Planetary health security?: critical scoping review of conceptual linkages between 'health security' and 'planetary health'

Max D LÓPEZ TOLEDANO[1], Amanda LOW[1], Matthew AVISO[1], LAM Sze Tung[1,2], Katrina JACINTO[3], Mishael HYAT AYUB[4], Natasha HOWARD[1,2]*

[1]Saw Swee Hock School of Public Health, National University of Singapore and National University Health System, 12 Science Drive 2, 117549, Singapore.

[2]London School of Hygiene and Tropical Medicine, Dept of Global Health & Development, 15-17 Tavistock Place, London, WC1H 9SH, United Kingdom.

[3]Faculty of Arts and Social Sciences, National University of Singapore, 5 Arts Link, 117570, Singapore.

[4]Division of Social Sciences, Yale-NUS College, 6 College Ave West, 138527, Singapore.

*Corresponding author.

EMAIL (ORCID)

MDLT: maxlopez@nus.edu.sg (0009-0004-1843-8972)

AL: alpt@nus.edu.sg (0000-0003-4053-2426)

MA: mbaaviso@nus.edu.sg (0009-0006-1753-4481)

LST: Sze-Tung.Lam1@alumni.lshtm.ac.uk (0000-0001-6033-262X)

KJ: katrina@nus.edu.sg (0009-0006-9770-1488)

MHA: mishael@u.yale-nus.edu.sg

NH: natasha.howard@nus.edu.sg (0000-0003-4174-7349)

WORDS

Abstract: 242; Narrative: 5,6673; Total: 8,977

DECLARATIONS

Author contributions

MDLT and NH conceptualised the study. MDLT developed the search syntax, with inputs from AL and a university librarian, and conducted database searches. All authors contributed to title/abstract and full-text screening. MDLT, MA, and AL coded and analysed data and drafted the initial manuscript, with critical revisions by NH. All authors contributed to critical review and approved the version for submission.

Funding

Data collection and analysis were funded by NH's Singapore MOE Tier 1 grant (A-0006103-00-00).

Conflicts of interest

None declared.

ABSTRACT

Background

'Health security' — the subjection of health to 'security' frameworks — and 'planetary health'— the study of human health impacts of the degradation of planetary ecosystems — have emerged in the last decades as prominent global health fields. However, limited literature connects them, particularly incorporating critical perspectives. We explored interactions between these approaches conceptually, institutionally, and empirically, aiming to chart a conceptual genealogy of these interactions.

Methods

We conducted a scoping review using Arksey and O'Malley's method and Levac's revisions, exploring the health, security, and ecology literatures. We identified 75 eligible sources of 10,352 screened and synthesised findings inductively using Braun and Clarke's thematic approach.

Findings

We generated five themes across these literatures: (1) environmental health as security issue; (2) biosecurity and non-traditional security; (3) institutional connections; (4) militarisation and environmental health; and (5) emerging risk-management methods and technologies. We found multiple descriptions of environmental health as 'crisis' and 'security' issue, yet health security's scope was primarily limited to containing emerging infectious diseases, rather than prevention or broader health concerns.

Conclusion

This initial exploration across disciplinary literatures of conceptual interactions between planetary health and health security showed both mobilising the language of 'security' to frame health issues, while raising concerns over inequitable experiences for some populations resulting from this framing. An overt emphasis on

containment over prevention and tacit commitments to the protection of some lives over others could result in asymmetrical health experiences, rendering some geographies and populations 'sacrificial' in their health risks.

Key words

Securitisation, global health, One Health, health security, biosecurity.

BACKGROUND

As the world pivots from Covid-19 amidst speculation regarding the next pandemic, microscopical agents are increasingly perceived as major threats with the potential to destabilise 'peacetime' and social normalcy, especially in parts of the world where "a feeling of insecurity arises more from worries about daily life than from the threat of war or conflict" [1]. Global 'security' efforts have become unprecedentedly attentive to public health, accounting for the emergence of the fields of 'health security' and 'global health security' over the last three decades [2]. Broadly, these refer to the framing and treatment of public health emergencies as 'security' matters, subject to processes that social scientists refer to as 'securitisation' [3]. This trend has developed at a global scale and has largely established itself as norm in the global health field, as demonstrated by the list of over 70 countries that signed onto the Global Health Security Agenda (GHSA), initially developed by 44 countries in 2014 [4]. Common dimensions of securitised approaches to health include the socio-cultural construction of diseases as political enemies [5], restrictions to mobility within and across national borders based on epidemiological concerns [6], [7], the decoupling of healthcare and health surveillance [8], the involvement of military actors in provision of public health [9], and the reallocation of resources from health systems to emergency health response [10].

Conversely, the field of 'planetary health' has gained prominence in the global health imagination over the last decade, based on the premise that "population health and the continuity of human civilization depend on the integrity—the health—of the Earth's life-support systems" [11]. Comparable — but not equivalent — to the notion of 'One Health' and many Indigenous notions of ecological interdependence between humans and all beings, planetary health has surfaced as a conceptual heuristic to think about the environmental conditions required to sustain human health, with a scope best summarised by Anderson [12]:

> *"Planetary Health, systemically and at global scale, has emphasized the impact on human population health of the degradation of planetary ecosystems, principally through anthropogenic global heating,*

leading to extreme heat events, bushfires, drought, flooding, destruction of arable land, freshwater shortages, rising oceans, and the range expansion of vectors of infectious diseases."

The contemporary importance of planetary health thinking in global health discussions cannot be overstated. Ecological forces such as extreme weather, water scarcity, and shifting disease vector geographies are increasingly framed as health determinants [13], with their severity only expected to grow due to anthropogenic climate change. From a health security standpoint, understanding the Earth's capacity to sustain life at a systemic level is crucial not just for the health and wellbeing of populations but also to prevent and mitigate any potential 'collapse' of society [14]. Given that health security is concerned with the dimensions of health through which the social order may be compromised and that the interdependence of human civilisation with environment has been demonstrated [15], understanding how 'health security' and 'planetary health' co-exist, co-produce, and contradict each other is particularly important.

However, these two fields have developed in parallel, with minimal conceptual interactions between them [16]. Critical perspectives have cross-pollinated even less, despite an emphasis in critical security studies on questioning the genealogical makeup of 'security' concepts [17] and an imperative in the field of political ecology to "examine power relationships and question mainstream claims about environment and development" [18]. The proliferation of concepts rooted in the field of 'security', after all, may implicitly or explicitly normalise inequitable and/or imperialist narratives, as reflected in growing scholarly concerns over health security reproducing what Besteman calls "security imperialism", ultimately referring to how implementation of 'security' measures across various domains of social life typically "prioritize the extractive objectives of political and economic elites" [19], [20], [21]. Of particular concern is the notion that subjecting health to securitisation processes translates to an unequal concentration of resources to secure privileged populations during crises, while doing little to protect most of the global population or address

the causes of risk [20]. Thus, investigating health security - as a field associated to broader 'security' narratives, demands a stance of 'criticality', that is "a self-conscious posture and attention to 'the way different kinds of linguistic, social, political and theoretical elements are woven together in the process of knowledge development" [22]. Understanding how health security, as global health norm, interacts with global ecologies, and whose interests it might explicitly or implicitly represent in the process, becomes increasingly important, as is understanding what the world that health security works to build looks like, in its capacity as world-making project [23].

We aimed to explore how 'health security' and 'planetary health' approaches interact and map onto each other in a world where 'health,' 'security,' and 'ecology' are all partial outputs of human design. Objectives were to: (i) summarise the scope of existing literature encompassing health, security, and ecology; (ii) synthesise findings related to the conceptual, institutional, and empirical connections or conflicts between these concepts and the principles, actors, or processes connecting health, security, and ecology; and (iii) identify related power asymmetries embedded in the conceptual interactions between health security and planetary health.

METHODS

Study design

We conducted a scoping review using Arksey and O'Malley's [24] method with Levac's [25] revisions. Table 1 provides study definitions.

Table 1. Study definitions

Health security	"Global public health security is defined as the activities required, both proactive and reactive, to minimise the danger and impact of acute public health events that endanger people's health across geographical regions and international boundaries." [26]

Political ecology	"Political ecology refers to the study of power relationships and how they shape and are shaped by interactions with the environment, particularly in the context of issues such as water allocation, land management, and deforestation. It emphasizes the connection between political and economic systems and their impact on the environment, particularly in developing countries." [27]
Planetary health	"Planetary Health is a solutions-oriented, transdisciplinary field and social movement focused on analysing and addressing the impacts of human disruptions to Earth's natural systems on human health and all life on Earth." [28]
Criticality	"Criticality is a self-conscious posture and attention to 'the way different kinds of linguistic, social, political and theoretical elements are woven together in the process of knowledge development, during which empirical material is constructed, interpreted and written.'" [22]

Stage 1. Defining the research question

Our research question was: "How do 'health security' and 'planetary health' interact conceptually, institutionally, and empirically, and what insights might critical perspectives on these interactions offer?"

Stage 2. Identifying relevant sources

First, we searched 5 relevant electronic databases (i.e. CINAHL, GreenFile, Medline, Scopus, Web of Science) on 31st May 2024, using terms and related terminology for 'security,' 'health,' and 'ecology' adapted to subject headings for each database. Given the absence of literature directly linking 'health security' and 'planetary health,' we searched using broad conceptual abstractions to also include indirect and conceptual connections. Thus, terms included in title, abstract, or key words were "(security OR securitiz* OR securitis* OR secur* OR militar*) AND (health OR medic* OR wellbeing OR illness OR disease) AND (ecology OR planetary OR OneHealth OR anthropocene OR ecocide OR capitalocene OR plantationocene OR chthulucene OR ecosystem OR plantations OR climate)."

Stage 3. Selecting studies

Table 2 shows our eligibility criteria, established iteratively based on the research question and with lines of inclusion/exclusion based on thematic relevance. All source types, time-periods, study designs, and languages were considered if full-text was accessible. After download and deduplication using EndNote software, all authors screened titles and abstracts against eligibility criteria to remove irrelevant documents. Authors then screened remaining full texts against eligibility criteria to identify the total documents for study inclusion. We resolved discrepancies through discussion and consensus.

Table 2. Eligibility criteria

Criteria	Included	Excluded
1. Context	• Global health security is used to contextualise the paper and then linked to some aspect of planetary health's conceptual scope.	• Participant recruitment was conducted in military settings, but security concerns are out of study scope.
2. Topic	• Discusses all of 'health,' 'security', and 'ecology (or associated terminology) while at least one of these is referred to as a social or historical process, system, or design to which human agency is attributed. • Discusses impacts of military/industrial activity (eg, armed conflict, military bases) on environmental health. • Ecological concerns that are not related to climate change are discussed but do refer to broader human relationships with Earth's life systems (e.g., soil health and contaminants as result of industrial or military activity).	• 'Security' is broadly used referring to 'safety,' 'guarantee', or 'protection' in general. • 'Refers to 'environmental/food/water security' but not 'health security.' • Refers to One Health and examines human-animal interactions without contextualising these in social and/or ecological systems or historical contexts.

	• Refers to health-related technologies that are designed to adapt to changing environmental conditions and are linked with immediate security purposes or vocabulary. • Refers to health-related technologies designed to adapt to changing environmental conditions and are immediately linked with 'security.' • Refers to Global Health Security as a tangible agenda, index, or political body explicitly in relation to Earth's life support systems. • Health security or biosecurity is discussed causally as a reason for changing health and/or environmental systems, or vice versa.	• 'Environment,' 'ecosystem', 'ecology' or related vocabulary does not refer to Earth's life support systems but merely to a given "setting" or "context". • Military research on environmental adaptations that do not discuss ecological processes related to Earth's life support systems.
3. Outcomes	• NA	• NA
4. Source type	• Primary literature sources (e.g. research-based scholarly journal articles, theses/ dissertations, reports, symposia/ conference abstracts including primary or secondary data). • Secondary literature sources (e.g. literature reviews if primary sources are not already included). • Commentaries/editorials including primary or secondary data. • Reports and book chapters including primary or secondary data.	• Tertiary sources with no primary or secondary research data (e.g. encyclopaedias, dictionaries, handbooks, legal/guidance documents). • Audio/video reports. • Conference abstracts covering the same material as an available publication. • Social media, blogs, media articles.
5. Time-period	• All up to 31st May 2024	• NA
6. Language	• All	• NA
7.Study design	• Any	• NA

8. Participants	• Any	• NA

Stage 4. Extracting (charting) data

Three of the authors used Covidence software to extract data to Excel spreadsheet categories of: (i) source identifiers (i.e. study authors, publication year, title, language); (ii) source characteristics (i.e. academic discipline, countries included, research question, study design, participants); and (iii) findings (i.e. 'security' definitions, attribution of human agency to ecological systems, incorporation of critical perspective, and lessons described).

Stage 5. Synthesising and reporting

First, we summarised the scope (i.e. extent, nature, distribution) of eligible sources. Second, we synthesised source findings inductively, using reflexive thematic analysis as described by Braun and Clarke [29]. Third, all authors discussed potential implications to identify central themes, points of argumentative tension, and synthesised critical perspectives and their implications for policy, practice, or research that we incorporated in our findings and discussion.

FINDINGS

Scope of the literature

Extent

Figure 1 provides the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram of the 75 eligible sources of 10,352 identified. Most were research articles (n=70), of which 21 were literature reviews (i.e. 2 scoping, 4 systematic, 15 narrative/undefined), 3 were commentaries/editorials, and 2 were conference/workshop reports. Publications started with 1 in 2000, with most published in 2017 or later (51) and peaking in 2022 (12/51).

Nature

Most publications were in English (n=73), with one each in Spanish and Portuguese. Academic disciplines included environmental sciences (n=24), public health and epidemiology (n=22), medicine (n=10), geography (n=9), international relations (n=5), anthropology (n=4), political science and history (n=3 each), science and technology studies and law (n=2 each), sociology and physical sciences (n=2 each), and economics (n=1). Most sources used purely qualitative approaches (n=53, of which only 5 included human participants), 15 used purely quantitative approaches (of which 2 included human participants), and 7 used mixed-method approaches (of which 2 included human participants).

Distribution

Geographically, most studied a single country (n=31), while 27 had a global or fully conceptual outlook, and 17 studied several countries. Publications focused on North America (n=12, of which 1 included Canada and 3 only Alaska), Central and Eastern Europe (n=11, of which 3 focused on Ukraine), Southeast Asia (n=10), South Asia and Europe (n=6 each), East Asia (n=5, 3 focused on China), Latin America (n=4), and Oceania (n=4, 3 focused on Australia).

Thematic synthesis

We synthesised findings into five inductive themes, exploring critical discussions within each: (1) environmental health as security issue; (2) biosecurity and non-traditional security; (3) institutional connections; (4) militarisation and environmental health; (5) emerging risk-management methods and technologies.

Environmental health as security issue

Twenty-one (28%; 21/75) sources developed theoretical connections between health, security, and ecology, frequently framing declining health of the planet as a security issue. Most of these (20/21) discussed forms of environmental degradation (e.g. climate change, deforestation, biodiversity loss, soil degradation) and 18

explicitly attributed human agency to this. Humans were framed as 'ecosystem engineers' whose collective agency was the main determining factor of the planet's health [30]. Western industrialisation and intensified reliance on fossil fuels following World War Two were assigned primary responsibility for accumulation of greenhouse gases in the atmosphere and, consequently, global climate change [31], [32], [33], [34], [35]. Five articles referred to land use changes, responding to growing demand for industrialised agriculture, as reasons for environmental degradation [36], [37], [38], [39], [40]. Three discussed human modifications to ecosystems as consequences of establishing urban settlements, introducing concepts of 'urbanisation of nature' and 'microbial borders' [41], [42], [43]. Three discussed the impact of military conflict on environmental health, proposing the concept of 'conflict pollution' [35], [44], [45].

All 21 articles linked declining environmental health to the idea of security, conceptualising this relationship in multiple ways. One framed this by arguing that the post-Cold War period has seen the world's geopolitical order move away from state-centric frameworks, consequently allowing 'security' to be conceptualised beyond narrow definitions based exclusively on militaristic ideas of national security [3]. Ten discussed the effects of climate change as security threats [3], [30], [31], [33], [35], [36], [44], [46], [47], [48], suggesting climate change increases the hazards humans are exposed to and that the "probability of conflict is increased by ecological degradation" [30]. One framed climate change as a 'threat multiplier' for other security issues [36]. Four [3], [35], [41], [42] considered the implications of framing environmental or health concerns as security issues, suggesting that 'preparedness' — rather than 'insurance' — for potential health emergencies and environmental crises is a growing ethos of global security efforts [38]. Two investigated 'securitisation' as a process, highlighting that security practices "are part of a wider process of problematisation and politicisation" [41] wherein framing something as a security concern responds to "subjective constructions" that elevate the perceived stakes of the issue at hand [3]. Two discussed the implications of different 'energetic' political pathways, exploring the different consequences for human and environmental health of fossil fuels and nuclear energy and both discussing energy supply as a security matter [31], [32].

Ten (48%) of these sources explicitly introduced critical conversations within this theme. Most commonly discussed (n=5) was an asymmetrical distribution of environmental health risks, suggesting the consequences of climate change were unequally distributed [34], [41], [44] and that occupational risks due to environmental exposure were unequally experienced [32], [39]. Wolf introduced a theoretical provocation suggesting that "rather than investigating how the poor came to inhabit landscapes of risk", we ought to ask "how zones of risk came to inhabit the territories of the poor" [41]. Other critical conversations, with two articles each, involved the lack of representation and unilateralism in risk management and decision-making by health authorities [35], [49] and the prioritisation of some issues and communities over others when determining what gets framed as a security threat [33], [41].

Biosecurity and non-traditional security threats

Only 12 (16%; 12/75) sources related to an important theme of 'biosecurity' and 'non-traditional' security (NTS) threats. NTS was broadly defined to include security issues that are not directly military but pertain to the wellbeing of individuals and society [50], including health security or concerns over 'eco-terrorism' (defined as "use of force or threat directed at the environment or ecosystem to terrorise or frighten people") [51], [52].

Most (9/12) discussed 'biosecurity,' defined as "protection of human beings and their surrounding environment against hazardous biological agents" [53] and as "biological border security" [38]. Conversations on biosecurity raised the idea that "law enforcement agencies and animal health agencies share common goals during the response to a biological threat" [52] while also cautioning that biosecurity practices were not devoid of socio-political influences: "biosecurity practices are influenced by capitalist forms of life and other social relations that operate within and beyond the lab" [54]. Most articles discussing biosecurity (6/9) linked this concept to food production systems. Four [55], [56], [57], [58] linked livestock farming to emerging infectious diseases (EID), citing high livestock density as enabling vector-borne pathogen transmission [58]. All four

related biosecurity risks to intensified livestock productivity demands, explicitly alluding to pig and poultry farming. Two [55], [58] discussed antimicrobial resistance (AMR) or multi-drug resistance as growing health security threats, with antibiotic use in agriculture directly associated with livestock farming productivity demands.

Of 12 articles discussing biosecurity and NTS, only four (33%) explored critical dimensions and primarily as regional asymmetries in vulnerability. Two [58], [59] considered Southeast Asia a particularly vulnerable region to environmentally-induced EIDs, while 1 [50] suggested South Asia as most vulnerable to NTS threats. The fourth argued that biosecurity measures required equipment and protocols that small-scale farmers could not afford, exposing them to risks those involved in large-scale farming could be better protected against [58].

Institutional connections

Twenty-four (33%; 24/75) sources discussed the relationship between health security and global ecologies at an institutional level. Of these, most (18/24) did so by associating health security with 'One Health' agencies, whereas 12 discussed health security as a political agenda or institutional network relating to environmental changes. Five discussing the latter [60], [61], [62], [63], [64] referred to the 'Global Health Security Agenda' (GHSA), established in 2014 by 44 national governments, and aiming to determine "regulations for global response and preparedness to the emergence of infectious diseases" [61]. Two discussed the importance of WHO's 'Joint External Evaluations' (JEEs) — alongside indices such as Global Health Security Index, Epidemic Preparedness Index, and World Organisation for Animal Health's (WOAH) 'PVS' evaluation — in setting political priorities related to health security [60], [65]. However, one provided a critical perspective on these indices, arguing they "reflect a predilection of global responses to focus on containment instead of prevention" and "do little to reflect the health effects resulting from anthropogenic activity" [60].

Of the 18 articles discussing One Health, this approach was broadly used to emphasise that domesticated animals, plants, and wildlife were part of the same "environment" and "social systems" as humans, and must thus be equally prominent in health security conversations [40]. One [64] proposed a 'One Health Security' vision, based on "integration of professionals with expertise in security, law enforcement, and intelligence to join the veterinary, agricultural, environmental, and human health experts essential to One Health and the Global Health Security Agenda". Another [60] historicised 'One Health', tracing its emergence to WHO, WOAH, and United Nations' Food and Agriculture Organisation (UNFAO) in 2010, and critiquing it for not "embracing the ecological, socioeconomic, cultural, and political contexts within which the agenda was framed". Although One Health was frequently discussed using a conceptual understanding of interdependence between humans and their environment, its scope was exclusively framed in relation to EIDs across all articles, contrary to planetary health's investments in broader considerations involving human health and the planet's capacity to sustain life.

Only 5 (21%; 5/24) sources exploring this theme included critical perspectives. Four [62], [66], [67], [68] discussed asymmetrical distribution of risks related to climate change and health emergencies affecting vulnerable populations the most, including "inequitable and risk-uninformed development planning" in the case of Southeast Asia. One [60] discussed inequities embedded in GHSA development, highlighting how "recognised tensions exist between perceived threats to high-income nations [...] and the health security needs of low-income countries". This article also elaborated on the shortcomings of indices such as WHO's JEE, arguing that assessment "is limited in how it (does not) consider health inequities within and among country population[s]."

Military activity and environmental health

Twenty-six (33%; 26/75) sources discussed the impact of military activity — a result of securitisation [69] — on environmental and human health. Disposal of heavy metals and other forms of waste (e.g. nuclear) caused by

military activity, alongside their environmental and health implications, were frequently discussed under umbrella terms of 'ecotoxicology' ("the study of the fate and effect of a toxic compound on an ecosystem") and 'environmental epidemiology' ("epidemiology that relates to non-infectious disease agents in the environment") [51]. The scope of environmental degradation discussed included damage to agricultural land that may render it unusable [70], sea floor littering [71], and overall pollution of land, air, food, and water sources. One article [32] associated environmental degradation through release of toxic waste to political narratives of national security, claiming that "whether the (toxic) releases were unintentional or intentional, they were justified in the name of national security." Common study locations for this theme were Balkan countries (n=5), of which four articles [44], [72], [73], [74] discussed long-term environmental health effects of bombings and ammunition disposal by NATO in the late 1990s; Ukraine (n=3), of which two [75], [76] discussed environmental health impacts of the war with Russia; and Alaska, with three articles [77], [78], [79] discussing long-term environmental health impacts of United States' military bases.

Eight (31%; 8/26) included critical perspectives, considering human equity implications of the impact of military activity on environmental health. Seven discussed differential exposure to environmental contaminants in ways that map onto existing social inequalities [32], [73], [77], [78], [79], [80], [81]. Three discussed "environmental injustice" due to exposures of Indigenous people (in Alaska) to carcinogens, endocrine-disrupting substances, and contaminants through the environment and through chronic dietary exposure [77], [78], [79], while one made an analogous argument in Puerto Rico [73]. One [81], discussing differential exposure to contaminants along racial lines in the United States, claimed "persons of colour are disproportionately affected by factors that increase the risk of environmental contaminant exposure compared to whites" and linked race to the probability of living in areas with known environmental contamination. Authors included additional examples, such as the disproportionate representation of non-white citizens in the military and in low-paying jobs with higher incidences of exposure to environmental contamination [81]. One article discussed how, by repurposing an abandoned military shooting range to host relocated asylum-seekers in Greece, migrants were exposed to

toxic ammunition residues [80]. One discussed occupational radiation (over)exposure of workers in nuclear plants [32]. The remaining article discussed tendencies among transnational security bodies such as NATO to make unilateral decisions with implications for national and subnational health systems [35].

Emerging risk-management methods and technologies

Seventeen (23%; 17/75) sources discussed novel technologies or risk-management methods associated with planetary health or health security. Most (n=11) proposed innovative approaches for the prevention and early identification of risks (e.g. primarily linked to EIDs, environmental hazards, biosecurity), including the use of drones for mosquito surveillance [82], genomic surveillance of antimicrobial resistance [83], meteorological data use for biosecurity [84], the study of 'bioindicator' species and other biomarkers to detect radioactive contamination [85], or modelling a digital replica of the Earth [86]. Three discussed 'who' conducts the science at the intersections of health security and planetary health, such as 'civilian science,' open-source analysis, and higher education STEM [31], [45], [87]. Two proposed 'nature-based' approaches to improve environmental and human health, including arguing for incorporation of "traditional indigenous plants" and "pharmafood" in the repertoire of health security and the 'bioremediation' of toxic pollutants in soil using 'natural' approaches [61], [88].

Critical discussions were introduced in only 2 (12%; 2/17) of these sources. One argued that "respect towards human values and rights such as solidarity and equity should underlie every agenda of national security" [61] and that using traditional botanical knowledge could support health security efforts in "developing" countries. The other discussed citizen science as 'critical pedagogy', claiming citizen-scientists should be empowered to participate in all steps of scientific knowledge production [87].

DISCUSSION

Despite growing relevance of 'planetary health' and 'health security' in contemporary global health discourse, the interactions — conceptual or otherwise — between these fields were not mapped, resulting in gaps in understanding how these overlapping issues are shaped and interpreted. With the role of the environment in human health frequently framed as an 'existential' or 'security' threat, understanding the transformations to global health these fields elicit together appears overdue. Moreover, even less attention was allocated to the equity dimensions of interactions between health security and global ecologies, despite socio-ecological asymmetries having strong and direct influence over the issues with which health security is concerned. This scoping review thus maps these relationships, offering insights into these dominant global health paradigms.

Only one eligible articles linked 'health security' and 'planetary health' directly, suggesting these two fields have developed separately [16]. Interactions we identified between these fields were indirect and conceptual, mapping onto each other through discussions on phenomena within the scope of both. Our findings map a network of global environmental risks consequent to a major point of tension and contradiction embedded in the idea of 'human civilisation': its expansion has altered the environment in ways that (continue to) interfere with the Earth's capacity to sustain inhabitation, humans included [31],[32],[33],[34],[35],[41],[42],[43]. Fuelling human civilisation has come at the expense of environmental modifications that create differential vulnerabilities for many inhabitants [31],[32]; feeding humans is now an enterprise largely reliant on hyper-productive animal farms that induce land-use changes with detrimental effects to the environment, while supporting new (and old) zoonotic diseases [36],[37],[38],[39],[40]; housing humans in urban settlements has transformed ecological relationships in many extractive ways, creating new forms of bio-insecurity and new tiered forms of exposure to harm for some populations but not necessarily all [41],[42],[43]; and military activity has transformed ecosystems in ways that make them irreversibly unhealthy — if not inhospitable — for humans and other species [35],[44],[45]. However, most discussions in the health security field seem to ignore or dismiss these realities, concerned instead — almost exclusively — with the risks of infectious human

diseases even while other aspects of human and environmental health are increasingly framed as security issues [3],[30],[31],[33],[35],[36],[44],[46],[47],[48].

We attribute these apparent conceptual contradictions to two primary reasons. First, as Wolf and Zalduendo argue, securitisation responds to subjective constructions, requiring political mobilisation to frame a particular moment and issue as 'crisis' [3],[41]. Most health impacts of declining environmental health, however, are long-term, only gradually experienced, and – at least initially — affecting populations that may lack political representation [33],[35],[41],[49],[60]. Their effects are akin to what Berlant called 'slow death' in the context of non-communicable diseases: "the physical wearing out of a population and the deterioration of people in that population that is very nearly a defining condition of their experience and historical existence" [89]. The 'moment' of crisis, in this case, is prolonged, making the political process of prioritising attention and resources equally diffused. Infectious diseases can instead be transmitted rapidly, acting aggressively on both individual and social bodies within the span of days, if not hours. Covid-19 is a poignant example, showcasing how assertive political mobilisation was concerted through health security responses when the issue was deemed of immediate relevance, which the 'slow' effects of environmental degradation in human health have so far failed to replicate [90].

Second, aligning with Traore et al's argument that health security assessments focus on containment while overlooking prevention [60], health security's lack of engagement with broader environmental health issues may be indicative of embedded geopolitical commitments. Seemingly, health security — and most biosecurity — is concerned with effective containment of health risks within specific geographies [91] and may be unilaterally decided by policy-makers who are not always directly affected [35],[49]. This, we suggest, reveals that health security's political investments diverge from promoting socio-ecological transformations to mitigate and prevent future health issues, instead protecting those who can afford to be 'secured' in a world of unequally distributed risk. As multiple scholars noted [42],[91],[92], health security logic deems some areas and

populations as having no choice but to become 'sacrifice zones', usually sacrificed by those less (or not) directly affected.

Implications for policy, practice, or research

Through foregrounding critical perspectives in our findings, asymmetrical distributions of risk and responsibility were central in how we understood the relationship between health security and planetary health, particularly in investigating who are the analytical subjects and audiences of each field. Generally, neither field seemed overly elaborate in defining their subject, relying on loosely universal assumptions of working to protect 'human health.' This raised issues. Scholars who have addressed questions of 'planetary' responsibility for the Earth's declining capacity to sustain life have experienced challenges making sense of who 'the human' is, and how differing relationships among humans and 'the environment' can be accounted for" [93], [94], [95], [96], [97]. For instance, shortcomings in the notion of the 'Anthropocene — which, akin to Lal's notion of humans as 'ecosystem engineers' [30], posits that our global geological era is the result of human agency — have long been exposed. Moore argued that "speaking about the collective 'we' of humanity should not imply that 'we' are politically one" [95], whereas Yusoff argued that, for many marginalized by today's world system, "to be included in the 'we' of the Anthropocene is to be silenced by a claim to a universalism that fails to notice its subjugations" [96]. Other attempts to redirect responsibility to transnational capital, as Moore did with the notion of the 'Capitalocene' [94], or to the historical expansion of plantation agriculture, as Haraway and Tsing did with the 'Plantationocene' [93], are likewise criticised for being incomplete or further obscuring where responsibility actually resides [97]. Beyond their conceptual and political limitations, these important discussions on the question of responsibility were virtually absent in our literature, possibly because the two fields in question, both Western constructs of 'health,' may have tacit political and epistemic attachments that require their subject to be purposely left undefined [11],[20],[98].

Our review additionally raised questions about what characterises 'planetary health' as a distinct heuristic, given the existence of other concepts proposing more-than-human notions of health that may have broader scope or more political traction (e.g. One Health). One Health, our findings suggest, is typically used in the context of policy and almost exclusively concerned with infectious diseases. Most One Health literature we encountered did not discuss socio-ecological contexts at length or at all, ignoring the environmental conditions where the multi-species interactions it is concerned with occur. Hence, while suitable for health security purposes, One Health failed conceptually, leaving undiscussed the larger issues of environmental health that surface as primary concerns when using a more-than-human or planetary perspective. Planetary health also has limitations as field or heuristic, remaining an anthropocentric conceptual tool that may disregard environmental issues that do not affect humans directly, or that affect subjects whose status as 'humans' has been historically contested. Brown argues, "racialized and colonized subjects have been excluded from 'the human', a category made ontological through the naturalization of Western imperial origin narratives" [99]. Thus, as much as planetary health can broaden the conceptual scope of health security and prompt it to confront issues beyond EID containment, our analysis warns against planetary health applications that focus exclusively on human health or erase Indigenous ways of interpreting ecological interdependence or other frameworks that fall outside the scope of Western/English-speaking academic discourse (e.g. Latin American 'cuerpo-territorio' [100]).

Ultimately, there needs to be critical consideration of health security's focus on containment for it is a perilous accomplice to any notion of planetary health with overt commitments to human health. This reinforces sacrificial logics that render some forms of life more worthy than others wherein only a select few stand a chance of survival in a world with a dwindling capacity to sustain life in all its forms. Such a tiered approach contradicts equity, raising concerns over potential securitised responses to environmental issues should joint efforts between planetary health and health security ever proliferate. Accounting for such concerns, there

should be a shift in focus towards strategic and preventative efforts that centre on protecting and preserving the collective health of Earth's lifeforms and ecologies.

Limitations

This study has several limitations. First, sources included are those within our search capacity. However, to ensure sufficient coverage, we included five databases and all languages. Second, as normal in scoping reviews, we did not evaluate source quality to enable as broad and diverse a range of eligible sources as possible. Third, we found only one result linking 'health security' and 'planetary health' fields directly or critical perspectives regarding their interactions, and thus established connections based on conceptual scope. This required active interpretation in selecting eligible studies, which may not be replicable by other researchers with different interpretative sensibilities. While producing a less replicable mapping of the relationship between these two global health fields, it allowed a deeper conceptualisation of interactions between themes and concepts that would not have been possible with narrower selection criteria.

Conclusion

Academic literature connecting health security with planetary health — or other forms of environmental health — is scarce, with a near-exclusive focus on infectious diseases. However, due to the extent of anthropogenic activity on multiple environments and ecologies globally, planetary health faces existential threats framed by many scholars as 'security' issues. Most health security responses focus on containment rather than prevention, exposing some populations more than others to environmental health risks. Likewise, 'security' narratives have long been associated with environmental degradation due to the militarised activity that securitisation, in all its forms, typically defaults to. Adequate and equitable responses to environmental health risks require shifting from containment towards prevention, necessitating related shifts in socio-ecological designs and emphasis on protecting the health of all human (and non-human) beings in the short and long-

term. Securitised approaches to health are rarely compatible with equity, as various critical perspectives highlight, and should elicit wary responses whenever encountered if health equity is held as an ideal.

ACKNOWLEDGEMENTS

Thanks to the LSHTM Librarian Jane Falconer, who helped develop our search syntax and strategy. For the purpose of open access, authors have applied a 'Creative Commons Attribution' (CC BY) licence to any Author Accepted Manuscript version arising.

REFERENCES

[1] Y. R. Khatiwada, "Poverty: A threat to human security," in *Human security in Nepal: Concepts, Issues, and Challenges*, Kathmandu: NIPS and NCCR North-South, 2013, pp. 33–59.

[2] A. Kamradt-Scott, *Health, Security, and Diplomacy in Historical Perspective*. Routledge Handbooks Online, 2014. doi: 10.4324/9780203078563.ch16.

[3] P. Zalduendo, "Legislative crystallization of covid-19 securitization processes.The case of Spain. From Law 4/1981 on states of alarm, exception and siege to Law 2/2021 on measures for the management of the pandemic," *RELACIONES INTERNACIONALES-MADRID*, no. 52, pp. 47–70, 2023, doi: 10.15366/relacionesinternacionales2023.52.003.

[4] "About," Global Health Security Agenda. Accessed: Jan. 22, 2025. [Online]. Available: https://globalhealthsecurityagenda.org/about/

[5] P. Fourie, *AIDS as a Security Threat*. Routledge Handbooks Online, 2014. doi: 10.4324/9780203078563.ch9.

[6] L. Weir, *Inventing Global Health Security, 1994–2005*. Routledge Handbooks Online, 2014. doi: 10.4324/9780203078563.ch2.

[7] D. L. DeLaet, *Whose Interests is the Securitization of Health Serving?* Routledge Handbooks Online, 2014. doi: 10.4324/9780203078563.ch28.

[8] R. Frankfurter, "Conjuring Biosecurity in the Post-Ebola Kissi Triangle: The Magic of Paperwork in a Frontier Clinic," *Medical Anthropology Quarterly*, vol. 33, no. 4, pp. 517–538, 2019, doi: 10.1111/maq.12528.

[9] S. Nanthini, "Public Health Emergencies: Moving Beyond Ad Hoc Military Responses," *Centre for Non-Traditional Security Studies*, Mar. 2023, Accessed: Jan. 05, 2024. [Online]. Available: https://reliefweb.int/report/world/public-health-emergencies-moving-beyond-ad-hoc-military-responses

[10] M. A. Stevenson and M. Moran, *Health Security and the Distortion of the Global Health Agenda*. Routledge Handbooks Online, 2014. doi: 10.4324/9780203078563.ch27.

[11] W. Anderson and J. Dunk, "Planetary Health Histories: Toward New Ecologies of Epidemiology?," *Isis*, vol. 113, no. 4, pp. 767–788, Dec. 2022, doi: 10.1086/722308.

[12] W. Anderson, "Toward Planetary Health Ethics? Refiguring Bios in Bioethics," *J Bioeth Inq*, vol. 20, no. 4, pp. 695–702, Dec. 2023, doi: 10.1007/s11673-023-10285-0.

[13] A. M. L. Li, "Ecological determinants of health: food and environment on human health," *Environmental Science and Pollution Research International*, vol. 24, no. 10, p. 9002, Nov. 2015, doi: 10.1007/s11356-015-5707-9.

[14] D. Brozović, "Societal collapse: A literature review," *Futures*, vol. 145, p. 103075, Jan. 2023, doi: 10.1016/j.futures.2022.103075.

[15] C. D. Butler, "Planetary Overload, Limits to Growth and Health," *Curr Envir Health Rpt*, vol. 3, no. 4, pp. 360–369, Dec. 2016, doi: 10.1007/s40572-016-0110-3.

[16] J. Zinsstag *et al.*, "Advancing One human–animal–environment Health for global health security: what does the evidence say?," *The Lancet*, vol. 401, no. 10376, pp. 591–604, Feb. 2023, doi: 10.1016/S0140-6736(22)01595-1.

[17] P. M. Frowd, C. E. Mutlu, and M. B. Salter, "Discourse," in *Research Methods in Critical Security Studies*, 2nd ed., London: Routledge, 2023, pp. 163–170. doi: 10.4324/9781003108016-28.

[18] T. A. Benjaminsen and H. Svarstad, *Political Ecology: A Critical Engagement with Global Environmental Issues*. Cham: Springer International Publishing, 2021. doi: 10.1007/978-3-030-56036-2.

[19] C. Besteman, *Militarized Global Apartheid*. in Global Insecurities. Durham, NC: Duke University Press, 2020.

[20] D. McCoy, S. Roberts, S. Daoudi, and J. Kennedy, "Global health security and the health-security nexus: principles, politics and praxis," *BMJ Global Health*, vol. 8, no. 9, p. e013067, Sep. 2023, doi: 10.1136/bmjgh-2023-013067.

[21] S. Elbe, "Who Owns a Deadly Virus? Viral Sovereignty, Global Health Emergencies, and the Matrix of the International," *International Political Sociology*, vol. 16, no. 2, p. olab037, Jun. 2022, doi: 10.1093/ips/olab037.

[22] Xavier Guillaume, "Criticality," in *Research Methods in Critical Security Studies*, Routledge, 2013, pp. 47–50. doi: 10.4324/9780203107119-10.

[23] Z. Glück and S. Low, "A sociospatial framework for the anthropology of security," *Anthropological Theory*, vol. 17, no. 3, pp. 281–296, Sep. 2017, doi: 10.1177/1463499617729229.

[24] H. Arksey and L. O'Malley, "Scoping studies: towards a methodological framework," *International Journal of Social Research Methodology*, vol. 8, no. 1, pp. 19–32, Feb. 2005, doi: 10.1080/1364557032000119616.

[25] D. Levac, H. Colquhoun, and K. K. O'Brien, "Scoping studies: advancing the methodology," *Implementation Sci*, vol. 5, no. 1, p. 69, Dec. 2010, doi: 10.1186/1748-5908-5-69.

[26] World Health Organisation, "Health security." Accessed: Apr. 05, 2024. [Online]. Available: https://www.who.int/health-topics/health-security

[27] R. P. Neumann, "Political Ecology," in *International Encyclopedia of Human Geography*, R. Kitchin and N. Thrift, Eds., Oxford: Elsevier, 2009, pp. 228–233. doi: 10.1016/B978-008044910-4.00580-0.

[28] Planetary Health Alliance, "Planetary Health and One Health approaches in Securing Sustainable Food Systems and nutrition at…," Medium. Accessed: Apr. 02, 2024. [Online]. Available:

https://phalliance.medium.com/planetary-health-and-one-health-approaches-in-securing-sustainable-food-systems-and-nutrition-at-9f3b18ba4a40

[29] V. Braun and V. Clarke, *Thematic Analysis: A Practical Guide*. SAGE, 2021.

[30] R. Lal, "The soil-peace nexus: our common future," *SOIL SCIENCE AND PLANT NUTRITION*, vol. 61, no. 4, pp. 566–578, 2015, doi: 10.1080/00380768.2015.1065166.

[31] J. Wadsworth, "Forging the Solution to the Energy Challenge: The Role of Materials Science and Materials Scientists," *METALLURGICAL AND MATERIALS TRANSACTIONS B-PROCESS METALLURGY AND MATERIALS PROCESSING SCIENCE*, vol. 41, no. 2, pp. 259–274, 2010, doi: 10.1007/s11663-010-9349-5.

[32] M. Lengefeld, "Nuclear Weapons and the Treadmill of Destruction in the Making of the Anthropocene," *JOURNAL OF WORLD-SYSTEMS RESEARCH*, vol. 26, no. 2, pp. 203–230, 2020, doi: 10.5195/JWSR.2020.982.

[33] Munslow B and O'Dempsey T, "From war on terror to war on weather? Rethinking humanitarianism in a new era of chronic emergencies.," *Third World Q*, vol. 31, no. 8, pp. 1223–235, 2010, doi: 10.1080/01436597.2010.542965.

[34] Poland B, Dooris M, and Haluza-Delay R, "Securing 'supportive environments' for health in the face of ecosystem collapse: meeting the triple threat with a sociology of creative transformation.," *Health Promot Int*, vol. 26 Suppl 2, pp. ii202-15, 2011, doi: 10.1093/heapro/dar073.

[35] Birch M and van Bergen L, "The trust deficit: pandemic, disarmament, climate change and the securitization of health.," *Med Confl Surviv*, vol. 37, no. 3, pp. 173–176, 2021, doi: 10.1080/13623699.2021.1972528.

[36] Moser SC and Hart JAF, "The long arm of climate change: societal teleconnections and the future of climate change impacts studies.," *Clim Change*, vol. 129, no. 1, pp. 13–26, 2015, doi: 10.1007/s10584-015-1328-z.

[37] Plowright RK *et al.*, "Land use-induced spillover: a call to action to safeguard environmental, animal, and human health.," *Lancet Planet Health*, vol. 5, no. 4, pp. e237–e245, 2021, doi: 10.1016/S2542-5196(21)00031-0.

[38] Murray KA *et al.*, "Cooling off health security hot spots: getting on top of it down under.," *Environ Int*, vol. 48, pp. 56–64, 2012, doi: 10.1016/j.envint.2012.06.015.

[39] Degeling C, Lederman Z, and Rock M, "Culling and the Common Good: Re-evaluating Harms and Benefits under the One Health Paradigm.," *Public Health Ethics*, vol. 9, no. 3, pp. 244–254, 2016, doi: 10.1093/phe/phw019.

[40] Saylors K *et al.*, "Socializing One Health: an innovative strategy to investigate social and behavioral risks of emerging viral threats.," *One Health Outlook*, vol. 3, no. 1, p. 11, 2021, doi: 10.1186/s42522-021-00036-9.

[41] Wolf M, "Rethinking Urban Epidemiology: Natures, Networks and Materialities.," *Int J Urban Reg Res*, vol. 40, no. 5, pp. 958–982, 2016, doi: 10.1111/1468-2427.12381.

[42] G. du Plessis, "When pathogens determine the territory: Toward a concept of non-human borders," *EUROPEAN JOURNAL OF INTERNATIONAL RELATIONS*, vol. 24, no. 2, pp. 391–413, 2018, doi: 10.1177/1354066117710998.

[43] N. Clark, "Mobile Life: Biosecurity Practices and Insect Globalization," *SCIENCE AS CULTURE*, vol. 22, no. 1, pp. 16–37, 2013, doi: 10.1080/09505431.2013.776366.

[44] K. Lasaridi and A. Valvis, "Environmental threats and security in the Balkans," *SOUTHEAST EUROPEAN AND BLACK SEA STUDIES*, vol. 11, no. 4, pp. 471–487, 2011, doi: 10.1080/14683857.2011.632546.

[45] Zwijnenburg W, Hochhauser D, Dewachi O, Sullivan R, and Nguyen VK, "Solving the jigsaw of conflict-related environmental damage: Utilizing open-source analysis to improve research into environmental health risks.," *J Public Health (Oxf)*, vol. 42, no. 3, pp. e352–e360, 2020, doi: 10.1093/pubmed/fdz107.

[46] P. Nahar, A. Collins, A. Bhuiya, F. Alamgir, N. Ray-Bennett, and R. Edgeworth, "Indigenous indicators of health security in relation to climatic disasters in Bangladesh," *ENVIRONMENTAL HAZARDS-HUMAN AND POLICY DIMENSIONS*, vol. 12, no. 1, pp. 32–46, 2013, doi: 10.1080/17477891.2012.749029.

[47] Chattu VK, "'Digital global health diplomacy' for climate change and human security in the Anthropocene.," *Health Promot Perspect*, vol. 12, no. 3, pp. 277–281, 2022, doi: 10.34172/hpp.2022.35.

[48] Charlier J *et al.*, "Disease control tools to secure animal and public health in a densely populated world.," *Lancet Planet Health*, vol. 6, no. 10, pp. e812–e824, 2022, doi: 10.1016/S2542-5196(22)00147-4.

[49] Moniz MA, Sabóia VM, Carmo CND, and Hacon SS, "Participatory environmental diagnosis and of health risks from the surrounding communities the Petrochemical Complex of Rio de Janeiro, Brazil.," *Cien Saude Colet*, vol. 22, no. 11, pp. 3793–3806, 2017, doi: 10.1590/1413-812320172211.23852015.

[50] S. Babar, "Rethinking Regional Security Paradigm: Non-Traditional Security Threats and the Role of Regional Dialogue in South Asia," *IPRI JOURNAL*, vol. 23, no. 2, 2023, doi: 10.31945/iprij.230202.

[51] Alexander GA, "Ecoterrorism and nontraditional military threats.," *Mil Med*, vol. 165, no. 1, pp. 1–5, 2000.

[52] Hoile R, "Emergency management at the health and security interface.," *Rev Sci Tech*, vol. 39, no. 2, pp. 503–512, 2020, doi: 10.20506/rst.39.2.3101.

[53] Bielecka A and Mohammadi AA, "State-of-the-art in biosafety and biosecurity in European countries.," *Arch Immunol Ther Exp (Warsz)*, vol. 62, no. 3, pp. 169–78, 2014, doi: 10.1007/s00005-014-0290-1.

[54] Y. Liao, "Shrimp in labs: Biosecurity and hydro-social life," *ENVIRONMENT AND PLANNING E-NATURE AND SPACE*, vol. 7, no. 1, pp. 141–165, 2024, doi: 10.1177/25148486231174302.

[55] Osman AY *et al.*, "Antimicrobial Resistance Patterns and Risk Factors Associated with Salmonella spp. Isolates from Poultry Farms in the East Coast of Peninsular Malaysia: A Cross-Sectional Study.," *Pathogens*, vol. 10, no. 9, 2021, doi: 10.3390/pathogens10091160.

[56] Smiley Evans T *et al.*, "Synergistic China-US Ecological Research is Essential for Global Emerging Infectious Disease Preparedness.," *Ecohealth*, vol. 17, no. 1, pp. 160–173, 2020, doi: 10.1007/s10393-020-01471-2.

[57] Machalaba CM and Karesh WB, "Emerging infectious disease risk: shared drivers with environmental change.," *Rev Sci Tech*, vol. 36, no. 2, pp. 435–444, 2017, doi: 10.20506/rst.36.2.2664.

[58] Auplish A *et al.*, "Capacity and needs assessment of veterinary services in Vietnam in biosecurity, biosafety and One Health.," *PLoS One*, vol. 19, no. 1, p. e0295898, 2024, doi: 10.1371/journal.pone.0295898.

[59] C. Jasparro and J. Taylor, "Climate change and regional vulnerability to transnational security threats in Southeast Asia," *GEOPOLITICS*, vol. 13, no. 2, pp. 232–256, 2008, doi: 10.1080/14650040801991480.

[60] Traore T *et al.*, "How prepared is the world? Identifying weaknesses in existing assessment frameworks for global health security through a One Health approach.," *Lancet*, vol. 401, no. 10377, pp. 673–687, 2023, doi: 10.1016/S0140-6736(22)01589-6.

[61] P. Sundarrajan, "Foods that heal: Traditional indigenous plants as bioresource for health security," *ANNALS OF PHYTOMEDICINE-AN INTERNATIONAL JOURNAL*, vol. 12, no. 2, pp. 5–11, 2023, doi: 10.54085/ap.2023.12.2.2.

[62] D. Canyon, F. Burkle, and R. Speare, "Health Security in Hawaii by 2050: The Physical Effects of Climate Change," *JOURNAL OF HOMELAND SECURITY AND EMERGENCY MANAGEMENT*, vol. 14, no. 2, 2017, doi: 10.1515/jhsem-2017-0013.

[63] Suu-Ire RD, Obodai E, Bonney JHK, Bel-Nono SO, Ampofo W, and Kelly TR, "Viral Zoonoses of National Importance in Ghana: Advancements and Opportunities for Enhancing Capacities for Early Detection and Response.," *J Trop Med*, vol. 2021, p. 8938530, 2021, doi: 10.1155/2021/8938530.

[64] Gronvall G, Boddie C, Knutsson R, and Colby M, "One health security: an important component of the global health security agenda.," *Biosecur Bioterror*, vol. 12, no. 5, pp. 221–4, 2014, doi: 10.1089/bsp.2014.0044.

[65] Woods R, Reiss A, Cox-Witton K, Grillo T, and Peters A, "The Importance of Wildlife Disease Monitoring as Part of Global Surveillance for Zoonotic Diseases: The Role of Australia.," *Trop Med Infect Dis*, vol. 4, no. 1, 2019, doi: 10.3390/tropicalmed4010029.

[66] Fang H, "[Carbon peak, carbon neutrality: strategic opportunities for China's health system].," *Zhonghua Yi Xue Za Zhi*, vol. 102, no. 2, pp. 90–93, 2022, doi: 10.3760/cma.j.cn112137-20211022-02339.

[67] Ofrin RH, Bhola AK, and Buddha N, "Turning commitments into actions: perspectives on emergency preparedness in South-East Asia.," *WHO South East Asia J Public Health*, vol. 9, no. 1, pp. 5–14, 2020, doi: 10.4103/2224-3151.282989.

[68] Toteja N, Gandhi AP, Satapathy P, Rustagi S, and Sah R, "Climate change and its impediments to global health security.," *Health Sci Rep*, vol. 6, no. 12, p. e1764, 2023, doi: 10.1002/hsr2.1764.

[69] R. M. Bernazzoli and C. Flint, "From militarization to securitization: Finding a concept that works," *Political Geography*, vol. 28, no. 8, pp. 449–450, Nov. 2009, doi: 10.1016/j.polgeo.2009.08.003.

[70] V. Mehdiyeva, I. Khalilov, and F. Eminov, "Greening and agroecological assessment of the agricultural sectorof the Karabakh region," *VISNYK OF V N KARAZIN KHARKIV NATIONAL UNIVERSITY-SERIES GEOLOGY GEOGRAPHY ECOLOGY*, no. 59, pp. 298–306, 2023, doi: 10.26565/2410-7360-2023-59-2.

[71] J. Obhodas, V. Valkovic, S. Davorin, D. Matika, and I. Pavic, "Environmental security of the port and harbors' sediments," presented at the OPTICS AND PHOTONICS IN GLOBAL HOMELAND SECURITY V AND BIOMETRIC TECHNOLOGY FOR HUMAN IDENTIFICATION VI, 2009. doi: 10.1117/12.817534.

[72] Z. Bjelajac, M. Pocuca, and M. Mijatovic, "URANIUM AND DIOXIN CONSEQUENCES OF BOMBING OF YUGOSLAVIA IN 1999 AND ITS IMPACT ON THE ECOSYSTEM AND HUMAN HEALTH," *JOURNAL OF ENVIRONMENTAL PROTECTION AND ECOLOGY*, vol. 14, no. 2, pp. 480–492, 2013.

[73] Bobonis GJ, Stabile M, and Tovar L, "Military training exercises, pollution, and their consequences for health.," *J Health Econ*, vol. 73, p. 102345, 2020, doi: 10.1016/j.jhealeco.2020.102345.

[74] Popovic D, Todorovic D, Frontasyeva M, Ajtic J, Tasic M, and Rajsic S, "Radionuclides and heavy metals in Borovac, Southern Serbia.," *Environ Sci Pollut Res Int*, vol. 15, no. 6, pp. 509–20, 2008, doi: 10.1007/s11356-008-0003-6.

[75] Rawtani D, Gupta G, Khatri N, Rao PK, and Hussain CM, "Environmental damages due to war in Ukraine: A perspective.," *Sci Total Environ*, vol. 850, p. 157932, 2022, doi: 10.1016/j.scitotenv.2022.157932.

[76] Turos OI *et al.*, "ASSESSMENT OF AMBIENT AIR POLLUTION BY PARTICULATE MATTER (PM10, PM2.5) AND RISK FOR HUMAN HEALTH CAUSED BY WAR ACTIONS.," *Wiad Lek*, vol. 76, no. 4, pp. 738–744, 2023, doi: 10.36740/WLek202304106.

[77] Miller PK *et al.*, "Community-based participatory research projects and policy engagement to protect environmental health on St Lawrence Island, Alaska.," *Int J Circumpolar Health*, vol. 72, 2013, doi: 10.3402/ijch.v72i0.21656.

[78] Jordan-Ward R *et al.*, "Elevated mercury and PCB concentrations in Dolly Varden (Salvelinus malma) collected near a formerly used defense site on Sivuqaq, Alaska.," *Sci Total Environ*, vol. 826, p. 154067, 2022, doi: 10.1016/j.scitotenv.2022.154067.

[79] Jordan-Ward R, von Hippel FA, Schmidt J, and Verhougstraete MP, "Formerly used defense sites on Unalaska Island, Alaska: Mapping a legacy of environmental pollution.," *Integr Environ Assess Manag*, 2024, doi: 10.1002/ieam.4902.

[80] Glatz Brubakk K, Gjengedal ELF, Enger Ø, and Sripada K, "Ammunition Waste Pollution and Preliminary Assessment of Risks to Child Health from Toxic Metals at the Greek Refugee Camp Mavrovouni.," *Int J Environ Res Public Health*, vol. 19, no. 16, 2022, doi: 10.3390/ijerph191610086.

[81] Rumph JT *et al.*, "Uncovering Evidence: Associations between Environmental Contaminants and Disparities in Women's Health.," *Int J Environ Res Public Health*, vol. 19, no. 3, 2022, doi: 10.3390/ijerph19031257.

[82] Carrasco-Escobar G, Moreno M, Fornace K, Herrera-Varela M, Manrique E, and Conn JE, "The use of drones for mosquito surveillance and control.," *Parasit Vectors*, vol. 15, no. 1, p. 473, 2022, doi: 10.1186/s13071-022-05580-5.

[83] Djordjevic SP *et al.*, "Genomic surveillance for antimicrobial resistance - a One Health perspective.," *Nat Rev Genet*, vol. 25, no. 2, pp. 142–157, 2024, doi: 10.1038/s41576-023-00649-y.

[84] Hemming D and Macneill K, "Use of meteorological data in biosecurity.," *Emerg Top Life Sci*, vol. 4, no. 5, pp. 497–511, 2020, doi: 10.1042/ETLS20200078.

[85] Lourenço J, Mendo S, and Pereira R, "Radioactively contaminated areas: Bioindicator species and biomarkers of effect in an early warning scheme for a preliminary risk assessment.," *J Hazard Mater*, vol. 317, pp. 503–542, 2016, doi: 10.1016/j.jhazmat.2016.06.020.

[86] IEEE, S. Albani, M. Lazzarini, P. Saameno, A. Luna, and O. Barrilero, "NEW SCENARIOS SHAPING A DIGITAL TWIN EARTH FOR SECURITY," presented at the 2022 IEEE INTERNATIONAL GEOSCIENCE AND REMOTE SENSING SYMPOSIUM (IGARSS 2022), 2022, pp. 5019–5022. doi: 10.1109/IGARSS46834.2022.9884363.

[87] Weir D, McQuillan D, and Francis RA, "Civilian science: the potential of participatory environmental monitoring in areas affected by armed conflicts.," *Environ Monit Assess*, vol. 191, no. 10, p. 618, 2019, doi: 10.1007/s10661-019-7773-9.

[88] Fernandez-Lopez C, Posada-Baquero R, and Ortega-Calvo JJ, "Nature-based approaches to reducing the environmental risk of organic contaminants resulting from military activities.," *Sci Total Environ*, vol. 843, p. 157007, 2022, doi: 10.1016/j.scitotenv.2022.157007.

[89] L. Berlant, "Slow Death (Sovereignty, Obesity, Lateral Agency)," *Critical Inquiry*, vol. 33, no. 4, pp. 754–780, 2007, doi: 10.1086/521568.

[90] S. O'Lear, "Climate science and slow violence: A view from political geography and STS on mobilizing technoscientific ontologies of climate change," *Political Geography*, vol. 52, pp. 4–13, May 2016, doi: 10.1016/j.polgeo.2015.01.004.

[91] S. Hinchliffe and K. J. Ward, "Geographies of folded life: How immunity reframes biosecurity," *Geoforum*, vol. 53, pp. 136–144, May 2014, doi: 10.1016/j.geoforum.2014.03.002.

[92] A. Ong, "Scales of exception: Experiments with knowledge and sheer life in tropical Southeast Asia," *Singapore Journal of Tropical Geography*, vol. 29, no. 2, pp. 117–129, 2008, doi: 10.1111/j.1467-9493.2008.00323.x.

[93] D. Haraway, A. L. Tsing, and G. Mitman, "Reflections on the Plantationocene: a conversation with Donna Haraway and Anna Tsing," *Edge Effects*, 2019.

[94] J. W. Moore, “The Capitalocene, Part I: on the nature and origins of our ecological crisis,” *The Journal of Peasant Studies*, vol. 44, no. 3, pp. 594–630, May 2017, doi: 10.1080/03066150.2016.1235036.

[95] A. Moore, “Anthropocene anthropology: reconceptualizing contemporary global change: Anthropocene anthropology,” *J R Anthropol Inst*, vol. 22, no. 1, pp. 27–46, Mar. 2016, doi: 10.1111/1467-9655.12332.

[96] K. Yusoff, *A Billion Black Anthropocenes Or None*. University of Minnesota Press, 2018.

[97] A. Hornborg, “Dithering while the planet burns: Anthropologists’ approaches to the Anthropocene,” *Reviews in Anthropology*, vol. 46, no. 2–3, pp. 61–77, Jul. 2017, doi: 10.1080/00938157.2017.1343023.

[98] S. Rushton, “Global Health Security: Security for whom? Security from what?,” *Political Studies*, vol. 59, no. 4, pp. 779–796, Dec. 2011, doi: 10.1111/j.1467-9248.2011.00919.x.

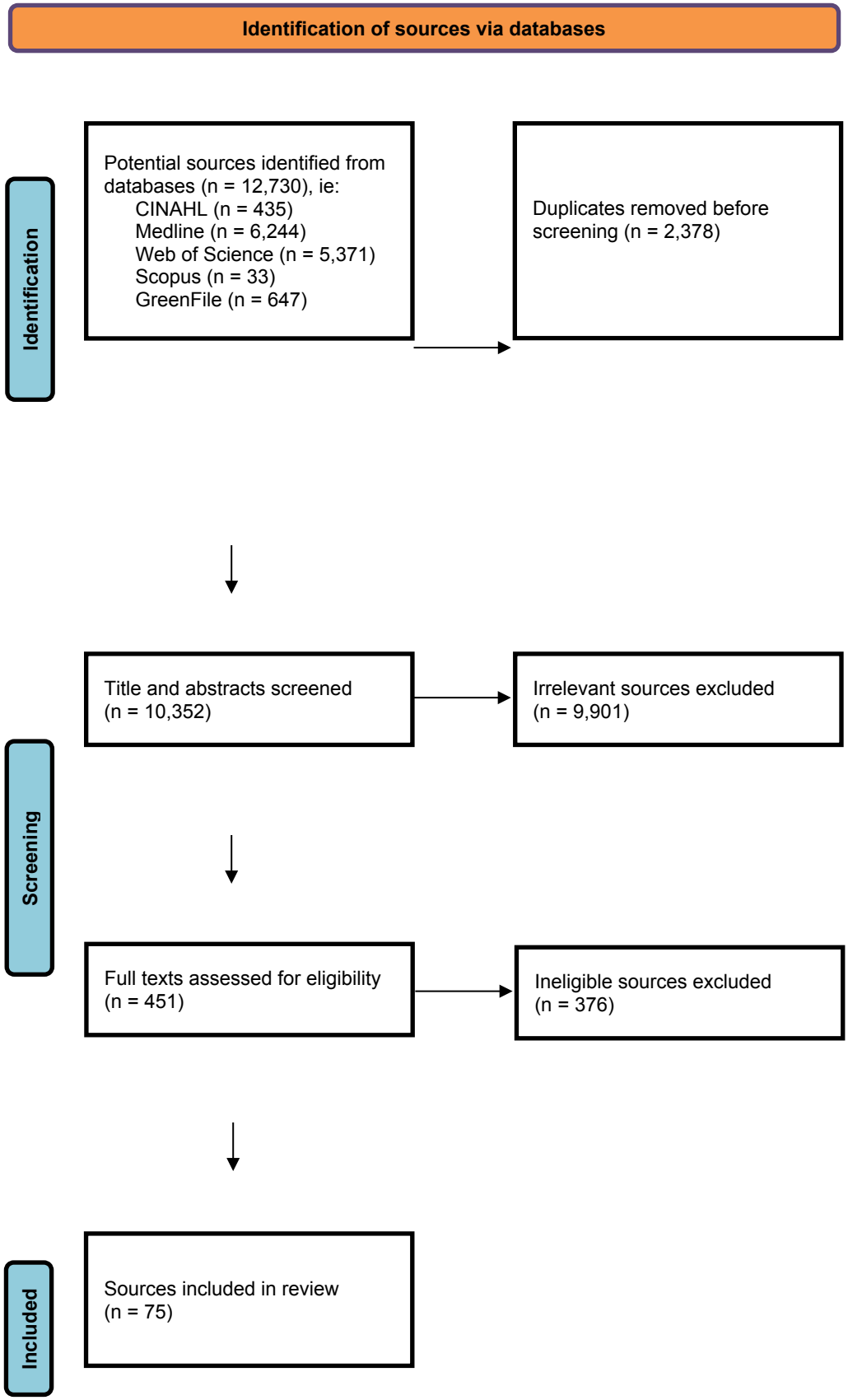
[99] J. Brown, *Black Utopias: Speculative Life and the Music of Other Worlds*. Duke University Press, 2021.

[100] L. Cabnal, “Acercamiento a la construcción de la propuesta de pensamiento epistémico de las mujeres indígenas feministas comunitarias de AbyaYala,” in *AAVV. Feminismos diversos: el feminismo comunitario*, Madrid: ACSUR–Las Segovias, 2010, pp. 11–24.

[101] M. J. Page *et al.*, “The PRISMA 2020 statement: an updated guideline for reporting systematic reviews,” *BMJ*, p. n71, Mar. 2021, doi: 10.1136/bmj.n71.

FIGURES

Figure 1. PRISMA diagram



NB: Adapted from [101].

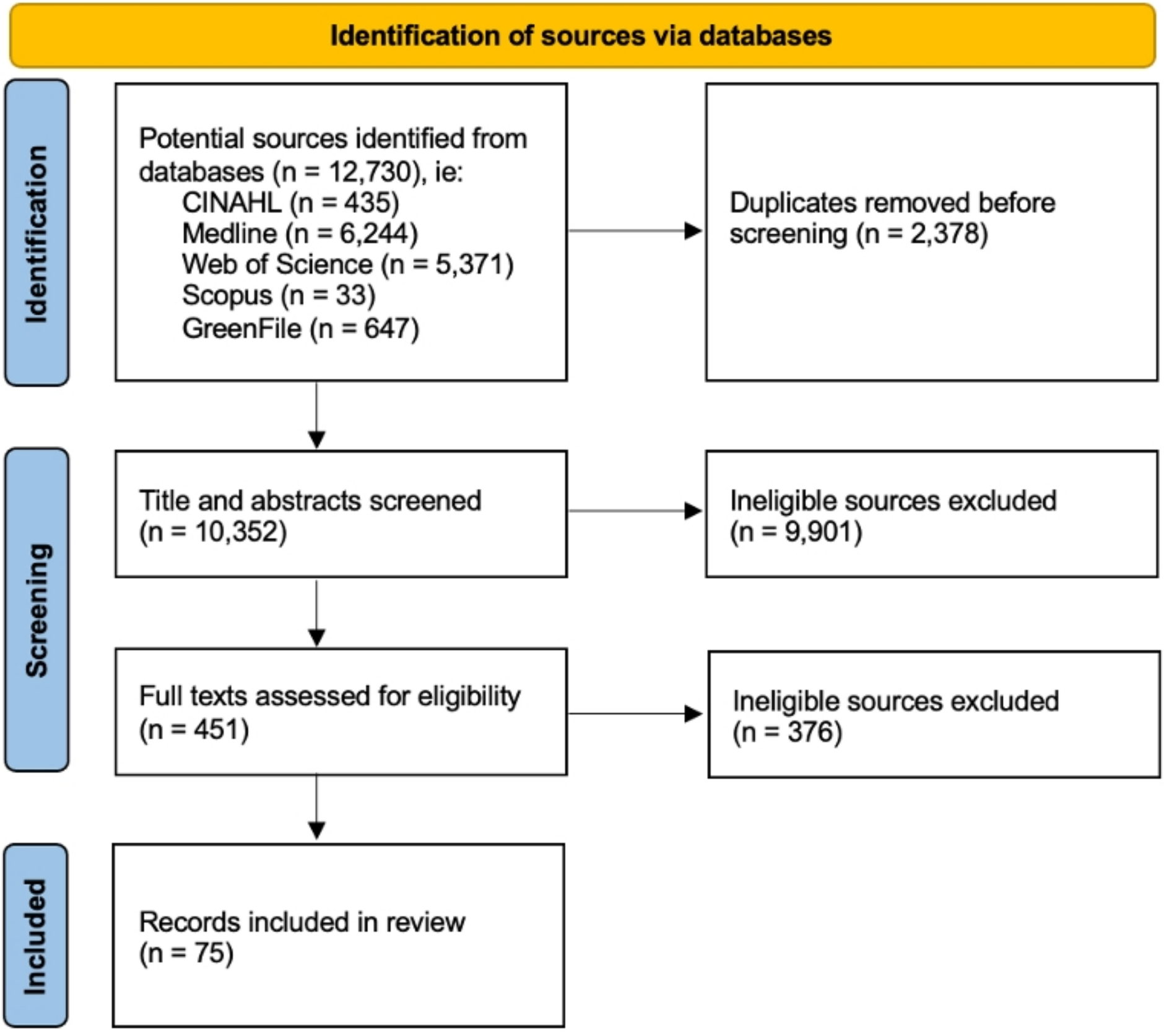


Fig1