). Conversely, articles pertaining to journals in the WoS
 250 sub-fields of ‘Mathematics’, ‘Psychology’, and ‘Sociology’ tended to use more theories
 251 (an average of 25.6%) (Fig. 5A).

252 Regarding the hazard type, we found that ‘Wildfire’, ‘Flood’ and ‘Storm surge’ studies
 253 tend to be more (explicitly) theoretically grounded. Less than 5% of the articles that
 254 address ‘Volcanic activity’, ‘Landslide’, ‘Heatwave’, and ‘Tsunami’ used one of the 29
 255 most frequent theories (SM1) to inform their empirical analysis (Fig. 5C). These hazards
 256 were often assessed using a ‘Physical Sciences’ point of view and are classified mostly
 257 with the ‘Geology’, ‘Meteorology’ or ‘Water Resources’ WoS subareas. Hence, we reason
 258 that the use of theories in SVRA research is more linked to the subarea of knowledge than
 259 the type of natural hazard investigated.



260

261 *Figure 5. Share of articles that use theories according to (A) the journal subarea of knowledge,*
262 *(B) the journal's main field of knowledge, and (C) the hazard type investigated. Since the articles*
263 *can have multiple hazards and fields, the percentage is given in terms of the number of entries.*
264 *Whisker lines show the Clopper–Pearson 95% confidence interval. To calculate the %, we*
265 *compared articles that used theories (n=248) against the sum of those that did not (127 that*
266 *mention theories but do not use them and 2303 that do not mention theories, see Fig. 1). For*
267 *clarity purposes, only sub-fields with at least 15 articles are shown in Fig. 5A.*

268 **4.3. Use of theories in SVRA research according to the theory type, research methods,** 269 **and study design**

270 This section analyses the 248 SVRA articles (Fig. 3) that used theories in-depth and
271 evaluates which theories, methods, and study design were applied. Table 1 presents an
272 overview of the theories mostly used.

273 Theories that focus on individual decision-making processes were most prevalent and
274 were used by 102 articles (Fig. 6). These include the ‘Protection motivation theory’ (PMT)
275 (n=39) and the ‘Protective action decision model’ (PADM) (n=16). Both PMT and PADM
276 use threat-based perceptions and coping appraisals, such as beliefs about the efficacy of
277 protective measures, for investigating the adoption of protective behaviours. These
278 highly individualistic approaches are often non-contextual since they usually do not
279 consider the socio-cultural context of risk (for an exception, see Strahan and Watson, 2019;
280 Noll et al., 2022). Similar to other reviews (Kothe et al., 2019), we found that the PMT and
281 PADM constructs (e.g. threat appraisal, self-efficacy) varied considerably in how they
282 were operationalised across studies (e.g. questions, scales). Therefore, even in the case of
283 articles that considered the same theory, results may be comparable only with additional
284 effort (or not at all) at identifying articles with similar operationalisation.

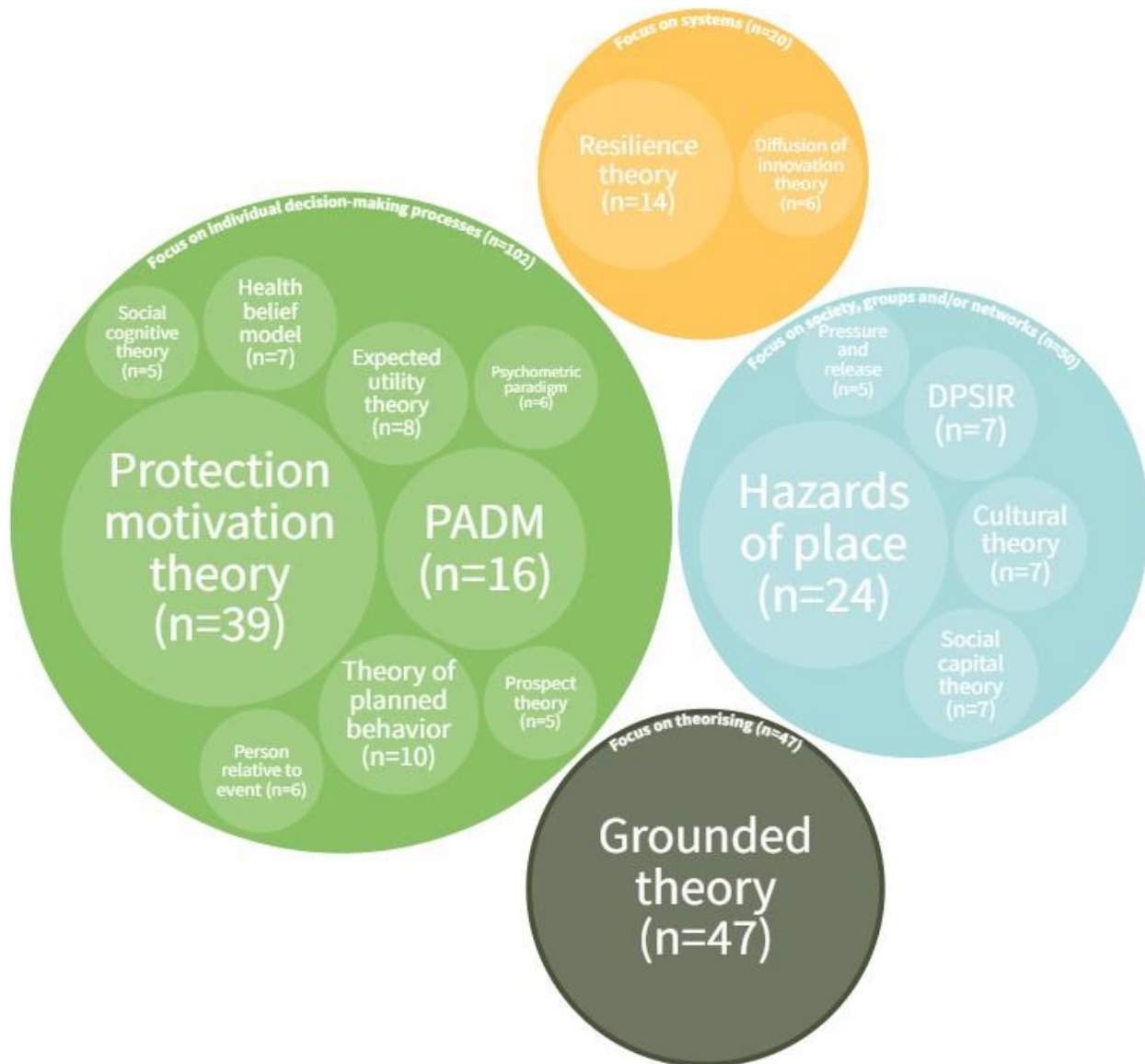
285 Theories that focus on micro and macro processes and how they are interconnected (e.g.
286 society, groups and networks) were also prevalent (n=50). Geography-related theories
287 such as the ‘hazards of place’ model (n=24), which operationalises vulnerability through
288 composite indicators, were widespread in this group. The popularity of this model can
289 be attributed to its flexibility, as multiple dimensions and data at different spatial scales
290 can be considered. Few studies used social capital and network theories (both with n=7),
291 which often focus on collective (support) behaviours before, during, and after crises.
292 Cultural theory (n=7) was used mainly inductively to interpret empirical observations on

293 disaster response driven by the risk perception of different groups (e.g. Scolobig et al.,
294 2012; Snel et al., 2019). The pressure-and-release (PAR) model was mentioned in several
295 studies (n=28). However, it was only applied in 5 articles that investigated, among others,
296 how poverty and/or other specific pressures translate into vulnerable conditions.

Table 1: Theories used at least five times in the reviewed articles grouped according to their focus and disciplinary background

Focus	Theory	Focus	Description	Discipline	N of articles that used this theory	Key reference
Individual decision-making processes	Expected utility theory	Individual	Estimates the utility of an action when the outcome is risky by weighting possible outcomes by their respective probabilities, assuming that people will choose the action or event that will provide the maximum expected utility based on an individual's risk aversion and budget constraints.	Economics	8	(von Neumann and Morgenstern, 1944)
	Health belief model (HBM)	Individual	Explains and predicts health-related behaviour, particularly healthcare utilisation using constructs such as perceived susceptibility, benefits and barriers, modifying variables, and self-efficacy.	Psychology	7	(Carpenter, 2010)
	Person relative to event (PrE)	Individual	Explains that fear-arousing or negative threat appeals predict that growing threat levels would promote problem-focused coping when resources are judged to be adequate compared to the scale of the threat.	Psychology	6	(Mulilis and Duval, 1997)
	Prospect theory	Individual	Augments expected utility theory by accounting for people valuing gains and losses differently and non-linear processing of probabilities, affecting their evaluation of risky prospects.	Behavioural economics	5	(Kahneman and Tversky, 1979)
	Protection motivation theory (PMT)	Individual	Considers how individuals process threats and choose responses to deal with the risk based on their perception of severity, probability of losses, the effectiveness of protective action, self-efficacy, and response costs.	Psychology	39	(Maddux and Rogers, 1983; Rogers, 1975)
	Protective action decision model (PADM)	Individual	Describes people's responses to natural hazards based on three core perceptions (threat, protective action, and stakeholders), information processing and situational factors.	Interdisciplinary	16	(Lindell and Perry, 2012)
	Psychometric paradigm	Individual	Explains how laypeople perceive risks by assessing risk using qualitative information such as perceptions of dreadfulness and newness.	Psychology	6	(Fischhoff et al., 1978)
	Social cognitive theory (SCT)	Individual	Considers that people learn from their own experiences and by witnessing the experiences of others, and it does so via the use of three interacting key constructs (personal and environmental factors and behaviour aspects).	Psychology	5	(Bandura, 2002)
	Theory of planned behaviour	Individual	Assumes that individual behaviour is driven by behavioural intentions, which depend on attitudes, norms, and perceived behavioural control.	Psychology	10	(Ajzen, 1991)
Societal	Pressure and release (PAR)	Society	Explores how societal structures translate into unsafe conditions. It conceptualises risk in the context of disaster and emergency and offers a framework for understanding how societal structures translate into vulnerability.	Geography	5	(Rauken and Kelman, 2010)

	Hazards of place	Society, Groups of people, places, regions	Ranks groups/places according to their vulnerability by using composite indicators. The degree to which people are vulnerable to hazards is influenced by socioeconomic variables such as income and housing qualities, as well as proximity to the potential source of the threat.	Geography, disaster studies	24	(Cutter, 1996)
	Cultural theory / Theory of plural rationality	Society	Postulates that stakeholder views about risk are plural but limited in number. The views stem from different contexts shaped by how people organise, perceive and justify their social relations. The theory argues that there are four ways of organising: hierarchy, individualism, egalitarianism and fatalism.	Anthropology	7	(Tansey and O’riordan, 1999)
	Social Capital Theory	Relationships between actors/entities	Social relationships that produce reproductive benefits are recognised as resources that can lead to the development and accumulation of human capital.	Sociology	7	(Allan Schmid and Robison, 1995)
	Driver-Pressure-State-Impact-Response (DPSIR)	Policies	It is a causal framework that describes interactions between societal response (e.g. policy choice) and environmental feedbacks.	Policy analysis	7	(Malekmohammadi and Jahanishakib, 2017)
<i>Systems</i>	Diffusion of innovation theory (DOI)	Social systems	It explains how and in which new or innovative ideas or technologies develop, diffuse, and are adopted through a population or social system over time.	Social Science	6	(Rogers, 1995)
	Resilience theory	Systems	Describes hierarchies and adaptive cycles in complex socio-ecological systems.	Interdisciplinary	14	(Holling, 2001)
<i>Theorising</i>	Grounded theory	Not specified	It is a systematic methodology that can be used to generate theories and hypotheses based on empirical data.	Sociology, social sciences	47	(Glaser and Strauss, 2017)



296

297 *Figure 6. Most commonly used theories in natural hazards SVRA studies that apply theories in*
 298 *either a deductive or inductive way. Some articles used more than one theory. For clarity*
 299 *purposes, only theories that were used by five or more articles are shown in this figure. For all*
 300 *the results, the reader is referred to SM4.*

301 Grounded theory was used quite often (n=47). This methodological procedure is
 302 prominent in qualitative interpretative research to structure the data and inform, ideally,
 303 a process of theorising. Grounded theory, thus, does not represent a theory in our
 304 understanding as it makes no assumptions about the relationship between variables and
 305 constructs. It rather allows scientists to investigate how individuals or groups define a
 306 phenomenon via their social interaction (da Silva Barreto et al., 2018). As such,

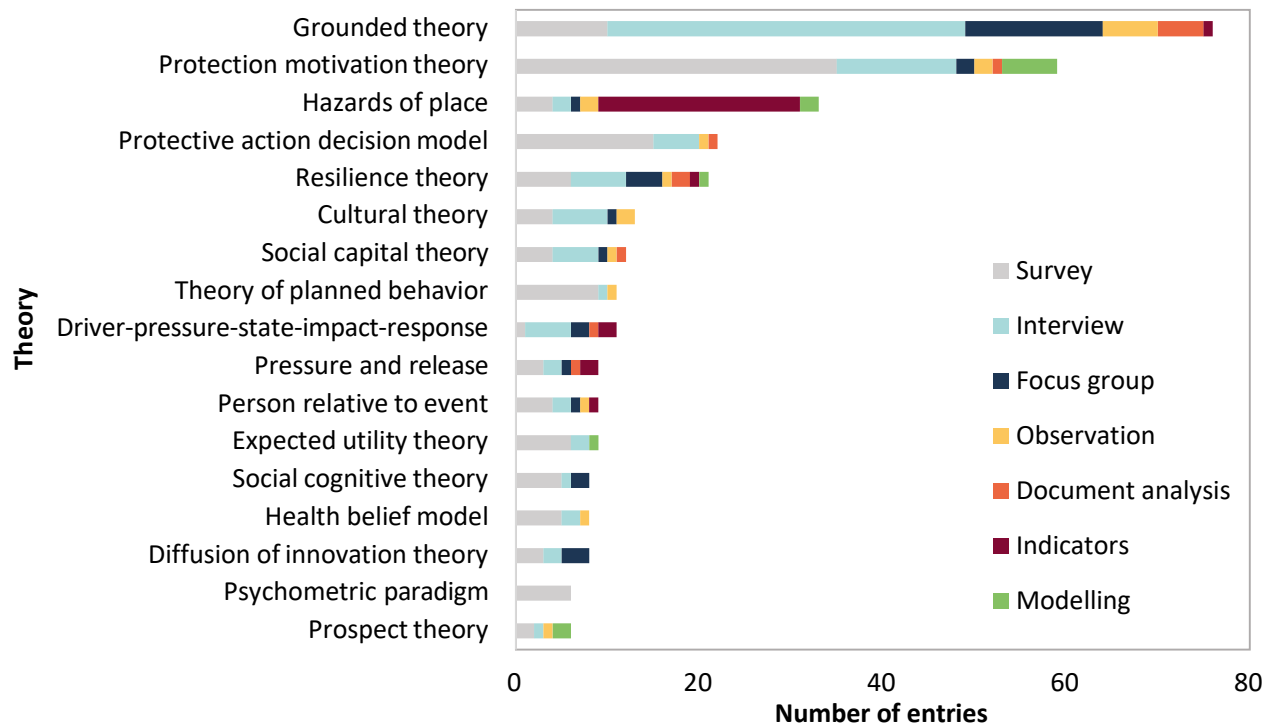
307 researchers often use this inductive approach to interpret results about individuals' social
308 and psychological aspects that shape their SVRA.

309 Few articles (n=20) have conducted in-depth analyses using theories that focus on
310 systems. For instance, MacDougall et al. (2014) applied the diffusion of innovation (DOI)
311 theory to explore how disaster mitigation measures may be spread within and across
312 communities. Besides this, resilience theory was used inductively to establish new
313 frameworks to understand adaptation to climate change (e.g. Hosen et al., 2020; Novalia
314 and Malekpour, 2020).

315 Concerning how the theories were used, we found that 152 studies used the theories
316 deductively, and 84 used them inductively (Fig. 3). Besides this, in 12 studies, the
317 theoretical insights resulted from a combination of both deductive and inductive
318 applications.

319 The methods used to collect data or assess SVRA varied according to the applied theories
320 ($p=0.0004$, Fisher's exact test) (Fig. 7). For instance, PMT and PADM articles often used
321 surveys as the main research tool. In contrast, interviews and other qualitative research
322 methods like workshops or observations were most often connected with grounded
323 theory to structure empirical data. In general, 'Surveys' (n=132) were the preferred tools
324 for almost all theories, followed by 'Interviews' (n=107), 'Focus groups or workshops'
325 (n=38), 'Composite indicators' (n=30), 'Observation' (n=26), 'Document or content
326 analysis' (n=18), and 'Computer modeling' (n=17). This suggests the intricate connection
327 between theory and empirical analysis.

328 With regard to the research design, only 9 used longitudinal and 16 (quasi)-experimental
329 designs to produce data. Longitudinal studies allow scientists to measure changes in
330 SVRA of an individual or system over time. Thus, they often have higher statistical power
331 (i.e. the power of a hypothesis test) than cross-sectional studies (Baghfalaki, 2019). The
332 advantage of (quasi)-experimental studies is that they allow scientists to control the
333 variables of interest and draw causal conclusions. The reason for the lack of longitudinal
334 studies could be that they can be expensive and time-consuming. Similarly, experimental
335 studies can require more controlled settings than traditional non-experimental cross-
336 sectional study designs.



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338 *Figure 7. Research tools applied according to different types of theories used. Some articles used*
 339 *more than one method and theory. For clarity purposes, only theories that were used by five or*
 340 *more articles are shown in this figure. For all the results, the reader is referred to the SM4.*

341 4. Discussion

342 This study systematically reviewed 4432 SVRA-related articles using both automatised
 343 text mining and close reading. In this section, we summarise and discuss our findings by
 344 referring to the guiding research questions underlying this study. Based on these, we
 345 raise reflexive questions on the role of theories in SVRA research.

346 4.1 To what extent is the theoretical underpinning of SVRA research made explicit?

347 Essentially, we can assume that all research is based on theoretical assumptions. Yet, as
 348 our analysis suggests, such assumptions are often not clearly stated, and researchers
 349 frequently use theories only implicitly and non-systematically. Only a small fraction,
 350 9.1% (n=248 out of 2716), of the reviewed studies explicitly mentioned using one of the
 351 investigated theories (SM1) to inform their empirical analysis or explain the relationship
 352 between theory and empirical analysis. This proportion remained relatively stable over
 353 time (SM2), indicating that engaging with underlying ontological or epistemological

355 oriented research fields in which “theory is the currency of [...] scholarly realm” (Corley
356 and Gioia, 2011, p. 12). However, we did not address the reasons for not explicitly
357 explaining theoretical assumptions, which requires further analysis (see section 4.6).

358 **4.2 Which explicated theories are more popular and which are less often referred to?**

359 Theories with an epistemic interest in individual decision-making processes and
360 behavioural aspects were most often used to inform the empirical analysis (n=102),
361 including PMT, PADM, Theory of Planned Behavior, Expected Utility Theory, Health
362 Belief Model, Person relative to Event, Psychometric Paradigm, Social Cognitive Theory,
363 and Prospect Theory. The majority of these studies were based on survey data.

364 Our findings suggest that methodological individualism prevails in SVRA research,
365 similar to other research fields (Jarvis et al., 2022). This means social processes are
366 predominantly analysed and explained through the lens of individual actions and sense-
367 making processes. This is presumably why the few existing quantitative meta-analyses
368 focus on the individual and primarily rely on socio-psychological theories (Bamberg et
369 al., 2017; Bubeck et al., 2018; van Valkengoed and Steg, 2019).

370 Theories focusing on collective social processes (e.g. Hazards of Place, DPSOR, Social
371 Capital, Cultural Theory and PAR) and social or socio-ecological systems (e.g. Resilience
372 Theories and Diffusion Innovation Theory) were less prominent in our sample, with 50
373 and 20 articles, respectively. Despite their low uptake, these theories have the potential
374 to provide a deeper understanding of complex relationships and processes underlying
375 SVRA. Nevertheless, they often require extensive data (Kiesling et al., 2012) or are rather
376 time-consuming to apply (MacDougall et al., 2014), which might explain why they were
377 used less often.

378 Grounded theory is a “false friend” in our sample. Although it mentions the term
379 “theory”, it is not considered a theory according to the understanding of this paper.
380 However, the high prevalence of this method for structuring and interpreting data
381 underlines the relevance of inductive qualitative research in this field.

382 **4.3 If theories are made explicit, how are they used in empirical studies?**

383 We observed a great variety of how theories are used to inform the analysis. Most studies
384 subjected to in-depth analysis followed a deductive process of producing evidence by

385 testing existing theories (n=152). In contrast, 84 studies were designed more exploratively
386 and followed an inductive research process. This implies that the prevailing focus in
387 SVRA research is on testing existing theoretical frameworks and their associated
388 assumptions rather than producing new insights through inductive reasoning (see
389 section 4.5).

390 4.4 If theories are made explicit, are there differences in their use according to the field 391 of knowledge and natural hazard investigated?

392 Clear patterns were observed in the relationship between the use of theories and the
393 journals' area of knowledge. Studies published in social sciences journals explicated
394 theories more often than studies published in the knowledge areas of engineering,
395 technology, and physical sciences. Likewise, studies in mathematics, psychology, and
396 sociology subfields used theories more often compared to other fields. These results are
397 consistent with Rufat et al. (2022) findings, which revealed that researchers in psychology
398 or sociology were 85% more likely to incorporate theories in their research design than
399 those in geography or environmental disciplines. We also found differences in the use of
400 theories across different hazards investigated. However, our findings suggest that the use
401 of theories is more strongly associated with the subarea of knowledge than the natural
402 hazard being investigated.

403 Our analysis suggests that, despite being an interdisciplinary field, theoretically explicit
404 SVRA research is associated with specific "epistemic cultures" (Cetina, 1999). Such
405 cultures influence what constitutes legitimate ways of collecting data and appropriate
406 research methods, theoretical frameworks and models. Consequently, these factors affect
407 the degree to which the findings of a study are considered a valid process of knowledge
408 production (Cetina, 1999).

409 4.5 Reasons why greater reflexivity about the role of theory in (case-study) SVRA 410 research is needed

411 Based on our findings, we argue that SVRA researchers should adopt a more reflexive
412 approach towards the role of theory in their research projects as well as in the field as a
413 whole. Before reasoning our claim, it is important to emphasise that we are not
414 advocating for theoretical homogenisation. Furthermore, we do not question demand-

415 driven studies that respond to the immediate needs of first responders and practitioners
416 (e.g. Williams and Webb 2021) nor studies that aim to enhance the capacities of vulnerable
417 groups, or those that strive to give a voice to marginalised groups overlooked in disaster
418 risk management (Hewitt, 1995). We also regard research following a case-study logic
419 (Orum, 2015) as vital for SVRA research as they provide a deep insight into social
420 phenomena and offer contextual insights that allow researchers to draw relevant
421 conclusions (Ruzzene, 2012).

422 With this in mind, we argue that the abundance of empirical material in SVRA research
423 that lacks consistent explicit theoretical reference systems is objectionable (Ridder, 2017).
424 As a result, SVRA research seems to spin in circles: researchers repeatedly conduct similar
425 analyses in different geographical settings with inconsistent or incommensurable
426 findings. Therefore, we contend that explicit engagement with theories in SVRA research
427 is required to ensure studies' (1) transparency, (2) incremental or revelatory
428 advancements, (3) comparability of findings, and (4) thus informing and influencing
429 decision-making processes on the policy level.

430 (1) The explicit use of theories reduces ambiguities and contributes to transparency

431 Whether explicated or not, theories influence the research design, including deciding
432 which variables are elicited and how data are collected, analysed and interpreted.
433 Explicitly referring to a theory/theories can help readers understand why scholars focus
434 on specific SVRA aspects or why they chose certain factors (and, by doing so, exclude
435 others). Making theoretical considerations salient thus supports understanding design
436 choices in the empirical analysis and opens them up for scrutiny. In this sense, explicitly
437 stating assumptions contributes to transparency. The documentation of empirical
438 strategies and the underlying theoretical considerations is a precondition for further
439 developing findings and evaluating their worth; it is the basis for evaluating the quality
440 of research processes and results by disciplinary peers and experts from other scientific
441 branches. The theory documentation deficits outlined in our analysis hamper the
442 productive development of SVRA research: If we aim to reduce the conceptual ambiguity
443 and the Babylonian babble of voices in SVRA research (Vogel, 2006), striving for inter-
444 subject comprehensibility based on shared theoretical frameworks seems vital.

445 (2) The explicit use of theories ensures a productive development of SVAR studies

446 Theories support “incremental” as well as “revelatory” scientific advancements (Corley
447 and Gioia, 2011). The role of theories is multifarious since there are different theory-
448 grounded strategies for producing knowledge (Lange et al., 2021). Following a *deductive*
449 *research* logic, one ideally departs from an existing theoretical framework and specifies
450 hypotheses, variables, and survey questions, typically similar to past studies with
451 comparable theoretical backgrounds. Such a single-theory strategy aims to test how well
452 a specific theory explains the phenomena of interest (e.g. adaptive behaviour).

453 However, there may be situations where expanding the theoretical basis and following a
454 multi-theory strategy that merges different theoretical frameworks or adds certain
455 variables is necessary. Reasons include cases in which a theory only covers specific
456 aspects of the study and/or it is known that the theory can only partially explain the
457 statistical variance of an observed phenomenon (see Bamberg et al., 2017 for PMT).
458 Additionally, practical reasons may arise where a study inspired by a single theory might
459 not provide the answers that scientists or practitioners are interested in. Therefore,
460 including additional variables or factors reflecting the interest of practitioners and
461 researchers might be desirable. However, merging theories should be done in a
462 systematic and cautious manner to ensure epistemological and/or methodological
463 consistency and comparable results (Klößner, 2013; Klößner and Blöbaum, 2010). Both
464 single and multi-theory strategies contribute to the cumulative understanding of the
465 underlying social phenomena and thus support incremental advancements.

466 In contrast to deductive reasoning, *inductive approach* is more open and exploratory.
467 Within this context, there are different views on which role theories should play in
468 informing research. For instance, the initial conceptualisation of grounded theory
469 required researchers not to rely on any pre-existing theoretical work in their qualitative
470 research, as the research focus would emerge from the empirical data itself (Glaser, 1992).
471 However, a later conceptualisation of grounded theory argues that *all* research is based
472 on prior knowledge (e.g. research interests, published literature, thematic focus, implicit
473 or explicit assumptions). Therefore, it is crucial to explicate such knowledge, including
474 the theories informing qualitative research (Strauss and Corbin, 1996).

475 Inductive research can be the basis for transformative research findings as such a strategy
476 helps reveal patterns that may not be explicitly articulated in existing theoretical
477 formulations. By carefully observing and analysing qualitative data such as interviews,

478 researchers can develop hypotheses that can be used to guide further research (Wilson
479 and Chaddha, 2009). Eventually, inductive research may lead to the process of theorising
480 (i.e. a reflexive process of abstraction) (Weick, 1995), resulting in new models,
481 frameworks or theories that provide a “novel or counterintuitive perspective that
482 questions assumptions underlying the prevailing theory” (Corley and Gioia, 2011). If
483 such a transformative perspective provides a novel perspective on a phenomenon
484 presumably well understood, it might become the new prevailing theoretical frame.
485 Within SVRA, for instance, the concept of social vulnerability emerged in response to a
486 increasing dissatisfaction with the, at that time, “prevailing scientific view” (Hewitt,
487 1983) –the hazard research paradigm (White, 1974). Through a process of iterative
488 theorising, scholars designed alternative theoretical frameworks resulting eventually in
489 the concept of social vulnerability (Watts and Bohle, 1993).

490 **(3) The explicit use of theories can enhance studies' comparability**

491 Referring to a theoretical framework enables comparing studies conducted in different
492 geographical settings and, by doing so, drawing more general conclusions. This is the
493 basis for developing robust evidence on SVRA (Kuhlicke et al., 2020; Rufat et al., 2020).
494 For standardised research, a shared theoretical framework associated with comparable
495 operational procedures provides the basis for conducting a quantitative meta-analysis to
496 identify relevant determinants shaping SVRA across different studies (van Valkengoed
497 et al., 2021). Also, an explication of theoretical assumptions is vital for the comparability
498 of case study research. It provides a frame for whether findings from case studies
499 conducted in different contexts are comparable, thus drawing general conclusions
500 beyond their immediate contexts (Ruzzene, 2012). Improved comparability then implies
501 a more systematic identification of research gaps, reduction of redundancy across studies,
502 and risk of “dead-end research endeavours” as well as a more straightforward synthesis
503 of findings from large bodies of empirical literature.

504 **(4) The explicit use of theories can support better evidence-based policy** 505 **recommendation**

506 The relatively low degree of studies with an explicit theoretical grounding also impacts
507 how science feeds into policy-making processes. The lacking theoretical basis for
508 ensuring the comparability of research outcomes (Kellens et al., 2013; Lechowska, 2018;

509 Rufat and Botzen, 2022) not only complicates the development of robust evidence base in
510 SVRA research but it can also be challenging to distil a clear-cut message from science to
511 stakeholders, especially for decision-making processes (Fünfgeld et al., 2019; Rufat et al.,
512 2020). This results in a paradox: while SVRA concepts and vocabulary have strongly
513 infiltrated the policy-making arena, the theoretical basis for providing evidence-based
514 policy-recommendation from within this field is rather fragile. This might not just
515 undermine the scientific originality of SVRA research but also deteriorate its capacity to
516 inform and shape policy-making processes over time.

517 **(5) The choice of theories can have practical and political implications**

518 Theories also have practical and political implications as they shape our understanding
519 of both the causes and effects of a disaster. In line with the concept of “the naturalness
520 out of natural disaster” (O’Keefe et al., 1976), SVRA aims at unravelling social, economic,
521 political and cultural root causes of disasters rather than attributing them solely to natural
522 or climatic forces. By prioritising the study of the societal drivers of a disaster, we are
523 better equipped to identify which decisions and policies led to them and, thus, hold
524 institutions and specific actors accountable (Kuhlicke et al., 2016; Kuklicke and Demeritt,
525 2016; Ribot, 2022).

526 **4.6 How to move forward?**

527 The question of whether it is desirable, meaningful or possible to establish an agreement
528 on research standards for theory use in SVRA remains open, given the sheer number of
529 disciplines involved. Therefore, instead of providing such a standard, we outline here
530 relevant factors that might support a more explicit and reflexive engagement with
531 theories in this research field.

532 One of the questions left open by this study is: Why did the authors of the investigated
533 studies hardly mention or use theories in their analyses? Our findings suggest that
534 disciplinary cultures might be a reason. Students are differently exposed to theoretical
535 debates in SVRA research, resulting potentially in a lacking awareness of and knowledge
536 about the relevance and meaning of theories in studying social phenomena. We,
537 therefore, consider it vital that disciplinary and interdisciplinary university programmes
538 become more explicit about the relevance of theories in SVRA studies.

539 The field's publication culture might also be of importance. By scanning the “aims and
540 scope” sections of leading journals in the field (see SM3), we found that only a few
541 journals encourage theoretical contributions, and none of them explicitly states the role
542 theory should play in submissions. Thus, journals could help raise awareness among
543 researchers by emphasising that theoretically informed studies are welcome.

544 Finally, we should not neglect the impact of project-based research funding schemes on
545 the use of theories. The pressure to design, conduct and publish over short periods
546 favours reproducing past research designs and following the lowest friction slope to
547 jump to actionable results. Furthermore, agencies funding applied projects often (1) foster
548 collaboration with practitioners, less acquainted with the theoretical background, (2)
549 value the societal relevance of the research and practical impact more than rigorous
550 science (and theory building), (3) encourage collaboration of researchers from different
551 fields with potentially conflicting traditions and theories, and/or (4) promote the
552 opportunistic involvement of researchers with less expertise in the field but related
553 expertise and skills required in other project aspects. As a result, theoretical debates
554 might be considered counterproductive and therefore skipped or kept in the background.
555 We, therefore, strongly believe that funding agencies and researchers should reflect on
556 the decisive role of theory in applied research, which should not be considered a “residual
557 category”.

558 **5. Limitations**

559 In this article, we draw from an initial sample of 4432 SVRA-related articles to understand
560 how theories are used in this field of research. Our goal was to underscore general
561 patterns and trends. Given the sheer number of articles, several generalisations were
562 made, influencing the results.

563 First, we considered only theories mentioned by 5 or more articles (SM1). As a result, 52
564 articles that mention 60 other theories were not read in detail. However, by scanning the
565 name of these theories (SM1), it is possible to observe that they often focus on individuals
566 (e.g. construal level theory, precaution adoption process model, social identity model),
567 confirming the overall trend in this field of research.

568 Second, when reading the articles (n=413), we observed that several of those tagged as
569 “do not use a theory” (n=127) seemed to be inspired by or even tested a theory. However,

570 the use of a theory was not explicitly mentioned. The lack of explicit references to theories
571 is both a finding and a limitation: We, as readers, are limited to what can be directly
572 understood from the papers. For the articles without an explicit reference to a theory, we
573 could only know with certainty if the author used a theory by interviewing them.

574 Third, we classified the articles in a binary fashion (i.e. theory use or no theory use).
575 However, there is a continuum between “theory mentioned as broad inspiration” and
576 “the study design is strongly based on established theoretical constructs”. In this regard,
577 we should emphasise that using theories *in any way* is not necessarily better than not
578 using them at all.

579 Fourth, we only focused on articles included in WoS. However, many SVRA studies are
580 also published in grey literature, as book publications, in other languages, or in unlisted
581 scientific journals. While this body of literature is relevant for this field of research,
582 particularly in an applied context, we expect a lower degree of explicit theory uptake than
583 in reviewed academic literature.

584 Finally, as with any systematic literature review (Vanelli et al., 2022), we may have missed
585 relevant articles due to the terms used for the search and the fact that we considered only
586 those mentioned in the abstract, title and keywords. Indeed, relevant articles which deal
587 with the consequences of these hazards (e.g. migratory crises, food shortage, water
588 scarcity) were ignored in cases where the hazard was not explicitly cited. These aspects
589 should be considered as a qualifying boundary condition of our findings.

590 **6. Conclusion**

591 In this review, we explored the role of theories in SVRA research by systematically
592 scanning 2716 and reading 413 articles to understand overall trends and patterns. Our
593 analysis reveals that a relatively small proportion of articles explicitly articulate their
594 theoretical underpinning. Among articles with an explicit theoretical framework, most
595 follow the idea of methodological individualism. Based on our findings, we argue for a
596 more reflective handling of theories in empirical SVRA research. The absence of a
597 theoretical basis not only undermines the development of a more robust evidence base in
598 SVRA research, but also hampers the generation of policy recommendations. Our call for
599 a more explicit engagement with theories is not aimed at promoting theoretical
600 homogenisation. On the contrary, we firmly believe that a greater diversity of theoretical

601 frameworks applied and developed further in SVRA research is vital for ensuring the
602 originality and relevance of future studies.

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Supplementary material (SM)

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850 *SM1: List with the 186 theories searched and the number of articles that mention them. Theories*851 *that were mentioned in less than five articles were not included in our analysis.*

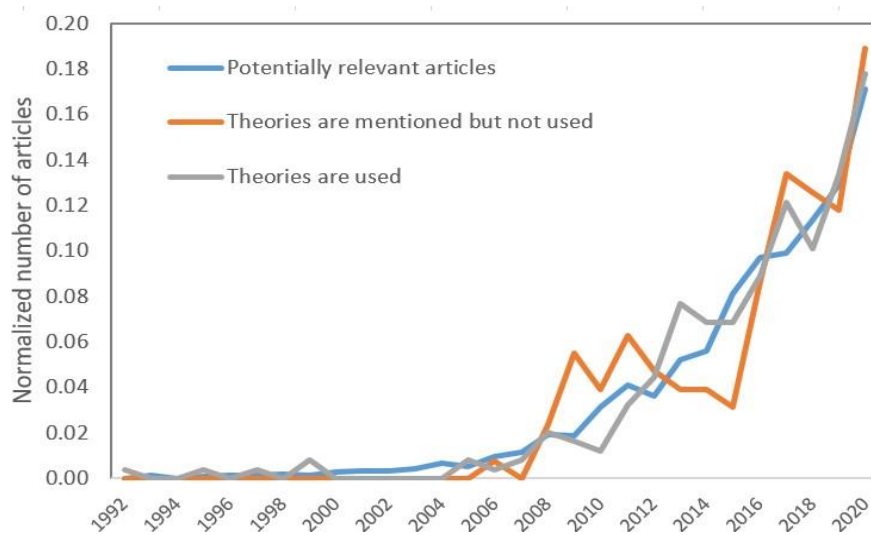
Theory	N of articles	Theory	N of articles
protection motivation theory	77	behavioral priming theory	0
grounded theory	53	behavioral reasoning theory	0
protective action decision model	38	behavioral spillover theory	0
hazards of place	36	behaviorism	0
pressure and release	33	ceos theory	0
resilience theory	30	classical conditioning	0
person relative to event	26	cluster theory	0
cultural theory	25	cognitive hierarchy theory	0
psychometric paradigm	23	com b system	0
theory of planned behavior	23	common pool resource theory	0
social theory	20	communityattachment theory	0
event theory	18	conflict orientated policy theory	0
expected utility	17	connectionism	0
dpsir	15	consumption as social practices	0
social cognitive theory	14	containment theory	0
social learning theory	14	conventional risk theory	0
theory of reasoned action	14	differential association theory	0
prospect theory	13	dynamic field theory	0
health belief model	12	early systems theory	0
systems theory	10	environmental conflict theory	0
diffusion of innovations theory	8	environmental scarcity theory	0
network theory	7	expectancy disconfirmation theory	0
property level protection	7	extended information processing model	0
social capital theory	7	feedback intervention theory	0
bounded rationality	6	fogg behavior model	0
social amplification of risk framework	6	forensic investigations of disaster	0
structuration theory	6	goal directed theory	0
transtheoretical stages of change model	6	goal framing theory	0
game theory	5	habitual behavior	0
complexity theory	3	hazard preparedness theory	0
construal level theory	3	health behaviour goal model	0
narrative theory	3	health behaviour internalisation model	0
precaution adoption process model	3	health promotion model	0

social identity model	3	implementation theory	0
theory of social practices	3	inequalities norms capabilities	0
social vulnerability theory	2	information motivation behavioural skills model	0
organisational field theory	2	instance based learning theory	0
actor network theory	2	integrated theory of health behaviour change	0
attribution theory	2	integrative model of behavioural prediction	0
bayesian updating	2	integrative model of health attitude	0
complex systems theory	2	interdependence theory	0
environmental justice theory	2	kasperson s ecological model	0
goal setting theory	2	lead user theory	0
health action process approach	2	model of pro environmental behaviour	0
panarchy theory	2	motivation intention volition	0
rational choice theory	2	motivation opportunities abilities model	0
social representation theory	2	needs opportunities abilities model	0
sociological theory	2	neural networks theory	0
adaptive comfort theory	1	nudge theory	0
agency theory	1	one shot decision theory	0
attitude behaviour context model	1	operant conditioning theory	0
behavior change model	1	operant learning theory	0
behavioral theory of decision	1	pressure system model	0
behavioural decision theory	1	prime theory	0
broaden and build theory	1	problem behaviour theory	0
cognitive adaptation theory	1	prototype willingness model	0
cognitive dissonance theory	1	rank dependent expected utility	0
collective action theory	1	real options value analysis	0
control theory	1	reflective impulsive model	0
cybernetics theory	1	regret theory	0
ecosystem theory	1	regulatory fit theory	0
expectancy theory	1	reinforcement learning theory	0
extended parallel processing	1	resource dependence theory	0
focus theory of normative conduct	1	risk as feelings theory	0
free trade theory	1	risk reduction model	0
gender theory	1	self control theory	0
institutional economics	1	self determination theory	0
knowledge product evaluation	1	self regulation theory	0
learning and action alliance	1	signal detection theory	0
model of action phases	1	situational crisis communication	0
modernisation theory	1	six staged model of communication effects	0
non-linear structural theory	1	social action theory	0
norm activation theory	1	social change theory	0

organisational field theory	1	social choice theory	0
person in context model	1	social consensus model of health education	0
portfolio theory	1	social development model	0
social exchange theory	1	social ecological model of behaviour change	0
social influence model	1	social norms theory	0
socio cognitive theory of information systems	1	systems model of health behaviour change	0
stakeholder theory	1	technology acceptance model	0
structural reliability theory	1	temporal self regulation theory	0
structural theory of social influence	1	theory model of consumption	0
structure issue time	1	theory of change model	0
subjective expected utility	1	theory of delay discounting	0
theory of bounded rationality	1	theory of governmentality	0
theory of climate communication	1	theory of institutionalised culture	0
theory of purity and order	1	theory of interpersonal behaviour	0
trade dependency theory	1	theory of normative social behaviour	0
value belief norm theory	1	theory of triadic influence	0
adaptive resonance theory	0	transaction cost theory	0
affective events theory	0	transcontextual model of motivation	0
behavioral agency theory	0	unified theory of acceptance	0
behavioral portfolio theory	0		

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853 *SM2: Normalised number of SVRA articles according to the use of not of theories.*



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855 *SM3: Top 20 journals with the highest number of SRVA articles and the % of articles that mention*
 856 *theories.*

Journal	Total N of articles	Do not mention a theory (%)	Mention a theory (%)
<i>International Journal of Disaster Risk Reduction</i>	289	88.6	11.4
<i>Natural Hazards</i>	236	85.6	14.4
<i>Sustainability</i>	72	83.3	16.7
<i>International Journal of Envir. Research and Public Health</i>	63	82.5	17.5
<i>Disaster Medicine and Public Health Preparedness</i>	63	93.7	6.3
<i>Disasters</i>	56	89.3	10.7
<i>Natural Hazards and Earth System Sciences</i>	54	75.9	24.1
<i>Disaster Prevention and Management</i>	48	79.2	20.8
<i>Regional Environmental Change</i>	47	85.1	14.9
<i>Risk Analysis</i>	46	58.7	41.3
<i>Climatic Change</i>	41	92.7	7.3
<i>Global Envir. Change-Human and Policy Dimensions</i>	37	62.2	37.8
<i>Environmental Hazards-Human and Policy Dimensions</i>	37	83.8	16.2
<i>Natural Hazards Review</i>	37	83.8	16.2
<i>International Journal Of Disaster Risk Science</i>	36	80.6	19.4
<i>Ecology And Society</i>	35	74.3	25.7
<i>Environmental Science & Policy</i>	34	79.4	20.6
<i>Climate And Development</i>	33	90.9	9.1
<i>Applied Geography</i>	31	90.3	9.7
<i>Water</i>	28	89.3	10.7

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