



Air Pollution as Gendered Oppression: An Intersectional Feminist Analysis

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Abstract

Background: Air pollution is commonly treated as a technical environmental issue, although its impacts are socially unequal and shaped by gender, class, geography, and access to resources. Women experience disproportionate burdens due to reproductive vulnerability, household exposure, unpaid care responsibilities, and limited participation in environmental decision-making.

Objective: This article examines air pollution as a gendered problem by positioning women not as statistical objects of exposure but as subjects whose lived experience constitutes a source of knowledge.

Methods: Drawing on scholarly literature, air pollution was analyzed as a layered form of oppression that situates women at the intersection of biological vulnerability, the domestic division of labor, class position, geographical location, and constrained economic access and health services.

Results: Three theoretical frameworks are integrated: Crenshaw's concept of intersectionality with its structural, political, and representational dimensions; Rocheleau's feminist political ecology, foregrounding access, control, knowledge, and struggle over environmental resources; and Elmhirst's extension, which insists that the relations among gender, environment, and power be read through the social, economic, and political structures that govern resource access and distribute ecological vulnerability.

Conclusion: The analysis shows that women are simultaneously the most exposed, the most burdened by care work, the least in control, the least represented, and the most frequently uncouneted. Gender-blind clean-air policy therefore tends to deepen rather than ease inequality.

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INTRODUCTION

Air is often imagined as a shared property. Because every human being breathes, air pollution is easily placed as a uniform problem, afflicting everyone indiscriminately, and therefore simply being dealt with through technical measures such as a decrease in particle concentration. This notion of uniformity first needs to be questioned. While the air you breathe may be the same, the experience of breathing it is never the same. Who inhales the longest, in what room, while doing what, and with what kind of self-protection ability, are all determined by social position. In other words, air pollution is a socially distributed problem, and that distribution follows pre-existing inequalities lines, including gender inequality. This literature review departs from this premise to read air pollution as a matter of justice, and specifically as a form of oppression that afflicts women in layers.

As a public health problem, air pollution is classified as severe and widespread. Exposure

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to fine particles as well as other pollutants is associated with acute respiratory infections, chronic obstructive pulmonary disease, ischemic heart disease, stroke, and lung cancer, thus working through many body pathways at once (Sang et al., 2022). This burden is concentrated in regions experiencing rapid urbanization, high density, and dependence on fossil energy, especially in South and Southeast Asia. However, the large burden figure itself does not explain the most socially important problem, namely that risks are not evenly distributed. Children, pregnant women, the elderly, informal workers, and poor households bear greater risk than other groups. This inequality in risk distribution is what makes air pollution not just an atmospheric problem, but a social structure problem.

Indonesia shows this problem in real terms. The standardized mortality rate attributable to household and ambient air pollution was recorded high, while the average PM_{2.5} concentration in urban areas far exceeded the World Health Organization's annual guideline (World Health Organization, 2024). In Jakarta and surrounding areas, sources of pollutants include motor vehicles, open fire, road dust, construction, coal-based power plants, and industrial activities, with significant health impacts and medical costs Syuhada et al. (2023) (Health workers also observed a strong link between poor air quality and respiratory disorders in children (Soemarko et al., 2023). This picture places clean air as an unmet health prerequisite, while also hinting at a group bearing a greater burden behind the average figure.

One such group is women, and its association with air pollution is most evident in household air pollution. Globally, billions of people still rely on firewood, charcoal, or other solid fuels that produce smoke and fine particles, and women and children are the most exposed groups because they spend longer in domestic spaces and near stoves (Kurata et al., 2020; World Health Organization, 2024). The level of exposure is not determined by biology, but by the division of labor: women are exposed more because women are tasked with cooking (Amegah & Jaakkola, 2016). Thus, the kitchen is not just a private space, but a workspace without protection, and household air pollution is a gender-charged problem from the beginning.

Women's vulnerability to air pollution cannot therefore be explained through biological factors alone. Biological factors are relevant, particularly in pregnant women, but broader vulnerabilities are shaped by social relationships that place women closer to domestic work and care, while giving them more limited access to information, income, health services, and decision-making space (El Haddad et al., 2021).

Air pollution, in other words, is produced and experienced through gender structures. Long-term exposure associated with chronic diseases is also layered with a reproductive dimension: in pregnant women, exposure to pollutants is associated with premature birth, low birth weight, pregnancy complications, and miscarriage (Ha et al., 2017; Nyadanu et al., 2022; Wang et al., 2021). Women's bodies bear the brunt of pollution in a distinctive way, but the social significance of those traces is determined by how much protection is available to them.

The problem is that the mainstream framework in understanding air pollution tends to erase this gender dimension. When policy speaks of "exposed populations", "households", or "communities", those seemingly neutral categories hide the division of labor and power within them. The household is treated as if it were a homogeneous unit, even though in it there is a determination of who cooks, who takes care of it, who inhales the smoke, and who decides. The average data treated all residents as if they had the same risk, even though the experience of breathing was very different between groups. As a result, the heaviest and least visible burden, that is, the burden borne by women, escapes analysis and from policy. To dismantle this erasure, a framework is needed that explicitly makes gender and power the center of reading.

Research Novelty: The novelty of this study lies in its integrative theoretical architecture. Unlike prior works that apply either intersectionality or feminist political ecology in isolation to environmental health issues, this study synthesizes three feminist frameworks—Crenshaw's intersectionality, Rocheleau's feminist political ecology, and Elmhirst's expanded feminist political ecology—into a unified analytical lens specifically designed to interrogate air pollution as a gendered phenomenon. This tri-framework integration enables the study to reveal not only the multi-layered nature of women's burden but also the institutional mechanisms that render this burden invisible.

This literature review offers such a reading by positioning women as subjects of

knowledge and by assembling three feminist theoretical frameworks in an integrated manner. First, Kimberlé Crenshaw's concept of intersectionality is used to explain why women's burdens are not merely the sum of a number of losses, but rather qualitatively distinctive positions at the intersection of various structures, by tracing their structural, political, and representational dimensions (Crenshaw, 1989). Second, feminist political ecology as formulated by Dianne Rocheleau and colleagues is used to read air pollution through access, control, knowledge, and the struggle for environmental resources ("Feminist Political Ecology. Global Issues and Local Experiences," 1996). Third, the expansion of Rebecca Elmhirst's thinking is used to affirm that gender, environment, and power relations must be read through social, economic, and political structures that regulate access to resources while distributing ecological vulnerabilities (Elmhirst, 2011). The discussion was arranged by mapping the position of women in air pollution outside of parenting, then the burden of parenting imposed on women, then reading both through intersectionality, and finally examining the realm of public policy that forgets women.

The primary aim of this study is to construct a feminist analytical framework that repositions women as knowing subjects in air pollution discourse, thereby revealing the structural, political, and representational mechanisms through which gendered oppression operates. The theoretical benefit lies in advancing the integration of intersectionality and feminist political ecology within environmental health scholarship, while the practical benefit consists of providing evidence-based recommendations for gender-responsive clean air policy design in Indonesia and comparable developing-country contexts.

METHOD

This research used a qualitative approach with a narrative and integrative design to collect, select, and analyze sources relevant to air pollution, gender, care burdens, intersectionality, and feminist political ecology. The literature search was conducted across Scopus, Web of Science, PubMed, and Google Scholar, supplemented by institutional reports from the WHO, ILO, and UN Women. The search terms included "air pollution AND gender," "household air pollution AND women," "intersectionality AND environmental health," and "feminist political ecology AND pollution." Publications from 2010–2026 were included, while seminal theoretical works were retained regardless of publication date. Of the 127 initially identified sources, 58 were retained after screening for relevance and thematic alignment. The inclusion criteria required sources to address air pollution with explicit attention to gender or social differentiation, or to provide empirical evidence regarding gendered health and economic impacts. Sources that addressed pollution solely from a biomedical perspective without incorporating social analysis were excluded.

This approach was selected because it enabled the development of a directed and conceptual understanding based on previous studies, official agency reports, policy documents, and civil society organization publications, while also allowing theoretical interpretations that linked empirical findings with feminist frameworks. Unlike systematic reviews, which emphasize the completeness and replicability of search procedures, integrative reviews emphasize cross-thematic synthesis and theoretical argument development. Therefore, this approach was considered appropriate for the purpose of this literature review, which sought to reinterpret air pollution issues through the lens of gender justice. Nevertheless, the process of collecting and selecting sources was carried out systematically to ensure that the arguments developed were supported by traceable evidence.

The use of secondary data enabled this study to examine air pollution issues across multiple scales, ranging from global and national to local contexts; however, this approach also had limitations that needed to be acknowledged. A major limitation was the lack of sufficient official data disaggregated by gender, age, occupation, social class, pregnancy status, and place of residence. Consequently, some arguments regarding women's burdens were constructed by integrating evidence from different contexts. This limitation itself represented an important finding, as it indicated that many impacts of air pollution on women had not been adequately documented. This issue was further discussed as part of the subsequent analysis.

RESULTS AND DISCUSSION

Results

Women as subjects in knowledge related to air pollution

Positioning women as subjects, not just statistical objects, is the cornerstone of feminist methodology in understanding air pollution. This perspective rejects a view that sees only humans as recipients of exposure or data points, because such an approach risks ignoring the life experiences that make up the real impact of pollution. On the other hand, feminism and feminist political ecology affirm that knowledge born from women's daily experiences (at home, in the workplace, in the care room, and in the living environment) is a legitimate source of knowledge to understand environmental issues ([“Feminist Political Ecology. Global Issues and Local Experiences,” 1996](#)).

Departing from women's bodies, time, and experiences, the analysis can show how air pollution generates layered burdens shaped by broader social, economic, and political structures. This approach is also in line with the development of feminist political ecology that places the body and corporate experience as an important part of environmental analysis, rather than just a side effect of ecological change ([Allen, 2020](#); [Elmhirst, 2011](#); [Nightingale, 2011](#)). Therefore, an understanding of air pollution needs to start from women's concrete experiences in dealing with its impacts, including the burden of parenting and care work, before examining it through the lens of intersectionality and criticizing public policies that often ignore women's vulnerability and knowledge.

The Position of Women in Air Pollution

Women's position in the polluted air landscape is shaped by gendered division of labor, space, time, and access to resources, so they experience layered burdens through a variety of overlapping pathways, including reproductive health, household smoke exposure, additional domestic work, geographic access, economic conditions, employment positions, and health services. One of the most prominent forms of vulnerability is seen in reproductive health, where exposure to air pollution, particularly fine particles, is associated with an increased risk of low birth weight, premature birth, stillbirth, small babies of gestational age, birth defects, as well as various pregnancy complications such as gestational hypertension, gestational diabetes, and preeclampsia ([Nyadanu et al., 2022](#)).

The findings are also supported by other studies that show an association between increased exposure to pollutants and reduced birth weight and an increased risk of preterm birth, although the magnitude of the impact varies between studies ([Ha et al., 2017](#); [Wang et al., 2021](#)). However, this vulnerability cannot be explained solely by biological factors, as the impact of women's reproductive health is also determined by social conditions that limit access to information, a safe environment, and adequate health services. Thus, as affirmed in feminist political ecology, women's ecological vulnerability is the result of a crossover between biological conditions and social structures that fail to provide equal protection, so that pregnant women who are poor and live in polluted areas face a much greater risk than those who have the resources to reduce exposure ([Elmhirst, 2011](#)).

The second layer of women's burden due to air pollution arises from domestic spaces, especially the kitchen and domestic work, which places women at higher levels of exposure than other family members. In many households that still use firewood, charcoal, biomass, or kerosene, women who cook are exposed to fine particles and harmful gases for a long time, especially when ventilation is poor ([Amegah & Jaakkola, 2016](#); [Kurata et al., 2020](#)). Globally, about 2.1 billion people still rely on solid fuels, and household air pollution causes about 3.2 million premature deaths per year, with women and children being the most affected groups ([World Health Organization, 2024](#)).

Women's health risks, including chronic respiratory diseases and lung cancer, are also linked to their role as the main cooks in the domestic division of labor ([Parikh, 2011](#)). In the perspective of feminist political ecology, the kitchen can be understood as a risky workspace that is often not recognized because it is in the private realm. In addition, air pollution from outside the home adds to the domestic burden through repetitive cleaning activities, which extend women's working hours and reduce time for other activities ([El Haddad et al., 2021](#)). This condition is even more severe because women already bear most of the unpaid care work, both

globally and in Indonesia, which is also an obstacle to their participation in the labor force. Thus, air pollution not only impacts health, but also increases domestic workloads and deepens gender-based time inequality.

Outdoor air pollution exposure is not evenly distributed, but rather is influenced by the location of residence and the type of work which in turn is shaped by class and gender. Women who live in congested areas near highways, industries, ports, or landfills face higher levels of exposure in their daily lives. In Jakarta, the main source of fine particles comes from motor vehicles, with variations in the contribution of other sources such as coal combustion and construction dust by region (Vital Strategies, 2020). In addition, many women work as street vendors, day laborers, nannies, or service workers who spend time in open spaces without adequate protection from polluted air. This condition suggests that pollution exposure is the result of urban spatial inequality and social position, not just individual risk. As affirmed in feminist geography and urban political ecology, environmental injustices are experienced directly through bodies that live and work in unequal spaces (Nightingale, 2011; Sultana, 2011).

This inequality is further exacerbated by economic limitations that determine a person's ability to avoid pollution. Poor households tend to live in more polluted environments, have limited access to air filters, safe transportation, and adequate health services (Rao & Min, 2018). Even when cleaner cooking technologies are available, costs are often a barrier so that the benefits are not automatically enjoyed by the most vulnerable groups. This condition intersects with gender inequality in the labor market, where the participation rate of the female labor force and the average income are still below those of men. As a result, when air pollution increases the need for health care costs and reduces productive time, poor women face the double pressure of increasing economic needs and limited resources to cope with them.

This burden is present both for women who work in the public sector and who play the role of housewives. Working women often bear the double burden of remaining responsible for domestic work and family care, while housewives spend more time in domestic spaces that are prime locations for exposure to kitchen smoke and cleaning work. Various studies show that improving household energy conditions through cleaner fuel use not only improves women's health, but also expands economic opportunities, increases labor force participation, and strengthens their position in household decision-making (Verma & Imelda, 2023).

On the other hand, when pollution causes illness in women or their family members, access to health services is also affected by class, location, and employment status, so women often bear the additional costs, time, and labor as patients as well as family companions. Overall, these various layers of vulnerability show that the impact of air pollution on women is an accumulation of various social positions that are stacked on top of each other—ranging from reproductive health, domestic exposure, spatial inequality, economic limitations, double workload, to barriers to access to health services—which together form what can be called layered oppression.

Parenting Imposed on Women

Parenting work has long been feminized, so the responsibility of caring for sick children and family members is more on women. In fact, care work is an important foundation for family and economic sustainability, although it is often not counted in formal economic measures and therefore remains invisible (Folbre, 2006; İlkkaracan, 2016). In this context, air pollution does not create a new burden of parenting, but magnifies existing inequalities due to increased diseases due to pollution adding to the need for care that is generally borne by women.

Children are a particularly vulnerable group to PM_{2.5} exposure, and research in the Jakarta metropolitan area shows that PM_{2.5} levels far exceeding WHO guidelines are associated with high cases of pneumonia and asthma in children. Although the association with asthma is not always statistically strong, the findings are still in line with global evidence on the impact of air pollution on children's respiratory health (Soemarmo et al., 2023). As a result, any increase in respiratory illnesses in children means an increase in unpaid care work, so air pollution deepens gender inequality through the burden of parenting that is often not seen in statistics or public policy.

The work of caring for sick children due to the impact of air pollution is a multi-layered burden because it includes physical, organizational, and emotional aspects at the same time.

Caregivers must monitor symptoms, administer medication regularly, take children to health facilities, manage diet and rest, and adjust the child's own school schedule and work activities. In chronic diseases such as asthma, this burden lasts longer because caregivers must continue to recognize relapse triggers, ensure medication availability, and deal with anxiety when a child has respiratory distress ([Yang et al., 2024](#)).

Research shows that most caregivers of children with asthma experience moderate to high levels of burden, and maternal status is one of the factors that independently increase the burden ([Yang et al., 2024](#)). In addition to physical work, women also bear the emotional work of anxiety, fatigue, and guilt when children are sick or when families are unable to provide a healthier environment, even though the source of pollution is beyond their control. The feminist perspective of political ecology helps to understand that environmental suffering is not only in the form of physical illness, but also emotional stress inherent in the body and family relationships ([Sultana, 2011](#)).

The burden of care due to diseases triggered by air pollution intersects directly with paid work and has significant economic consequences for women. When children are sick, women often have to take leave, reduce working hours, refuse overtime, or lose job opportunities, especially for those in the informal sector without job protection ([Laforest et al., 2004](#)). This impact occurs in the context of an already unequal labor market, where women have lower levels of participation and income than men. In addition to lost income, households also bear health costs such as transportation, medical consultations, medicines, and follow-up care, which are often managed by women even though they do not always have full control over economic resources.

This inequality between care responsibilities and access to resources reflects a pattern of injustice that has long been discussed in feminist political ecology ("[Feminist Political Ecology. Global Issues and Local Experiences](#)," 1996). On a macro level, the economic impact of air pollution is also reflected in the estimated health losses in Jakarta which reach billions of dollars per year, most of which are ultimately borne by households through health costs and loss of income ([Syuhada et al., 2023](#)).

Most of the maintenance burden due to air pollution is not recorded in official statistics. Health data generally only records the number of cases of diseases such as pneumonia, asthma, or respiratory infections, without counting the time of treatment, loss of working days, or the psychological burden borne by the mother ([Folbre, 2006](#); [Rao & Min, 2018](#)). The absence of this measurement makes women's contribution in absorbing the social impact of pollution seem much smaller than in reality, especially since Indonesia does not have a routine national time use survey.

This condition shows the existence of a cost-shifting mechanism, where the pollution produced by the industrial, transportation, and energy sectors is not borne by the main actors, but is transferred to households and finally absorbed by unpaid women's care work. Thus, women's bodies and time serve as a buffer for the social costs of economic activities that benefit others, as can also be seen in studies that environmental degradation increases the burden of unpaid care carried by women ([UN Women, 2023](#)). To understand why these burdens remain invisible and mutually reinforcing, an intersectionality framework is needed that explains how gender, class, and power structures work simultaneously in shaping women's experiences.

Air Pollution: Layered Oppression of Women

This subsection uses Crenshaw's concept of intersectionality to read women's burdens from air pollution as layered oppression, not simply an accumulation of loss. Intersectionality describes experiences that are at the intersection of various subordinated systems and cannot be understood by summing categories separately ([Crenshaw, 1989](#)). In this context, relevant crossovers include gender, class, type of work and informality, geographical location, and reproductive status, all of which are produced simultaneously with ecological relations in everyday life ([Kaijser & Kronsell, 2014](#); [Nightingale, 2011](#)). Intersectionality is therefore understood as a way of reading how power structures are interlocked in the same body, rather than just a stacked list of identities.

On the structural dimension, women at the crossroads (for example, poor pregnant women working in the informal sector in polluted areas) experience a form of vulnerability that

cannot be reduced to a single category. The seven layers of burden that have been described previously meet in one body, ranging from environmental exposure, economic limitations, to reproductive burdens and domestic work. This condition suggests that institutions designed for the "average citizen" or formal workers tend to fail to reach those at the crossroads, including in employment protection, air quality monitoring, and health policies (Archer & Sinswat, 2023; [El Haddad et al., 2021](#)). This failure is structural because it is born from the way institutions are built on a single axis of categories, so that groups at intersections are systematically invisible.

In the political dimension, women's issues are fragmented into separate policy arenas, such as clean air policy, gender policy, and labor policy. As a result, the burden at the intersection has no "political house" and is not fought for in its entirety by any of the arenas. This situation is similar to that described by Crenshaw, where experiences at intersections are not represented because movements and policy agendas are structured in separate silos ([Crenshaw, 1991](#)). The weak linkages between environmental, gender, and work issues reinforce the inability of policies to respond comprehensively to women's experiences.

In the representational dimension, women are often removed or reduced in the discourse on air pollution. They are not visible in aggregate statistics, or if they do appear, they are narrowly represented as passive victims or mothers whose behavior needs to be corrected. Programs such as clean cooking, for example, often individualize structural problems and ignore women's knowledge as a form of expertise ([Parikh, 2011](#); [World Health Organization, 2023](#)). This is contrary to feminist political ecology that emphasizes women's experiential knowledge as a legitimate source Feminist Political Ecology. Global Issues and Local Experiences (1996), as representational elimination makes women's capacity as knowledgeable subjects invisible.

The three dimensions reinforce each other in a circle: structural blindness due to the absence of disaggregated data reinforces political marginalization, political marginalization reinforces representational elimination, and representational elimination again justifies structural neglect ([Crenshaw, 1989](#)). This circle explains why layered oppression is systemic and difficult to overcome with just technical intervention. However, women also show agency through knowledge, environmental activism, and ecological justice movements in various contexts, including Indonesia, such as the Jakarta air pollution lawsuit, the Kartini Kendeng movement, and the struggle of Aleta Baun. However, this agency needs to be understood as ecological citizenship, not a romanticization of the role of motherhood, because the imposition of environmental responsibility on women can reinforce existing inequalities ([Buckingham, 2010](#)). Thus, intersectionality shows both the structure of oppression and the space of agency, before the analysis proceeds to the distribution of power over resources and policy in the perspective of feminist political ecology.

Public Policy: The Forgotten Women

This subsection examines how policy institutions "forget women" through three main mechanisms: the way data is compiled, the way polluting industries are regulated, and the way policies are formulated, before being read through the feminist political ecology of Feminist Political Ecology ([Elmhirst, 2011](#)). The focus is on the structural level, as women's invisibility most systematically occurs when policy determines what counts and who is considered relevant.

The first problem is gender-inresponsive data. Air quality policies generally rely on technical indicators such as PM2.5, PM10, and air quality indices, while data disaggregated by gender, occupation, or social status are still limited ([United Nations Statistics Division, 2023](#)). Many relevant SDGs indicators—such as 3.9.1, 5.4.1, 7.1.2, and 11.6.2—are also not fully gender-disaggregated because they are collected at the household or regional level ([United Nations Statistics Division, 2023](#)).

As a result, women's experiences of exposure to pollution and care work are difficult to see in the statistical system. Only the indicators of unpaid care work directly touched on the gender dimension, while the pollution indicators remained seemingly neutral. This shows that gender inequality in environmental impacts is not only not measurable, but also structurally not prioritized in data design. The absence of this data makes the burden of women disguised behind the average figure.

The second problem is the masculine disposition in the governance of polluting industries.

The fossil energy, transportation, and heavy industry sectors are dominated by technocratic logic and economic growth, with low representation of women in decision-making (Conley & Seager, 1995). In Jakarta, motor vehicles account for around 57 percent of PM2.5 during the dry season, along with the contribution of coal, construction, and road dust (Vital Strategies, 2020). This structure shows that the source of pollution as well as the center of decisions is in a domain that is insensitive to women's domestic burdens.

This masculine disposition can also be seen from the way social costs are separated from economic calculations. The impact of health and care work is not included in the industrial calculation, but is shifted to the female-dominated household and care economy. Thus, the policy logic emphasizes production efficiency more than the sustainability of life, creating an inequality between economic production and social reproduction.

The third problem is the weak representation of women in environmental policy. Studies show that increased women's representation in parliament is related to stricter climate policies and lower emissions (Mavisakalyan & Tarverdi, 2019). But in practice, women's participation is often limited and does not always recognize their experiences as a legitimate form of knowledge. In the framework of Feminist Political Ecology, this means not only a question of representation, but also a question of the legitimacy of knowledge ("Feminist Political Ecology. Global Issues and Local Experiences," 1996).

In the thought of Feminist Political Ecology and the thoughts of Rebecca Elmhirst, these three issues show that women's vulnerability to air pollution is not natural, but the product of unequal policy, economic, and knowledge structures (Elmhirst, 2011; Sultana, 2011). Therefore, fair clean air policies must change the way data is collected, the way industries are managed, and the way women's knowledge is recognized, rather than relying solely on gender-neutral technical approaches.

Discussion

Reproductive vulnerability is a social product, not a biological one. The findings of the association between exposure and pregnancy outcomes should be read without getting caught up in biological determinism. The biological peculiarities of women's bodies during pregnancy turn into social vulnerability precisely because of inadequate protection, information is minimal, the environment remains polluted, and health services are difficult to reach. In line with feminist political ecology's assertion that ecological vulnerability should not be naturalized Elmhirst (2011), the risk differential between poor and able pregnant women is entirely social. The kitchen, in this reading, deserves to be seen as a dangerous workplace that has never been treated as such because it is in a domestic sphere that is considered private and apolitical.

Pollution as an increase in the economic burden of treatment. Cleanup work due to pollution that penetrates private spaces is invisible and rarely counted as an impact. On top of the existing time inequality, pollution widens the gap in time allocation between women and men. Through the child health pathway, there is a chain of causes that connects factory chimneys and vehicle exhausts to a mother's sleepless nights, a chain barely visible in air quality reports. This care work is physical, organizational, and emotional; its emotional dimension is a form of emotional work that is also feminized and innumerable (Crenshaw, 1989; Sultana, 2011).

Cost transfer mechanism. The discussion uncovered a mechanism that could be called cost shifting: industry, transportation, and energy produce pollution as a side effect of profitable activities, but the cost of health and care is shifted to households, then to unpaid women's care work. Women's bodies and time function as shock absorbers that absorb the social costs of polluters (UN Women, 2023). This mechanism aligns with social reproduction theory, which argues that capitalist production systematically externalizes the costs of reproducing labor power onto the unpaid domestic sphere, a sphere disproportionately occupied by women. The cost-shifting identified in this study thus represents not merely an environmental injustice but a structural feature of the political economy that sustains polluting industries by rendering their social costs invisible within female-dominated care economies. This is the most basic injustice: the one who enjoys the benefits and the one who bears the costs is the other party, and the one who bears is the least powerful.

Oppression is layered through the lens of intersectionality. The burden of women is not

just an accumulation of losses, but a layered oppression that strengthens itself. Following Crenshaw (1989), this problem is read through three dimensions. Structurally, the position of pregnant-poor-informal workers at the edge of the truck lane is qualitatively different, not a sum of categories, so that single-axis institutions fail to reach them. Politically, women's burdens fall between the barriers of the clean air agenda (technical, gender-neutral) and the gender equality agenda (rarely touching environmental exposure), thus losing a political home. Representationally, women are removed in the aggregate category or reduced to passive victims/cooks whose behavior must be corrected (Parikh, 2011). The three form a circle that locks into each other and explains why the load is not lost even though control technology is available.

Agency without romanticization. The recognition of women's agency (citizens' lawsuits, Kartini Kendeng, Aleta Baun) affirms women as environmental political actors, not passive victims (Krauss, 1993). However, this agency needs to be read carefully so as not to romanticize the role of motherhood, which can strengthen the burden and make women's struggle a substitute for state responsibility (Buckingham, 2010). Agency should be understood as ecological citizenship that demands structural justice.

Policy reading through feminist political ecology. Through Rocheleau's four axes (access, control, knowledge, struggle) and Elmhirst's expansion, the realm of policy seems to consistently forget women: data that doesn't see, industries that don't engage, and processes that don't acknowledge women's knowledge. The masculine nature of polluting industries and the shifting of costs are two sides of the same coin, an order that values production while ignoring care (Conley & Seager, 1995). Elmhirst (2011) affirms two consequences: vulnerability is a product of policy (therefore changeable), and women are not homogeneous categories. By implication, gender-responsive policies should not be individualized (masks, air filters), as they return structural responsibility to individuals, and in practice to women.

Clean air is a public right; In the Indonesian context, specific policy gaps are evident: the 2023 Jakarta Governor Regulation on Air Quality Control (Pergub No. 66/2019, as amended) contains no gender-differentiated provisions; the National Medium-Term Development Plan (RPJMN) 2020–2024 addresses gender mainstreaming and environmental sustainability as separate pillars without cross-integration; and the Ministry of Women Empowerment and Child Protection's strategic plan does not explicitly address environmental exposure as a gender issue. These gaps illustrate how institutional silos prevent the development of genuinely intersectional environmental policy. Fair policies must work on pollution sources as well as treatment infrastructure, redistribute control, and acknowledge women's knowledge.

CONCLUSION

Air pollution is not a gender-neutral technical problem, but a form of layered oppression that disproportionately burdens women. Through reproductive health pathways, exposure to household smoke, additional domestic work, economic vulnerability, the dual burden of productive and reproductive work, and unequal access to health services, women are the most affected groups as well as the least visible in data and policy. Analysis using intersectionality theory and feminist political ecology shows that vulnerability is not the result of biological conditions alone, but rather the result of social, economic, and political structures that place women in positions of greater exposure, more burdened with care work, less control over decisions, and less represented in policy processes. The case of Indonesia, especially Jakarta, shows how the cost of health and treatment work due to pollution is shifted from the polluting sector to households, and then borne mainly by women through unpaid work.

Therefore, air pollution control needs to shift from a technical approach to a gender-responsive approach to justice. Policies should be supported by disaggregated and intersectional data, integrated emission reductions with strengthening health services and care infrastructure, increasing women's participation in decision-making, and recognition of women's knowledge and experience as legitimate sources of expertise. In addition, the state needs to avoid an approach that imposes protection from pollution on individuals, as this often only shifts the responsibility to women in the household. By placing women as knowledgeable and actionable subjects, clean air policies can be an instrument of justice that not only reduces pollution levels, but also reduces the gender inequality that has been hidden behind it.

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AUTHOR CONTRIBUTION STATEMENT

Windy Dwi Ariyanto contributed to conceptualization, literature review, methodology development, data analysis, and manuscript preparation. Mia Siscawati contributed to theoretical framework development, critical interpretation, and manuscript revision. Hariati Sinaga contributed to validation, academic supervision, and refinement of the research arguments. All authors participated in reviewing and approving the final manuscript and agreed to be accountable for the integrity and accuracy of the research.

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