

Anthropogenic Environmental Change and Sexual and Reproductive Health in Southeast Asia: A Scoping Review

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ABSTRACT

While often neglected, sexual and reproductive health (SRH) is a significant dimension of the health implications of global anthropogenic environmental change, including climate change. However, literature on the topic is scarce and largely neglects low and middle-income countries (LMICs) and regions such as Southeast Asia. We thus aimed to synthesise the literature connecting anthropogenic environmental change and SRH in Southeast Asia.

We conducted a scoping review, searching 5 databases systematically, and inductively synthesized findings. We included 45 eligible sources of 2,764 screened, and generated 5 themes pertaining to pollution; nutrition; gender-based violence; changes in ways of life; and infectious diseases. Regional patterns of environmental change were presented as forces influencing SRH (e.g. fertility and pregnancy outcomes); increasing gendered vulnerabilities (e.g. in extreme-weather events); and potentially disrupting reproductive plans, attitudes, and access to services.

Region-specific factors such as the large-scale expansion of plantation agriculture, pollution due to agricultural and industrial developments, and heightened susceptibility to extreme-weather events given the tropical climate were associated with worsened SRH outcomes. This highlighted the need for further research, particularly of ethico-political considerations.

Keywords: sexual and reproductive health; environmental change; climate change; Southeast Asia; pollution

INTRODUCTION

Anthropogenic environmental change at the global scale is a growing threat to life and livelihood, resulting in particularly challenging conditions in climatic environments such as the tropics (Corlett, 2012). Global environmental changes—many shown to be anthropogenic or human-influenced—include stratospheric ozone depletion, changes in ecosystems due to loss of biodiversity, changes in hydrological systems and supplies of freshwater, land degradation, pollution and changing bio-geo-chemical flows, urbanization, stresses on food-production systems, and climate change.

Accordingly, research on the health implications of environmental change has proliferated over the past decade and has increasingly become a central preoccupation in the global health agenda. For instance, the emergence and becoming-hegemonic of ‘planetary health’ (Fearnley, 2022)—referring to “the impact on human population health of the degradation of planetary ecosystems” (Anderson, 2023)—attests to the shifts in priorities that have taken shape. Now more than ever, there is a need to deepen our understanding of how environmental transformations impact human health, and how this can be mitigated and managed.

Despite the broad development of an ‘environmental’ awareness in public health, the field of sexual and reproductive health (SRH)—broadly defined as the “range of services that cover access to contraception, fertility and infertility care, maternal and perinatal health, prevention and treatment of sexually transmitted infections (STIs), protection from sexual and gender-based violence, and education on safe and healthy relationships” (WHO, n.d.)—has remained largely understudied. The literature on the topic remains limited (Arunda et al., 2024; van Daalen et al., 2021), even while environmental changes continuously present new questions concerning reproductive health at the individual and population level. In fact, as Grace (2017) notes, “an incorrect assumption—that there is no reproductively relevant biological or behavioural response to climate change (beyond migration)—has become standard”.

Accordingly, based on the available literature and speculative hypotheses, efforts by SRH scholars to set research directions and highlight priority areas in this intersection have grown (e.g., Rousseau, 2023; Sorcher et al., 2024). Such priorities, however, have been developed vis-à-vis sharp asymmetries in the geographical distribution of published research, with certain regions—as well as low-and-middle-income countries (LMICs)—given negligible consideration (Arunda et al., 2024). Southeast Asia, specifically, is minimally represented in the already limited literature on the topic, despite susceptibility to climate change “*effects [that] are often more dramatic around the equator, and [whose] negative impacts are more severe in low-income and middle-income countries with less financial, infrastructural and geographical resources to mitigate the consequences*” (Arunda et al., 2024). The result, then, is not only a limited understanding of region-specific conditions but also an obscuring of the factors shaping differential consequences of environmental degradation across geographical, socio-economic, gendered, and racial lines. Furthermore, as Reis Castro (2023) notes, “*climate change is creating new epidemiological geographies but also prompting epistemic shifts*” in the directionality of health expertise, with the implication that asymmetries in the regional focus of research risk overlooking valuable lessons not just of regional-applicability but potentially for other parts of the world.

Thus, in such an ‘Anthropocene’ setting, referring to “*the current epoch of unprecedented anthropogenic planetary change*” (Moore, 2016), our scoping review aimed to synthesize published

literature exploring SRH, environmental change, and related questions of environmental in/fertility in Southeast Asia, identifying region-specific lessons and directions for policy and research. Our objectives were to: (1) summarize the scope (i.e. nature, extent, distribution) and findings of existing literature encompassing the effects of environmental change on SRH services needs and access in Southeast Asia, how these are distributed across social differentiations, and existent or potential interventions; (2) explore current and potential impacts of environmental change on SRH needs and services provision in the Southeast Asia region, and identify lessons and potential interventions to mitigate these impacts in line with a politics of ‘environmental reproductive justice’ (Dow & Chaparro-Buitrago, 2023); and (3) generate knowledge and conceptual tools to understand the health effects of environmental change with particular relevance to Southeast Asia and broader study of the region.

METHODS

Study design

We conducted a scoping review using Arksey and O’Malley’s (2005) method with Levac’s (2010) revisions. Table 1 provides study definitions.

Stage 1. Defining the research question

Our primary research question was: “what are the scope and main findings of literature exploring environmental change effects on SRH in Southeast Asia?”. As secondary research questions, we also asked: “How does the literature on climate and environmental change and SRH in Southeast Asia reflect, nuance, differ from, or advance dominant global narratives on the topic?” and “How can we conceptualise the health effects of climate and environmental change, with particular relevance to SRH and Southeast Asia and within the broader scholarship of the region?”.

Stage 2. Identifying relevant studies

To increase breadth and comprehensiveness, we searched 5 relevant electronic databases (i.e. Medline, CINAHL, Web of Science, GreenFile, Scopus) completed on 6 May 2025. We used ‘environmental change’ AND ‘SRH’ AND ‘Southeast Asia’ terms and related terminology, adapted to MESH terms and subject headings for each database, across title, abstract, or keywords. Table 2 provides an example for Medline.

Stage 3. Selecting studies

Table 3 shows our eligibility criteria, established iteratively based on research questions and lines of inclusion/exclusion based on thematic relevance. All source types, time-periods, study designs, and languages were considered if there was an English abstract and full-text in any language accessible.

After download and deduplication using Covidence software, all authors screened titles and abstracts against eligibility criteria to remove irrelevant documents, then remaining full texts against eligibility criteria to identify total documents for inclusion. We resolved discrepancies through discussion and consensus.

Stage 4. Charting data

Two authors (MDLT, KMW) extracted data from Covidence to an Excel spreadsheet using categories of: (i) source identifiers (i.e., study authors, publication year, title, language); (ii) source

characteristics (i.e., academic discipline, country setting, research question/study aim, study design, participants); and (iii) findings (i.e., environmental changes observed, impacts on reproductive health, distribution of risks across social strata, conceptual contributions, and potentially specific characteristics to a Southeast Asian setting).

Stage 5. Synthesizing and reporting

First, we summarized the scope (i.e. extent, nature, distribution) of eligible sources. Second, we synthesized source findings inductively, using reflexive thematic analysis as described by Braun and Clarke (2021). 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 literature

Extent

Figure 1 provides the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram of the 45 eligible sources of 3,321 identified. Most were research articles (n=44) along with 1 commentary. Publications started in 2005, when 1 article was published, peaking in 2024 with 8 articles published. Most articles were published after 2018, with the volume of publications tripling in the last decade (2016-2025) compared to the previous one (2005-2015). We identified 34 publications on the topic in the past 10 years, as opposed to 11 in the previous decade.

Nature

All publications were in English (n=45). Of the 44 research studies, 33 were quantitative studies (27 included human participants and 6 did not), 8 were qualitative (3 included human participants and 5 did not), and 3 were reviews (all intra-country scoping reviews). Most (n=39) were epidemiological studies, of which 31 displayed explicit disciplinary affiliations—either through the departments authors were affiliated with or through the publisher’s scope of work—to both public health and environmental sciences, whereas only 5 were framed as exclusively public health publications. Other academic disciplines included were: sociology (n=4), gender studies (n=3), and anthropology, development studies, film studies, law, and urban studies with 1 article each.

Distribution

All studies were conducted in or focused on Southeast Asian countries and none were multi-country. Thailand (n=12) was most represented, followed by Indonesia (n=8), Vietnam (n=7), Philippines (n=6), Malaysia (n=5), Cambodia (n=3), and Singapore (n=2), while the remaining Southeast Asian countries (i.e., Brunei, Laos, Myanmar, Timor Leste) were not included.

Thematic findings

We synthesized findings into five inductive themes: (1) pollution; (2) nutrition; (3) gender-based violence; (4) changes in ways of life; and (5) infectious diseases.

Pollution

In total, 35 sources (35/45; 77.8%) discussed the reproductive impacts of exposure to environmental pollutants. This was the most dominant theme in our study, suggesting that even while global climate change is a concerning phenomenon, local-scale anthropogenic influences on the environment must not be overlooked. The impacts on SRH studied can be broadly summarized as either (a) impacting fertility, (b) impacting foetal development, (c) affecting birth outcomes, and/or (d) impacting child development, whereas the causes for pollution cited by sources were multiple.

Considering that most countries in Southeast Asia have large rural populations whose income and way of life is tied to agricultural practices, most (n=21) of these articles discussed the impact of agriculture-related pollution on SRH. Pesticides, insecticides, and herbicides featured prominently in this regard, primarily exposure to organochlorine pesticides (OCPs) (Asawasinsopon et al., 2006; Malarvannan et al., 2009; Naksen et al., 2015; Sudaryanto et al., 2006; Tan et al., 2009), organophosphate pesticides (OPs) (Liang et al., 2022; Naksen et al., 2015; Onchoi et al., 2020; Wang et al., 2025; Widyawati et al., 2020), pyrethroid insecticides (Wang et al., 2024, 2025), and dioxin (Reagan, 2011; Van Luong et al., 2018). Their use was described as happening “*in significant amounts to reduce crop losses and enhance agricultural yields, with beneficial effect on food security*” (Dang et al., 2017), while also linked to the large-scale conversion of land into export-oriented rubber and oil palm plantations that has occurred in multiple areas of Southeast Asia since at least the 1950s (Sakai et al., 2017). Some of these pollutants were also linked to phenomena beyond agricultural use, such as ‘dichlorodiphenyltrichloroethane’ (DDT), linked to malaria-eradication efforts in the second half of the 20th Century (Asawasinsopon et al., 2006; Sudaryanto et al., 2006), or dioxin use in Vietnam by the United States’ military (Reagan, 2011; Van Luong et al., 2018).

Many pollutants were described as having “endocrine-disrupting” effects, and consequent impacts on fertility, foetal development, birth outcomes, and infant development, potentially lasting generations (Reagan, 2011; Wee & Grinang, 2024). Endocrine-disrupting chemicals (EDCs) were specifically associated with infertility (Asawasinsopon et al., 2006; Dang et al., 2017), low-birth weight (Asawasinsopon et al., 2006; Widyawati et al., 2020), pre-term birth (Asawasinsopon et al., 2006; Dang et al., 2017), puberty disturbances (Dang et al., 2017), neurobehavioral deficits (Asawasinsopon et al., 2006; Dang et al., 2017; Sinitkul et al., 2018; Wee & Grinang, 2024) and other non-reproductive health complications. Notoriously, various sources emphasized the vulnerability of fetuses to “biological transfer” in cases of in utero exposure to EDCs (Asawasinsopon et al., 2006; Wee & Grinang, 2024), framing the placenta as porous; maternal milk as a potential “exposure route” (Wee & Grinang, 2024); and raising “the criticality of accounting for environmental factors during pregnancy” (Wang et al., 2024). Vulnerability to agriculture-related pollutants was explicitly discussed as an occupational hazard for people working in agricultural settings more than those living and working elsewhere (Baumert et al., 2022).

Likewise linked to agriculture, but also to regional patterns of urbanization, air pollution was raised by 9 sources as a major concern for SRH in Southeast Asia. In some cases, air pollution was attributed to biomass burning or the “dependence on fires to extend lands for agriculture” (Ardiyani et al., 2023), which was presented as a ‘transboundary’ issue due to the potential airborne travel of pollutants (Thaichana et al., 2025; Vichit-Vadakan & Vajanapoom, 2011). However, carbon-dioxide emissions, related to motorcar traffic, geochemical factories, and coal power plants, were

also connected to air pollution, especially in Thailand (Sinitkul et al., 2018). At large, air pollution was linked to adverse birth outcomes such as low birth weight (Ardiyani et al., 2023; Mueller et al., 2021; Thaichana et al., 2025; Vichit-Vadakan & Vajanapoom, 2011), pre-term births (Ho et al., 2023; Thaichana et al., 2025), or “respiratory health issues in the offspring” (Soh et al., 2018). Additionally, 1 article emphasized the regional relevance of air pollution, noting how even though “more than 90% of the global population resided in areas with polluted air [...] Southeast Asia was among the regions with the highest concentration of PM_{2.5} in 2015” (Soh et al., 2018).

Similarly, regional industrialization - mostly from the 1980s onwards (Sakai et al., 2017), was linked to SRH issues, with 12 articles discussing adverse effects of industrialization on SRH - often resulting from poor management of waste and industrial discharge. In fact, water pollution was an important dimension of this environmental transformation, for “industrial discharges have been a primary source of water pollution, releasing a wide range of pollutants into water bodies” (Wee & Grinang, 2024). However, the “unregulated disposal of computers and other electronic equipments”, which Malarvannan et al. (2009) argued to be disproportionately an Asian issue; wastewater discharge (Chheang et al., 2021; Ho & Watanabe, 2018); and solid waste discharge (Qureshi et al., 2015) were all raised as significant pollution issues. Reported effects of exposure ranged from complications during pregnancy such as “abortion and abnormal fetal development” (Thanh et al., 2024), reproductive disorders (Wee & Grinang, 2024), and “disruption in development and growth” or “neurological diseases” (Wee & Grinang, 2024). Comparably, 4 articles raised pre-natal exposure to heavy metals resulting from mining (Ho & Watanabe, 2018; Sinitkul et al., 2018; Somsuan et al., 2019; Thanh et al., 2024), with reproductive implications including potential “intellectual deficits, diabetes, [or] attention deficit hyperactivity disorder and immune dysregulation” in offspring (Bustami et al., 2024). Lastly, 1 article discussed micro-plastics exposure, noting potential consequences including infertility, “stunted growth” and, if exposure occurred during the neonatal period, “onset of several diseases in adulthood” (Hasanah et al., 2024).

It is worth noting that while differentiated impacts across genders was not explicitly discussed, most articles focused on the impact of pollution on foetuses during pregnancy, and thus on pregnant women as primary subjects of research. Nevertheless, only 1 article explored potential vulnerability to pollutants specific to pregnant women and not just their foetuses: “Pregnancy might be a potential window of increased susceptibility to DNA adducts formation through placental oxidative stress-induced DNA damage and inflammation because of a wide range of enzyme metabolic functions in the placenta” (Ardiyani et al., 2023). This has been discussed elsewhere (Pfohl-Leszkowicz, 2008) as a potential step in carcinogenic processes, yet such implications were not part of our study. What was discussed, albeit by just 1 article (Reagan, 2011), were indirect psychological and cultural consequences of pregnancy complications. Such consequences, felt most by women who were pregnant or had adverse birth outcomes, were described as “an initial horrified reaction, social stigma, eventual acceptance of their own children, and then the ongoing heavy burden of care” (Reagan, 2011).

Nutrition

Six (13%) articles discussed nutrition as prominent theme, broadly exploring the impacts on SRH that anthropogenic environmental changes in Southeast Asia have in relation to the availability and quality of water and food. Nutrition was generally presented as being in a state of change due to

environmental changes, while also being a route of exposure to environmental perils. Indeed, 5 of 6 articles in this theme were concerned with deterioration of drinking water quality or bio-accumulation of pollutants in food (Chheang et al., 2021; Hasanah et al., 2024; Ho & Watanabe, 2018; Sakai et al., 2017; Thanh et al., 2024). Nevertheless, an article also developed explicit links between reproductive attitudes and pregnancy outcomes with extreme-weather events and climatic patterns (Sellers & Gray, 2019). Nutrition was also framed as a relevant dimension of SRH in times of regional environmental change considering how the region has been significantly shaped socio-politically by the political economy of food production, from large-scale palm plantations in Malaysia and Indonesia (Wee & Grinang, 2024) to the Mekong delta being “one of the biggest rice-producing regions of the world” (Dang et al., 2017).

Four articles focused on the SRH impacts of bio-accumulation of contaminants in food sources. These reported comparably on the issue from Cambodia (Thanh et al., 2024), Indonesia (Hasanah et al., 2024), Malaysia (Sakai et al., 2017), and Vietnam (Ho & Watanabe, 2018), suggesting regional patterns of exposure. In Cambodia, Thanh et al (2024) showed how “urban growth, poor waste management by communities or cities, agricultural or industrial residues” all led to water pollution, which has in return led to the “presence of contaminants in fish”. Moreover, authors noted how climate change and the human manipulation of water systems, such as building hydroelectric dams, “are altering the course of the water” and threaten the biological equilibrium of aquatic habitats, potentially exacerbating the contamination of fish. The potential SRH risks arising from consumption of contaminated seafood included potential “abortion and abnormal fetal development” if exposure happened during pregnancy (Thanh et al., 2024). In Indonesia, microplastics were reported in drinking water, salt, rice, and approximately 690 marine species, with Hasanah et al (2024) arguing that “microplastics in body tissues can lead to many detrimental effects on an organism’s health, such as infertility, stunted growth, internal or external damage, and blockage of body tracts”. Similarly, a study in Malaysia identified that waste released from urban settlements into the Selangor River basin led to heavy-metals in the water (Sakai et al., 2017). Such contaminants accumulated in some marine and freshwater species used for human consumption and “exceeded their maximum permissible levels for food established by the Malaysian Food Regulations [in] 1985” (Sakai et al., 2017). Likewise, Ho & Watanabe (2018) found that “municipal sewage, industrial wastewater, agricultural runoffs, and landfill leachates” in Long An, Vietnam, led to contaminated food consumption that acted as “endocrine disruptor responsible for adverse effects on the reproductive, immune, and central nervous systems of wildlife and humans”.

Similarly, 2 articles focused on the SRH impacts of deteriorating water quality due to exposure to contaminants. Much like the articles focusing on post-industrial exposure to contaminants via food, these articles—from Cambodia (Chheang et al., 2021) and Indonesia (Hasanah et al., 2024)—also attributed water contamination to phenomena such as “rapid growth in the industrial and agricultural sectors” (Chheang et al., 2021). The reported consequences followed similar patterns, with an article investigating lead contamination in water noting: “...excessive intake of lead can cause long-term health problems associated with children’s behaviours, growth, and development of their hearing and learning abilities” (Chheang et al., 2021). Authors also highlighted socio-economic factors influencing vulnerability, as access to clean water intersected with income and social power. Namely, Chheang et al (2021) noted there are “serious health concerns to villagers

who are living in the areas (...) where local water vendors pump the water and sell it to the villagers who do not have access to the public [piped] water supply”.

The remaining article focused on climate change, presenting potential associations between it and changes in SRH at the population level. Writing about Indonesia, Sellers and Gray (2019), suggested that in future climate scenarios “there is likely to be a greater frequency of years with delayed monsoon onset which in turn may result in lower rice production”. In return, “shortfalls in rice production may have important implications for fertility outcomes”. Authors explored the range of potential consequences by listing existent relationships between agricultural output and reproduction:

“Birth weights are significantly higher in Indonesia for children born immediately following the main rice harvest (...), the effects of climate shocks on livelihood and expenditure patterns may have increased maternal stress levels, affecting the probability of a live birth (...), changes in both nutrition and stress may have played some role in influencing the gap between fertility intentions/family planning use and live births” (Sellers & Gray, 2019).

Gender-based violence

Six sources developed this important theme, exploring the ways symptoms of anthropogenic environmental change—often extreme-weather events—heightened gendered vulnerabilities to structural and interpersonal violence. Indeed, as Valerio (2014) argued, despite natural disasters being imagined as affecting all people similarly, “gender relations are part of the human experience of disasters and may under some conditions lead to the denial of the fundamental human rights of women and girls in crisis”. Tanyag (2018) added: “Vulnerability to the impacts of a disaster is mediated not only by different physical exposures and biological or physiological gender differences, but also by the different socially constructed vulnerabilities that derive from the social roles men and women assume, (...), as well as existing patterns of gender discrimination”. Articles presented climate shocks as gendered experiences, heightening women’s—though not exclusively (Alibudbud, 2023)—vulnerability to overt and structural violence.

Most (5/6) focused on direct exposure to gender-based violence resulting from extreme-weather events. Of those, 4 focused on the heightened vulnerabilities experienced by women (Nguyen, 2019; Nguyen, 2025; Tanyag, 2018; Valerio, 2014), whereas 1 discussed the experiences of LGBTQ+ individuals (Alibudbud, 2023). Nguyen’s (2019) article offered a salient conceptual tool to frame the social context following a climate shock (e.g., a typhoon), referring to Italian political philosopher Agamben’s (1998) notions of “bare life” and “state of exception” in “emergency settings where normal juridical systems are suspended (...) In these instances, people are stripped to “bare life,” a form of life that can be killed/destroyed without fear of punishment” (Nguyen, 2019). Thus, framing the social aftermath of natural disasters as “a time when social order breaks down amid the ensuing chaos and destruction”, Nguyen (2019) provided conceptual context to make sense of pre-existent gendered relationships and vulnerabilities. In this social staging, often accompanied by population displacement, all authors insisted on the risks of sexual violence (i.e., sexual abuse, rape) for girls and women, with potential additional consequences including exposure to sexually-transmitted infections (Tanyag, 2018), maternal mortality (Tanyag, 2018), or unwanted pregnancies (Nguyen, 2025).

Moreover, Alibudbud's (2023) work on LGBTQ+ Filipinos revealed a different set of gendered vulnerabilities to natural disasters. Following a 'minority stress theory' framework, Alibudbud traced how "patterns of discrimination against LGBTQ+ Filipinos are apparent in relief efforts after climate-related events in the country", resulting in potential "overt denial of relief goods" and services, "disregarding self-determined gender", or LGBTQ+ individuals or families being "deprived of housing and food support since they are not recognized as families or a priority" (Alibudbud, 2023). Moreover, by applying minority stress theory, Alibudbud suggested that mental health problems among LGBTQ+ individuals (and potentially other minoritized groups) may be heightened by climate change, drawing an association between increased risk of natural disaster and "the experience of prejudicial events, expectations of rejection, hiding and concealing one's sexual orientation, and gender minority identities due to social stigma" (Alibudbud, 2023).

Comparably, 2 articles explored the indirect forms of violence experienced by women following extreme-weather events (Tanyag, 2018; Tran & Downes, 2023), namely, the asymmetrical burden of care demanded of women during disaster relief. These articles explored the ways in which expectations are placed on women so that "post-disaster survival of families and communities depends on demands for self-sacrificing acts" (Tanyag, 2018), hence relying on patriarchal assumptions over the division of labour and the role of women in the heteronormative family. Across the settings studied—post-typhoon experiences in the Philippines and adaptations to accelerating floods in Vietnam—there was a common understanding that environmental disruptions result in an added burden on women, whether through direct domestic labour or as "extra expenses to clean premises" that therefore "expose women to health risks, including waterborne diseases and lower life expectancy" (Tran & Downes, 2023). Tanyag (2018) framed it as: "disaster relief and reconstruction constitute gendered processes that rely on and mobilize women's unremunerated social reproductive labour, particularly through their role as primary caregivers". Furthermore, Tanyag (2018) traced national and political narratives of women's 'resilience' in response to natural disasters, expressing cynicism over the structural implications of an overreliance on women's care work. That is, "the gradual depletion of female bodies at the national level, where preexisting material inequalities are exacerbated through a broader neoliberal project of developing a 'disaster-resilient country' in a crisis-prone world" (Tanyag, 2018).

Changes in ways of life

While most sources drew direct causal connections between anthropogenic environmental change and impacts on SRH, 6 articles described an indirect relationship, though such connections were relatively disjointed. The concerns of these articles ranged from attempts to make sense of broad changes in the total fertility rates of nations (e.g., Qureshi et al., 2015) to politically engaged research concerned with the impacts of displacement and modernization on communities' abilities to maintain their ways of life (e.g., Saunders et al., 2024). Altogether, these articles assembled a broad picture of shifting narratives around reproduction in Southeast Asia, linked to larger scale socio-political transformations of the region over the past decades.

A prominent discussion in this theme was that of internal displacement and land dispossession. Two studies were concerned with the reproductive implications of changing ways of life due to loss of land, whether that resulted from natural disasters (Tanyag, 2018) or state violence (Saunders et al.,

2024). These articles adopted an outlook akin to the ideas of “structural fertility” (Yopo Díaz & Watkins, 2025), understanding reproduction as directly linked with structural forces acting on individuals and communities. Saunders, Sherwood, and Whyte (2024) explored this in West Papua, Indonesia, considering how industrialization processes and the arrival of extractive industries such as mining and plantations to Indigenous land resulted in a loss of political autonomy. They linked this to the idea of “social reproduction”, and argued that “the idea that political autonomy can be viewed as ontologically distinct from the conditions that sustain life, is itself difficult to sustain” (Saunders et al., 2024). In their view, this led to a loss of Papuans’ “autonomy over the necessary conditions that reproduce social, economic and biological life”, amounting to a “slow-motion genocide” that echoes concerns over reproductive justice raised by social scientists elsewhere (e.g., Clarke, 2018). Similarly, Tanyag (2018) considered the experience of displacement following natural disasters, raising concerns over the SRH harms that women are exposed to in “the equally traumatic experience of contending with the long-term or gradual harms associated with rebuilding their lives in protracted internal displacement”.

We identified 2 articles preoccupied with structural notions of fertility, though with less attunement to the situated struggles of specific communities. Both Jegasothy et al. (2021) and Qureshi et al. (2015) in Malaysia explored questions concerning the impact of industrialized ways of life in the country’s total fertility rate. While they maintained a broad approach to identify possible connections, concerns were raised over socio-economic forces. For example, Jegasothy et al. (2021) claimed: “Through its economic effects, climate change could have a substantial impact on population growth, primarily by influencing behaviour of people towards increasing family size”. Qureshi et al (2015) focused on other energetic pathways for industrialization, observing correlations between use of different sources of energy (i.e., nuclear, combustibles) and indicators such as total fertility rate, total life expectancy at birth, and infant mortality rate.

The remaining 2 articles explored broad changes in SRH outcomes and attitudes in rural, agricultural, and forested settings, suggesting specific potential changes in reproductive attitudes in such contexts due to climate change (Nguyen, 2025; Sellers & Gray, 2019). For example, Sellers and Gray (2019) suggested that, while there are “strong effects of climate shocks on fertility intentions and family planning use in non-farm populations”, environmental changes “may have played some role in influencing the gap between fertility intentions/family planning use and live births observed in both farm and non-farm households”. Likewise, Nguyen (2025) suggests that “exposure to drought could lead women to want to accelerate their childbearing to offset their perceived risk of their children’s mortality or to increase household labor”. However, these claims remained merely speculative as evidence was lacking to advance them.

Two articles also factored in potential disruption to the provision of SRH services due to climate. Jegasothy et al. (2021), for example, argued that “floods can affect the health of new-borns by affecting the pregnant women in terms of both mental and physical health and diminishing their capability to avail health services”, whereas Nguyen (2025) argued that climate shocks may result in “limited access to reproductive health services including contraception due to suppressed economic circumstances and reduced availability of reproductive healthcare”.

Infectious diseases

Only 2 articles (Chakrabarti, 2021; Fuentes Cordoba, 2024) addressed infectious diseases. Specifically, both focused on malaria as an outcome of anthropogenic environmental change that impacts SRH, even while other vector-borne diseases such as Zika or dengue are known to affect SRH in Southeast Asia (Maneerattanasak et al., 2024). While we identified results for such diseases, only these 2 articles developed explicit links between anthropogenic influences in the environment, epidemiological patterns, and SRH.

Both discussed malaria risk as an outcome of deforestation: “Forest loss and expansion of land used for agricultural and non-forest activities can lead to an acceleration of the mosquito life cycle with higher temperatures leading to higher biting rates” (Fuentes Cordoba, 2024). Multiple reasons were provided to account for this: “compared to forested soil, cleared land is more likely to be without sunshade increasing the presence of stagnant water and puddles. Likewise, the puddles formed in deforested land are less acidic creating more favorable conditions for mosquito’s reproduction”, (Fuentes Cordoba, 2024), whereas biodiversity losses also caused a decline in natural mosquito predators (Chakrabarti, 2021). The large-scale spread of plantation agriculture in Southeast Asia was therefore attributed responsibility for this anthropogenic environmental change: “The largest driver of deforestation in Indonesia has been the expansion of industries such as palm oil and timber” (Chakrabarti, 2021). The reported effects on SRH of deforestation—with malaria at its centre—were “higher mortality risks due to in utero exposure to [the consequences of] protected forest loss” (Chakrabarti, 2021) and, for “children more exposed to deforestation the year before conception [...higher likelihood] to be shorter for their age, thinner for their height, and report lower birth weights” (Fuentes Cordoba, 2024).

DISCUSSION

Overview

To our knowledge, this review is the first to trace connections at a regional level between anthropogenic environmental change and SRH in Southeast Asia. Existent research on the topic had thus far been conducted elsewhere in either a preliminary or theoretical manner focusing on future directions (Dow & Chaparro-Buitrago, 2023; Rousseau, 2023; Sorcher et al., 2024; van Daalen et al., 2021; Yopo Díaz & Watkins, 2025) or in Western or higher-income settings, such as Europe (e.g., Dow, 2016), North America (e.g., Schneider-Mayerson, 2022), and Australia (e.g., Roberts et al., 2023). Implications for LMICs have thus only been glossed over by broad initial efforts (Arunda et al., 2024), with no other regional works attempting to understand this issue in the unique Southeast Asian context. In fact, research on this topic remains minimal in Asia as a whole, barring growing awareness in China as reported by studies on the perception of climate change and its impact on reproductive plans and choices (Fu et al., 2023) and cultural panic related to declining sperm count in men suspectedly due to environmental pollution (Lamoreaux, 2023; Wahlberg, 2018).

Such a regional absence in the literature has ultimately led to crucial shortcomings in our understanding of SRH in ‘Anthropocene’ times. This is especially so when critical scholars of Southeast Asia insist that “the Anthropocene” as a notion “was theorized with profound intellectual and political intensity in Java long before it became of interest to contemporary Western scholars” (Bobbette, 2023). Central concepts in our contemporary understanding of planetary health such as

the ‘Anthropocene’ are conceptually indebted to Southeast Asian contributions, most of which have been made invisible by mainstream scientific canon.

Indeed, beyond the overarching concept of the ‘Anthropocene’ and its origins, theorists in the environmental humanities have long emphasized the pivotal role of the Southeast Asian region in our understanding of contemporary global ecologies (Bloembergen et al., 2025), characterized by experiments with plantation frontiers (Chao, 2022; Li & Semedi, 2021; Paredes, 2023; Tsing, 2004) and as a tropical region where adaptations to anthropogenic climate change are increasingly salient (Clancey et al., 2024; Ley, 2021). Moreover, beyond the country-specific literature we identified in our review, adopting a regional approach in Southeast Asia also allowed for a more complex understanding of the “transboundary” environmental issues affecting people in more than one country. This included, but is not necessarily limited to, concerns over water quality in the Mekong river spanning China, Myanmar, Laos, Thailand, Cambodia, and Vietnam (Chheang et al., 2021) and transboundary haze due to slash-and-burn land clearing for agricultural purposes, resulting in air pollution affecting various countries at once (Thaichana et al., 2025; Vichit-Vadkan & Vajanapoom, 2011). So, what lessons can we draw and what stories are there to tell from Southeast Asia on SRH in environmentally-challenged times?

Our SRH findings map regional patterns of environmental risk including: potential exposure to pollutants during pregnancy in agricultural and urban settings (see “Pollution”); concerns over food and water safety due to industrial discharge (Chheang et al., 2021; Hasanah et al., 2024; Ho & Watanabe, 2018; Sakai et al., 2017; Thanh et al., 2024) as well as shifting food production patterns due to climate change (Sellers & Gray, 2019); an increasing burden of vector-borne diseases directly linked with deforestation, specifically mosquito-borne diseases such as malaria, Zika, and dengue which have deleterious effects on developing fetuses and children (Chakrabarti, 2021; Fuentes Cordoba, 2024); the absence of protections for women (Nguyen, 2019; Nguyen, 2025; Tanyag, 2018; Valerio, 2014) and gender minorities (Alibudbud, 2023) following natural disasters and extreme-weather events in ways that create risks of gender-based violence; displacement and land dispossession due to natural disasters and political violence on the environment (Saunders et al., 2024; Tanyag, 2018); and shifting attitudes towards reproduction amidst uncertain environmental conditions (M. Nguyen, 2025; Sellers & Gray, 2019).

Unequivocally, SRH in Southeast Asia is “entangled” (Nading, 2014) with plantations as mode of agricultural mass-production (Sakai et al., 2017; Saunders et al., 2024; Wee & Grinang, 2024); industrialization and post-colonial developmental visions (Sakai et al., 2017; Saunders et al., 2024); a global food economy demanding accelerated agricultural production through potentially harmful pesticides, herbicides, and insecticides (Dang et al., 2017; Sakai et al., 2017); and with living and non-living environmental entities such as mosquitos (Chakrabarti, 2021; Fuentes Cordoba, 2024) and typhoons (Tanyag, 2018). Many of these issues require transnational solutions—the most prominent examples being pollution of water bodies spanning multiple countries (Chheang et al., 2021) or air pollution due to agricultural expansion (Thaichana et al., 2025; Vichit-Vadkan & Vajanapoom, 2011)—ranging from regional cooperation in regulatory frameworks, care provision for environmentally-displaced communities, or global re-designs of economic forces.

Implications

Our research stands within a growing canon of public health literature attuned to environmental issues, setting the stage for further topic-specific and regionally-situated research on SRH in Southeast Asia. Indeed, this topic necessitates interdisciplinary perspectives drawing on the recent work of social scientists who have attempted to expanding the SRH conceptual repertoire (e.g., [Dow & Chaparro-Buitrago, 2023](#)). [Yopo-Díaz and Watkins \(2025\)](#), for instance, proposed the concept of ‘environmental infertility’ to understand how “transformations in the environment are also substantially affecting reproduction and the ability to have children”. Beyond environmental change, social scientists have long insisted on understanding SRH beyond the physical process of reproduction, locating it instead within broader structural and socio-cultural settings ([Clarke, 2018](#); [Lamoreaux, 2023](#); [Van Hollen & Appleton, 2023](#); [Wahlberg, 2018](#)). By attending specifically to environmental conditions, we have sought to incorporate such perspectives into an accelerating history of ecological thinking in public health research. Starting from development of the notion of “disease ecology” in the 20th Century ([Anderson, 2004](#)) or the contemporary surge of ‘planetary health’ as a macro-lens ([Anderson, 2023](#); [Fearnley, 2022](#)), there are new directions to draw out the ways in which ecological systems, and their potential imbalances, result in embodied burdens on individuals. In fact, while early notions of the idea of “disease ecology” focused specifically on infectious diseases, allowing for what [Anderson \(2004\)](#) referred to as “natural histories of infectious disease”, the environmental conditions of today make it clear that concepts of disease ecology must expand beyond the sole confines of infectious diseases.

Accordingly, our study highlights several lessons for health researchers, service providers, and policymakers. Clearly, grand narratives of “declining fertility” — especially in Asia ([Lamoreaux, 2023](#); [Wu & Huang, 2018](#)) — must account for environmental factors, including declines in fertility due to environmental factors; potential pregnancy and developmental complications due to exposure to pollutants; or simply shifting attitudes toward reproduction amidst environmental uncertainty. While these are yet to be reported in Asia, the latter may be linked with “birth strikes”—protests by individuals who refuse to reproduce until authorities commit to providing a liveable future in environmental and political terms ([Schneider-Mayerson, 2022](#)). Narratives of maternal responsibility or “blame” over care of offspring during and after pregnancy should certainly be revised ([Dow, 2016](#); [Ford, 2019](#); [Jokela-Pansini, 2022](#); [Lamoreaux, 2023](#); [Lappé et al., 2019](#); [Roberts et al., 2023](#)), especially if these insist on the idea that child development depends on parenting skills and management of risk. As our findings suggests, environmental conditions far beyond the control of any given individual increasingly influence foetal and child development, potentially even before conception ([Fuentes Cordoba, 2024](#)). While SRH services may be adapted to include air or water filters among care packages during pregnancy or for newborns, the expectations placed on individuals must be balanced with the broader environmental landscape in which they are situated. Arguably, stringent regulations ensuring environmental protection against industrial and agricultural waste or reducing air pollution from cars and plantations may be most effective in improving public health outcomes, highlighting the need for interdisciplinary public health collaborations with environmental advocates.

Our review also raises the need for gender-specific consideration of SRH services, narratives, and policies amidst shifting environmental conditions. Namely, the 6 articles discussing an elevated burden of gender-based violence in the context of extreme-weather events ([Alibudbud, 2023](#); [Nguyen, 2019](#); [Nguyen, 2025](#); [Tanyag, 2018](#); [Valerio, 2014](#)) raised the need for gender-specific

protections in climate change-induced disasters as a public health issue. In Europe, Amorim-Maia et al (2023) suggested a potential response of “refuge spaces” that “must be gender responsive, culturally inclusive, and easily accessible”, whereas Ayeb-Karlsson’s (2020) work in Bangladesh suggests that interventions need to start earlier to ensure women visit climate shelters when disasters occur. Beyond physical safety, our review also highlights the importance of broader cultural interventions regarding reproduction and the socio-political construction of women’s duty to reproduce. For example, if widespread environmental degradation comes with the implication of higher risks of unsuccessful pregnancy and adverse birth outcomes, then it is imperative for public health narratives and services to mitigate the “initial horrified reaction” of women and attempt to undo “social stigma” that Reagan (2011) reports. However, few articles in our review raised specific gendered-vulnerabilities, with further research required to highlight potential targeted interventions.

The evident need for SRH research in the Southeast Asian context must be balanced with careful ethical and political considerations. Feminist social scientists have repeatedly highlighted the need for a delicate balance when reporting on SRH issues and caring for those affected. It must nuance our understandings of gender, sexuality, and reproduction without reproducing the “heteronormative pathologizing of intersexuality, nonreproductive sexual activity, and impaired fertility” that Lamoreaux (2023) warns of, and “refusing a retrenchment into heteronormative fantasies about “normal” bodies” that feminist social scientists scholars like Roberts et al (2023) or Agard-Jones (2013) report on. In a way that is accelerated by environmental degradation, public health research on SRH may need to revise the cultural and medical ideals and expectations of reproduction it builds upon, engaging directly with critical feminist perspectives in the social sciences (e.g. Keaney et al., 2025).

We echo concerns raised by Lamoreaux (2023) about potential intersections between environmental degradation and long-standing legacies of “Orientalism” deployed on Asian people, cultures, and countries. Such medico-cultural compounding can result in the discursive production of a “polluted Other” (Litzinger & Yang, 2020). That is, a depiction of non-Western people’s exposures to environmental risks in ways that normalize and naturalize chronic exposures and associated health issues, “racialize toxicity” (2023), and “problematically disconnect (...) pollution from the very systems of globalized production and consumption (...) that have propelled and intensified both [Southeast Asia’s] stupendous development and its ecological challenges” (Litzinger & Yang, 2020). Likewise, there are ethico-political considerations related to the emergent intersections between SRH and what is commonly referred to as “tropical medicine” in Southeast Asia. After all, the cultural construction of “the tropics” has historically been imbued with racial imaginings, anxieties, and desires (Anderson, 2006; Chang, 2016; Manley, 2025). “The tropics”, after all, tropics are not just a physical geography (...), they are also an “imaginative geography” that was, in the mode of Saidian Orientalism, constructed as an otherness to European civilization” (Chang, 2016).

We might navigate this impasse by attending to the epistemic shifts that anthropologist Reis Castro (2022, 2023) raises. Through her work on contemporary mosquito science in Brazil, Reis Castro (2023) notes a phenomenon she refers to as the “becoming Brazil of the world”. Namely, this alludes to how global patterns of “tropicalization”—meaning the “transformation of temperate

ecosystems (...) in response to warming temperatures” (Osland et al., 2021)—driven by anthropogenic climate change, are shifting epidemiological geographies and thus expanding the scope of a ‘tropical medicine’ that was previously constrained to a limited part of the world and exclusively to non-Western people. For epidemiologists in Brazil and health researchers more broadly, this transformation is accompanied by a sense of “opportunity for a global South, nonhegemonic science to confront global hierarchies of knowledge production” (Castro & Reis-Castro, 2022). Thus, instead of turning from tropical medicine’s culturally contested legacies, imbued with orientalist debris and imperial aims, we may instead re-think how a knowledge-base of tropical health matters—SRH, in this case—can also inform global preparedness in regions facing new climatic susceptibilities.

Lastly, despite the cartography of environmental risks pertaining to SRH we developed, our review found limited research regarding environmental concerns and SRH in Southeast Asia. Most sources focused on environmental pollution, which raised meaningful lessons but similarly highlighted the remaining gaps in understanding how climate change, specifically, affects SRH. Likewise, we found regional knowledge gaps related to cultural attitudes on reproduction in shifting environmental conditions, the reproductive impact of heat stress in warming temperatures (Molla, 2025), and the environmental impacts of menstrual products and contraceptives (Rousseau, 2023). This review, then, emphasizes the need for further regional research while incorporating the ethico-political considerations unpacked above.

Limitations

This study is not without limitations. Firstly, sources included were those within our search capacity that included English-language title and abstract indexing, which may have introduced a selection bias. However, to ensure sufficient coverage, we included 5 databases and all languages for full texts. Secondly, as normal in scoping reviews, we did not evaluate source quality to enable as diverse a range of eligible sources as possible. Lastly, while there is more literature on potential impacts of environmental change on SRH, we excluded all sources that did not explicitly describe the environmental transformations involved.

Conclusion

While often considered separate phenomena, SRH and anthropogenic environmental change are increasingly linked. Understanding these impacts in a locally- and regionally-situated manner is of utmost importance, with lessons to be drawn from and for under-represented regions such as Southeast Asia. Our findings suggest that climate change—specifically manifested as extreme-weather events and unpredictable precipitation patterns—and post-industrial pollution are growing influences on SRH in the region, whereas attention is also needed on how environmental changes impact epidemiological patterns of relevant infectious diseases. More research on this topic is necessary, particularly on the experiences of people most likely to be at risk. For example, there is emphatic need to understand how to guarantee the SRH safety of women and gender minorities in the context of climate disasters; how to minimize and mitigate the occupational exposure to pesticides in agrarian workers; how to consider the impacts of environmental pollution in antenatal care; how SRH risk awareness and attitudes in the region are developing in relation to other parts of the world; and how “tropical” risks from Southeast Asia may be increasingly experienced by “non-tropical” populations elsewhere.

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TABLES AND FIGURES

Table 1. Study definitions

Anthropocene	“The Anthropocene is the scientific label given by earth scientists to the current epoch of unprecedented anthropogenic planetary change... humans are now a geological force in and of themselves, driving planetary change at an unprecedented rate” (Moore, 2016).
Anthropogenic environmental change	“Anthropogenic Environmental Change, at its most basic, refers to the alterations in our planet’s environment that are predominantly caused by human actions... [However,] it is not merely human-caused environmental alteration, but a profound transformation of Earth’s systems resulting from the confluence of industrialization, globalization, and specific socio-political structures” (Sustainability Directory, n.d.).
Environmental change	This encompasses (i) climate change: Long-term shifts in temperature and weather patterns, often linked to increased greenhouse gas emissions; (ii) ecosystem degradation: Loss of biodiversity, changes to ecosystem services, and damage to natural habitats; (iii) biodiversity loss: Extinction of species and decline in the variety of life on Earth; (iv) land use change: Deforestation, urbanization, and conversion of natural habitats for agriculture; (v) Pollution: Release of harmful substances into the air, water, and soil; (vi) Changes in land, waterways, and ocean productivity: Alterations in the ability of land, waterways, and oceans to support life and provide resources; (vii) Changes in atmospheric chemistry: Alterations in the composition of the atmosphere, including greenhouse gas concentrations.
Environmental in/fertility	“Factors affecting the ability to conceive and have children beyond the biomedical model to encompass (...) environmental degradation” (Yopo Díaz & Watkins, 2025).
Environmental reproductive justice (ERJ)	“ERJ brings environmental justice and reproductive justice together to analyze how exposure to environmental conditions impacts physical, social, and cultural reproduction [...] ERJ is a relational framework through which human, animal, and land reproduction are interconnected and interdependent for the continuation of life.” (Dow & Chaparro-Buitrago, 2023).
Sexual and reproductive health	Health issues and services that cover contraception, fertility and infertility care, maternal and perinatal health, prevention and treatment of sexually transmitted infections (STIs), protection from sexual and gender-based violence, and education on safe and healthy relationships” (WHO, n.d.)
Southeast Asia	All 10 ASEAN member states plus Timor-Leste (CSAS, n.d.)
Structural infertility	“The ability to conceive is significantly impaired by the lack of adequate social conditions for having and raising children” (Yopo Díaz & Watkins, 2025).

Table 2. Search syntax and keywords for Medline (PubMed)

Key word	Related terminology
Southeast Asia	ASEAN OR Southeast Asia OR Brunei OR Cambodia OR East Timor OR Timor-Leste OR Indonesia OR Laos OR Malaysia OR Myanmar OR Philippines OR Singapore OR Thailand OR Vietnam
Sexual and reproductive health	SRH OR (health AND sexual OR reproductive OR reproduction OR fertility OR infertility OR SRH OR RSH OR pregnan*)
Environmental change	Climat* OR environm* OR ecolog* OR toxicolog* OR pollution OR contamina* OR plantation*

Table 3. Eligibility criteria

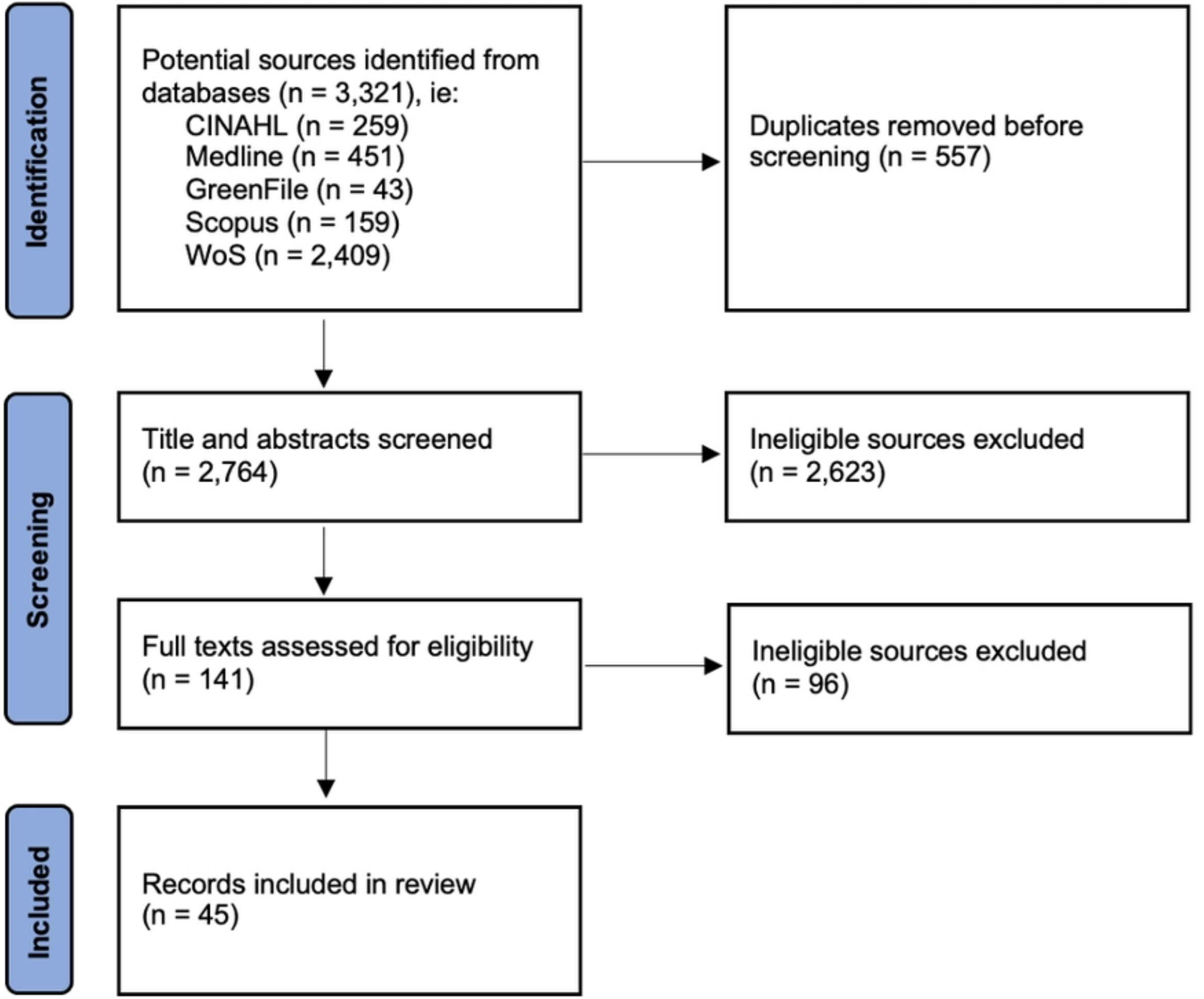
Criteria	Included	Excluded
Context	Southeast Asia region or one or more Southeast Asian country as explicit study focus.	- Southeast Asia region or country are mentioned but focus is elsewhere. - NOT Southeast Asia (e.g. research with Southeast Asian diasporas outside the region).
Topic	Anthropogenic environmental change is discussed generally or as a component (eg, climate change; ecosystem degradation; biodiversity loss; land use changes such as deforestation, urbanization, and conversion of natural habitats for agriculture; pollution in air, water, or soil; changes in the ability of land, waterways, and oceans to support life and provide resources; changes in the composition of the atmosphere, including greenhouse gas concentrations).	Environmental changes that are not anthropogenic (eg, Earth's orbital changes, such as variations in its tilt and shape that affect the amount of solar radiation received; solar radiation variations that impact Earth's climate; volcanic activity that releases gases and aerosols into the atmosphere that can temporarily cool the planet by blocking sunlight; tectonic shifts, mountain building, and continental drift; natural greenhouse gas emissions such as decomposition of organic matter or release of gases from volcanoes and ocean ecosystems; Earth's internal climate variability, meaning natural fluctuations in temperature, sea levels, and other parameters that occur without external forcing).
Outcome	- Discusses SRH generally or as a component (ie, contraception, fertility and infertility, maternal [pre/peri/post] and neonatal health, STI prevention and treatment [including HIV], sexual and gender-based violence, safe and healthy intimate relationships) drawing causal links to anthropogenic environmental changes; OR - Discusses socio-cultural norms related to SRH generally or to any SRH component with explicit causal links to anthropogenic environmental change generally or as specific components; OR - Discusses SRH structurally (e.g., mentions impacts on “social reproduction” that align with the definition of structural infertility) with explicit causal links to anthropogenic environmental change generally or as specific components.	- Discusses SRH outcomes and environmental changes but does not develop explicit causal links (e.g., climate change is listed as one of several challenges). - Suggests social norms informing SRH, gender, and/or sexuality are informed by environmental conditions, but not in the setting of anthropogenic environmental change (e.g., discusses sexual behaviour of a population in urban environments but does not expand on the process of urbanisation as a form of environmental change). ‘Environment’, ‘ecosystem’, ‘ecology’ or related vocabulary does not refer to Earth's life support systems but merely to a given context (e.g., “...socio-political climate...”, “ecological study”, “school environment”) - Discusses environmental risks such as exposure to pesticides or pollutants, without contextualisation within patterns of anthropogenic influence on environment change (eg, effects of smoking, gas stoves, personal care products). - Discusses SRH outcomes deriving from anthropogenic influences on the environment but as isolated instances rather than as patterns or enduring transformations (e.g., an oil spill).
Source type	Primary literature sources (e.g. research-based scholarly journal articles, theses/ dissertations, reports, symposia/ conference	Tertiary sources with no primary or secondary research data (e.g. encyclopaedias, dictionaries, handbooks, legal/guidance documents).

	abstracts including primary or secondary data analysis). • Secondary literature sources (e.g. literature reviews if primary sources are not already included). • Commentaries/editorials including primary or secondary research data. • Reports and book chapters including primary or secondary research data.	• Conference abstracts or literature reviews covering the same material as an available publication. • Social media, blogs, media articles. • Audio/video reports.
Time-period	• All	• NA
Language	• All for which an English abstract is accessible.	• Sources for which no English abstract is accessible.
Study design	• Any	• NA
Participants	• Any human.	• Non-human animals. • Flora and fauna.

Figure 1. PRISMA-ScR diagram

Adapted from Page et al (2021).

Identification of sources via databases



Figure