On the Intersectionality Between Women's Issues and Air/Water Pollution: Case Studies and Solutions from India

Keck Center for International and Strategic Studies
Keck Center Research Fellowship in Comparative Politics

Written By Amari Huang, Claremont McKenna College 2023
Faculty Reader: William Ascher, Donald C. McKenna Professor of Government and Economics

Introduction

Necessary everyday activities like cooking, sanitation, and home heating significantly contribute to air and water pollution, especially in rural areas of developing communities — leading to sometimes life-threatening health problems in men, women, and children. These issues have long been prevalent, since biomass fuel was the first-ever fuel used by mankind, but are even more pressing today because growing population sizes magnify pollution rates that lead to more health problems than before. These issues are also importantly linked to women's rights issues because of women's particular position of being more affected by pollution and their overwhelmingly greater interest in issues related to taking care of the home. This research paper primarily focuses on how the use of biomass fuel impacts air quality, how poor water and sanitation infrastructure impact water quality, and how women's abilities can contribute to the solutions.

Background

Pollution emitted from using energy sources like biomass fuel — this includes the burning of wood, manure, crops, and sometimes garbage — contribute to air pollution in the form of particulate matter (PM10 and PM2.5) and other noxious emissions. Biomass fuel types are still used in much of the developing world to satisfy everyday household needs. At least half of the world's population and up to 90 percent of households in rural areas of developing countries still depend on unprocessed biomass fuels for domestic cooking and home heating.[1] Also, about 60 percent of global traditional fuel is wood — which poses deforestation problems

[1] Mondal, Nandan Kumar, Bidisha Mukherjee, Debangshu Das, and Manas Ranjan Ray. "Micronucleus formation, DNA damage and repair in premenopausal women chronically exposed to high level of indoor air pollution from biomass fuel use in rural India." *Mutation Research/Genetic Toxicology and Environmental Mutagenesis* 697, no. 1-2 (2010): 47-54.

in its harvesting and contribution to pollution when it is burned.[2]

In fact, according to a 2014 report, 80 percent of households in rural India still use biomass fuel for cooking, which in this case is particularly defined as any use of cheap materials such as wood, crop residues, or cow dung for cooking or heating purposes.[3] Also, the PM10 concentrations (particulate matter that has a diameter greater than 10 micrometers, which includes inhalable particles like dust, pollen, mold etc.) in Indian households vary between 500 μg/m3 and 2000 μg/m3 which is at least 200 μg/m3 higher than the air quality standard recommended by the US Environmental Protection Agency.[4] The release of PM10 can cause many health problems including aggravated asthma, decreased lung function, nonfatal heart attacks, and sometimes even premature death due to heart or lung disease.[5] Strong evidence suggests that because cooking with biomass fuel contributes to air pollution, it causes negative health effects like chronic bronchitis, tuberculosis, cataracts, severe asthma and stillbirths.[6] In addition, the burning of biomass fuels, especially indoors, can release toxic amounts of PM2.5, which leads to higher risks of cardiovascular and respiratory diseases.[7] The release of PM2.5 also affects women significantly more than men because they are often the ones responsible for the cooking.[8] The World Health Organization also reported that the smoke released by burning biomass fuels contributes to approximately three percent of the total global burden of diseases,

---

[2] Smith, Kirk R., A. L. Aggarwal, and R. M. Dave. "Air pollution and rural biomass fuels in developing countries: a pilot village study in India and implications for research and policy." *Atmospheric Environment (1967)* 17, no. 11 (1983): 2343-2362.

[3] Sehgal, Meena, Suliankatchi Abdulkader Rizwan, and Anand Krishnan. "Disease burden due to biomass cooking-fuel-related household air pollution among women in India." *Global health action* 7, no. 1 (2014): 25326.

[4] Sehgal.

[5] "Health and Environmental Effects of Particulate Matter (PM)." Environmental Protection Agency.

[6] Sehgal.

[7] Ibid.

[8] Ibid.

1.6 million premature deaths every year — including almost 1 million children deaths under the age of five.[9]

Other evidence suggests that the release of carbon dioxide and other greenhouse gases by the use of biomass fuel can also lead to DNA damage through oxidative stress.[10] In fact, it has been estimated that improved cookstove performance in India could prevent about 570,000 premature deaths in rural women and children and over four percent of India's estimated greenhouse gases.[11] Pollution from burning biomass using traditional household cooking technologies is the leading environmental cause of death in developing countries.[12]

The World Health Organization has proposed a feasible target of a 50 percent reduction in the usage of solid biomass fuels in households by 2025, which can be done with the change to liquified petroleum gases (LPGs) or other less polluting energy resources such as electricity or natural gas.[13] This is surely a desired outcome to reach, but there are several hurdles of implementation that must be surmounted; this requires awareness generation and education among the public and policymakers, centralized planning with community support, and availability of and access to LPG, electricity, or natural gas infrastructure. Another important component to infrastructural changes includes the production and distribution of more stable, user-friendly cookstoves. Advocates for encouraging the use of improved biomass cookstoves define such cookstoves as ones that are designed to release fewer pollutants and to increase

---

[9] Mehetre, Sonam A., N. L. Panwar, Deepak Sharma, and Himanshu Kumar. "Improved biomass cookstoves for sustainable development: A review." *Renewable and Sustainable Energy Reviews* 73 (2017): 672-687.
[10] Ibid.
[11] Venkataraman, Chandra, Ambuj D. Sagar, Gazala Habib, Nick Lam, and Kirk R. Smith. "The Indian national initiative for advanced biomass cookstoves: the benefits of clean combustion." *Energy for sustainable development* 14, no. 2 (2010): 63-72.
[12] Mohapatra, Sandeep, and Leo Simon. "Intra-household bargaining over household technology adoption." *Review of Economics of the Household* 15, no. 4 (2017): 1263-1290.
[13] Sehgal.

efficiency for overall reduced fuel consumption.[14] Accordingly, there are several cookstoves that have already been invented that satisfy these requirements, and would also be preferable over more traditional cookstoves.

In a similar manner to air pollution, water pollution also negatively impacts people's health. While the same exact solution cannot be used to fix water pollution problems, solutions should be able to be reasonably adapted to address water pollution problems — especially from the framework of women's involvement because they tend to have a stronger interest than men in health issues that affect the family. Depending on the pollutants that contaminate the water, there can be a multitude of negative health effects. For instance, the disposal of waste from coal can cause toxic elements to enter into drinking water, causing bladder, lung, and skin cancers.[15] The presence of chemicals from coal as a pollutant in water resources can also impair people's immune systems, lung functioning, and respiratory systems. Additionally, when examining what would be most relevant to rural areas in India, chemical fertilizers like nitrogen fertilizers are high in heavy metals and ammonia, and these pollutants can contaminate groundwater, a source of drinking water, through runoff from local rivers. Drinking or using this water for cooking can lead to negative health effects including methemoglobinemia, gastric cancer, birth malformations, and hypertension among others.[16] Another major source of water pollution in rural areas originates from pesticide usage, which include chemicals like insecticides, fungicides, herbicides, and rodenticides among others.[17] Similar to chemical fertilizers, pesticides can also

---

[14] Ibid.
[15] Zhang, Junfeng, and Kirk R. Smith. "Household air pollution from coal and biomass fuels in China: measurements, health impacts, and interventions." *Environmental health perspectives* 115, no. 6 (2007): 848-855.
[16] Singh, Upma, Shikha Singh, Rishikesh K. Tiwari, and Ravi S. Pandey. "Water pollution due to discharge of industrial effluents with special reference to Uttar Pradesh, India–a review." *International Archive of Applied Sciences and Technology* 9, no. 4 (2018): 111-121.
[17] Ibid.

enter into water resources through surface runoff and through leaching, which can come from both point sources or nonpoint sources.[18] Pesticides can affect human health through skin contact, inhalation, or ingestion — which can all be heightened through their general use and through water contamination.[19] Contact with pesticides can affect human health through the growth of cancers, reproductive inhibition, immune system suppression, endocrine system suppression, cellular and DNA damage, and physical deformities.[20]

Water pollution issues have different specific policy implications than air pollution ones, but they can both benefit from policy that prioritizes women's cooperation and education. Policy efforts — in support of increased building of sanitation infrastructure like latrines and sewers as well as funding educational programs to persuade people to correctly use this infrastructure — would contribute to solving the health problems that water pollution causes. Currently around 2.6 billion people worldwide around 638 million people in India lack access to latrines that dispose of human waste without leading to water pollution.[21] Finding ways to increase access through infrastructure building is one issue, some research studies show that that alone is not enough. For example, in the southern Indian State of Tamil Nadu, among households that had a home latrine, only 51 percent of adults and 48 percent of children chose to defecate in latrines as opposed to outside.[22]

In seeking solutions to the problems of air and water pollution, specifically in rural regions of developing countries, women should also be considered both the avenue of and main

---

[18] Singh.
[19] Ibid.
[20] Anju, Agrawal, Pandey Ravi S, and Sharma Bechan. "Water pollution with special reference to pesticide contamination in India." *Journal of Water Resource and Protection* 2010 (2010).
[21] Clasen, Thomas, Douglas Fabini, Sophie Boisson, Jay Taneja, Joshua Song, Elisabeth Aichinger, Anthony Bui et al. "Making sanitation count: developing and testing a device for assessing latrine use in low-income settings." *Environmental science & technology* 46, no. 6 (2012): 3295-3303.
[22] Clasen.

benefactors of successful solutions. First, a solution based on women's education is certainly a part of the solution. A 2009 study found that biomass fuel users were more likely to be uneducated, live in rural areas, and had a longer duration of fuel burning for cooking.[23]

Second, a transition to increasing the use of improved cookstoves (ones that still use biomass fuel) or ones that do not use biomass fuel could also benefit women because women would not need to spend as much time collecting fuel, and they could use that free time to create political / social platforms or to gain economic strength — through employment or education.[24]

While air and water pollution can affect anyone, strong evidence shows that women's health is more negatively affected than men's health. In fact, women exposed to indoor smoke are three times more likely to suffer from chronic obstructive pulmonary diseases like chronic bronchitis or emphysema than women who cook with electricity, gas or other clean fuels.[25] Additionally, many of the negative health effects listed above are far less likely to be found in men than women. This is likely because in general women are responsible for taking care of the home and completing chores like cooking, cleaning, and heating the home — especially when the burning of biomass fuels is done inside rather than outside. Although it is not the case that women *should* or *must* be the primary caretakers of the home, during a time in which they are the primary home makers, women are in closer proximity to biomass fuel emissions. As such, women inherit greater health risks for continuing the use of biomass fuel. This is not to say that men are not also negatively impacted by poor air and water conditions, but rather that women are more so.

---

[23] Siddiqui, A. R., K. Lee, D. Bennett, Xiaowei Yang, K. H. Brown, Z. A. Bhutta, and Ellen B. Gold. "Indoor carbon monoxide and PM2. 5 concentrations by cooking fuels in Pakistan." *Indoor air* 19, no. 1 (2009): 75-82.

[24] Mehetre.

[25] Parikh, Jyoti. "Hardships and health impacts on women due to traditional cooking fuels: A case study of Himachal Pradesh, India." *Energy Policy* 39, no. 12 (2011): 7587-7594.

Thus, women can and should play a pivotal role in making decisions about adopting more sustainable and less polluting energy alternatives, because they play a significant role in managing the household, are the most negatively affected by the type of fuel usage, and generally show greater concern for the wellbeing of the family. This paper will focus on the important role that women play in improving the problems of air and water pollution by reviewing the current literature, then examining two case studies, and finally offering a preferable solution in terms of mobilizing women to work within their communities and confront their governments. The analyses and case studies in this paper will primarily draw from the history and experiments in India. However, the conclusions and recommendations at the end of this paper have more broad implications for people living in regions of the world where traditional cookstoves are still the predominant tool for cooking.

Challenges with Adopting Improved Cookstoves

Although it is proven that certain technological advancements of certain household items would benefit women's and their children's health, there can still be barriers to their adoption. The reasons why attempts to convince women to change their cooking practices have failed in many parts of India are that many of the supposedly improved cookstoves are not actually improved, the suggested cookstoves were more difficult to use than traditional *chulhas* (some tip over, break easily, or are hard to learn to use).[26] Additionally, *chulhas* not only serve as a cookstove but are also often used as a source of light, to cure food, to dry hand-made ceramics,

[26] Khandelwal, Meena, Matthew E. Hill Jr, Paul Greenough, Jerry Anthony, Misha Quill, Marc Linderman, and H. S. Udaykumar. "Why have improved cook-stove initiatives in India failed?." *World Development* 92 (2017): 13-27.

and to deter insects/pests.[27] While these surely pose a challenge to convincing rural Indians to transition to improved cookstove technology, there are simpler solutions to such problems.

In previous case studies, all of these problems contributed to the difficulty of adopting healthier cookstoves but another significant reason is that the Indian cookstove — *chulha* — maintains historical and traditional significance, especially for rural women. The presumption that people living in rural communities reject modern technology is countered by the fact that people living in rural communities readily adopt technology like cell phones and solar lighting. This suggests that the resistance to alternative cookstove technologies — despite their clear health benefits and contributions towards cleaner air and water — might have to do with the cultural significance of *chulhas*, among other factors.

To elaborate on the significance of this challenge, the Indian government and non-government organizations have tried to increase the adoption of more environmentally friendly cookstoves for almost a century and a half. In 1879, British colonial officials tried to change Indian women's cooking practices so that the dung, which was the primary fuel type they were using, could be used for agricultural purposes instead.[28] This attempt was fruitless, and it is just one example in the unsuccessful history of trying to persuade women to change their cooking practices. This history of attempts also shows that rural India is distinctive, even when compared to other countries at similar development levels. For example, in the 1980s to 2000s, the National Improved Stove Program in China distributed over 100 million cookstoves, and almost all of the cookstoves were in use. On the other hand, during the same time period, the National Programme

[27] Ibid.
[28] Ibid.

on Improved *Chulha* in India was far less successful when it distributed over 148 million cookstoves in a similar manner and virtually none was in use.[29]

Grassroots Movements

While there might be many federal or state-level attempts at fixing the health issues caused by air and water pollution, there are many reasons to advocate for more grassroots movements instead that can also benefit from and propel the women's movement. This paper primarily focuses on social movements in the capacity of ones that are a sustained challenge to power holders in the name of a population living under the jurisdiction of those power holders by means of repeated public displays of that population's worthiness, unity, numbers, and commitment. Although some social movements work within or cooperatively with established policies and governments, the women's movements that this paper will highlight are ones that challenge existing institutions.

First, the pollution problem can surely benefit from women's involvement on the local level, as will be highlighted by this paper's first case study. To elaborate on the necessity of encouraging local cooperation, in many developing countries, much of the pollution problem is derived from "local pollutants" — which are smaller-scale environmental incidents usually committed by individuals or small businesses that cause pollution that affects the local community.[30] Examples of localized pollution include pollutants emitted from transportation vehicles like cars and motorcycles that contribute to air pollution or illegal dumping of waste that contributes to water pollution. Localized pollution is particularly relevant to this paper because

---

[29] Ibid.

[30] Bickerstaff, Karen, and Gordon Walker. "Public understandings of air pollution: the 'localisation'of environmental risk." *Global environmental change* 11, no. 2 (2001): 133-145.

of the way that women can affect change with their individual roles — for example, by adopting LPG cookstoves in exchange for their traditional, biomass cookstoves or *chulhas*.

Second, this paper seeks to simultaneously focus on environmentalism in the capacity of air and water pollution as well as women's mobilization. As such, recognizing the importance of feminism — women's liberation and equality — in and of themselves are critical to this paper's argument. To illustrate, ample feminist theory highlights the inherent value of women's rights, regardless of its potential impact on other economic, cultural, environmental, or other issue. Women's rights are inherently valuable in and of itself, rather than as a vehicle for the improvement of other societal factors. This distinction is important to make because valuing women's rights as merely a means to an end does not give the proper weight to its significance. Women's equality and social movements to promote them are alone an element of significance and reason for this issue's urgency. Although often a gendered lens is ignored when analyzing policy issues, feminist theory considers "the dual beliefs that gender difference has played an important and essential role in the structuring of social inequalities in much of human history and that the resulting differences in self-identifications, human understandings, social status, and power relationships are unjustified."[31] It would be impossible to accurately present problems without taking account of gender challenges — especially problems of water and air pollution in predominantly rural, developing communities.

Almost every issue can be observed by applying a gendered lens, but for the purpose of this paper, in the case of water and air pollution in rural India, gender is relevant because women face the consequences of pollution in more severe ways than men; therefore, women will likely benefit more from making changes to solve the issue. As explained earlier in this paper, women

[31] Tickner, J. Ann. *Gender in international relations: Feminist perspectives on achieving global security*. Columbia University Press, 1992.

face more severe consequences from air pollution released by traditional cookstoves than men, because of their expected responsibilities as caretakers of the home and therefore proximity to particles released from *chulhas* burning biomass fuels. Thus, solving this issue of heavy pollution causing cookstoves will have a larger positive impact on women's health than on men's health. As those who are most gravely affected by the issues of water and air pollution, women are also most motivated to find solutions to the problem, once they are educated and aware of the issue. Not only are women more personally affected by these issues, they are also traditionally more responsible for and are more concerned about the well-being of their children and the family. Consolidating resources and seeking an answer to this problem is a women's issue, and people should care about making this improvement insofar as it helps women — not to the capacity that there is an environmental issue and using women would contribute to finding a solution.

Third, grassroots movements have a crucial capacity to establish some women as leaders and women as a social class to mobilize in order to address other women's issues — such as education, discrimination, family size, age of marriage, domestic violence, among other issues that generally negatively affect women more than men. In fact, there is ample evidence to show that "improving the status of women also enhances their decision-making capacity at all levels in all spheres of life, especially in the area of sexuality and reproduction."[32]

In this case, the negative health effects that traditional cookstoves have on women, in the form of air pollution, is just a singular issue that can be construed as a women's issue; however, there are clearly countless other women's issues that need to be addressed — not only in India but also in many other parts of the world too. Grassroots movements show that when leaders rise

[32] Thapa, Deependra Kaji, and Anke Niehof. "Women's autonomy and husbands' involvement in maternal health care in Nepal." *Social Science & Medicine* 93 (2013): 1-10.

to prominence, they can use their platform to propel other important issues as well. As such, women who aim to improve water and air quality in India may also adopt a platform for other women's issues as a whole. (Evidence of this will be presented in the first case study of the Chipko Movement.) This is highly significant because there are several implications in the name of improving all aspects of women's lives.

In addition to platform creating, improving women's lives in this specific aspect of more efficient cookstoves could also contribute to improving women's lives by creating more free time. Some more efficient cookstoves have the potential to eliminate or decrease the time spent on the "unproductive labor" of fuel collection, which can sometimes eat up to four hours per day.[33] This newfound free time could help give women time to create platforms for mobilization by limiting a daily responsibility that might have prohibited women from having time to organize and advocate for their issues.

Thus, this paper takes the stance of recommending the encouragement and organization of grassroots movements because such movements have the benefits of (1) necessarily being a localized movement as formed by a group of people who are near one another and/or face similar issues (2) can be especially supportive in recognizing women's rights as an inherently important value (3) can create a platform for and raise the voices of women so they can launch other campaigns that are also necessarily women's issues which can advantage women in the long run.

Case Study 1: The Chipko Movement

[33] Ghertner, D. Asher. "Technology and tricks: Intra-household technology implementation and gender struggles." *Gender, technology and development* 10, no. 3 (2006): 281-311.

The Chipko Movement, which translates to "Embrace the Tree," began around 1973 in the Uttarakhand region of Garhwal Himalaya, India. This movement followed the traditional Indian strategy for resolving conflict through non-cooperation — *Satyagraha* — which can be translated to "Soul Force." This method of protest, also known as the Gandhian method of passive resistance, can be understood at two levels: first, there needs to be a level of open-mindedness in trying to understand the validity of any perspective, and second, this practice lays the general foundation surrounding peaceful confrontation.[34] Not only has *Satyagraha* been successful in helping India gain independence from Great Britain, it has also been successful in the past for resolving conflict when it was used in Champaran to save Indian peasants from compulsory growth of indigo, in Dandi to protest against the Salt Law, and to protect Indian weavers from competitive prices of mill-made cloth from Europe during the Industrial Revolution.[35]

During British colonial rule, India faced severe deforestation and after independence, the Indian government also failed to successfully confront this issue.[36] After just one year, over 10,000 tea trees in Malabar were cut down for the British imperial fleet and railway building. This process changed the way that forests were valued in India: from cultural significance and sustainability necessity for rural Indians to its simple economic importance via the "forest economy."[37] Eventually some attention was paid to the environmental issue from academic,

---

[34]Mayton, D. M., and M. Daniel. "Gandhi as peacebuilder: The social psychology of satyagraha." *Peace, conflict, and violence: Peace psychology for the 21st century* (2001): 307-313.
[35] Shiva.
[36] Passantino, Eleonora. "Ecofeminism in India: from the Chipko Movement to the Case of Narmada Valley Development Project." Bachelor's thesis, Università Ca'Foscari Venezia, 2017.
[37] Passantino.

journalist, and social pressure, but the policy attempts from this pressure were unsuccessful because they failed to incorporate local people's needs, voices, and expertise.[38]

Thus, high rates of government-backed deforestation and restricted forest access for local Indian people sparked the Chipko Movement in April of 1973 — when villagers spontaneously demonstrated in the Mandal Forest.[39] People had noticed the increase in extreme weather events, like floods and landslides, and their self-provided food sources were no longer reliable to the extent that local residents had to turn to imports at unprecedented rates.[40] At first, the Chipko Movement's primary focus was on the over-exploitation of forest resources that threatened their livelihoods, but this eventually evolved into greater concerns for the "distribution of ecologically generated material costs."[41]

Another landmark event of note from the Chipko Movement took place on March 26, 1974 in Reni village, Hemwalghati in the Chamoli district of Uttarakhand, India. Guara Devi, a woman from the Reni village, organized a protest when the Forest Department announced an auction of thousands of trees in the Reni Forest — which was already causing flooding due to deforestation.[42] Gaura Devi organized hundreds of women in her village to protest by using their bodies to physically protect the trees against felling. This protest influenced a ten-year ban on all tree felling in the Reni Forest, and encouraged similar protests that also successfully pushed for a similar ban on felling in Himachal Pradesh, Karnataka, Rajasthan, Bihar, Western Ghats, and Vindhyas.[43] Additionally, Gaura Devi's organization of these protests propelled her voice and

---

[38] Ibid.
[39] Rao, Manisha. "Ecofeminism at the crossroads in India: A review." *Dep* 20, no. 12 (2012): 124-142.
[40] Ibid.
[41] Shiva.
[42] Rao.
[43] Sen.

built a platform for her to gain substantial political support as well. To illustrate, even though she was not formally educated, she was asked to be the president of the Mahila Mangal Dal (the Women's Welfare Association), an organization that continues to protest against the Indian government's environmental shortcomings that affect health and hygiene.[44]

Since its initiation, the Chipko Movement has been successful in forcing a fifteen-year ban on commercial green felling in Uttar Pradesh and clear-felling in the Western Ghats and Vindhyas.[45] They have also had a hand in India creating a more sustainable national forest policy that is geared towards people's ecological needs.

Much of the Chipko Movement success can be attributed to the decentralized guidance of local women and *padyatras*, which are long marches on foot from village to village.[46] While there was still a strong absence of women in formal institutions during the movement, their work in the grassroots movement opened the door to demanding more rights: "Thanks to greater confidence following successes such as that of the Chipko, women began to ask to be members of village councils and to be considered in the decision-making positions within and beyond the household."[47]

This movement can be understood in context of the pre-Independence period and the post-Independence period. Because the Chipko Movement as a whole was not only about protecting forests but also about preserving cultures and empowering livelihoods, the women of Garhwal — as the "main bearers of [their] culture — are the leaders of this movement."[48] For a long time, in rural economies, the women have predominantly held responsibility for handling

[44] Ibid.
[45] Shiva.
[46] Passantino.
[47] Passantino.
[48] Ibid.

agricultural practices and community relationships with forests, whereas men were predominantly wage laborers. Collecting fuel, fodder, and water has long been a predominantly female responsibility.[49] Both environmental and economic concerns played an important role in encouraging women's participation in this movement. It is true that some women were simply more motivated than men to be involved in the Chipko Movement because they are "deeply aware of the dangers of ecological disasters, and led to the empowerment of environmental awareness and women status within society."[50] Simultaneously, the Chipko slogan — "Ecology is permanent economy" — highlights the clear inseparability between environmental and economic issues.[51]

Although some men were involved in the Chipko Movement, women were often the leaders and backbone of protests. In some instances, women had to work against men in their communities in favor of prioritizing long-term subsistence.[52] As such, the breadth of the Chipko Movement widened to include other women's issues like male alcoholism, domestic violence, and women's representation in village councils.[53] This highlights the argument made earlier in this paper regarding the significance of grassroots activism's ability to expand their issues across a grander spectrum of issues — several issues that fall under the same umbrella as ones that seek women's empowerment.

The Chipko Movement can be used as a case study to understand how women have worked to successfully mobilize on behalf of an environmental concern in the past and how

[49] Sen.
[50] Passantino.
[51] Sen.
[52] Rao.
[53] Ibid.

women can repeat similar efforts to achieve comparable goals today. Four important lessons can be learned and applied from the Chipko Movement.

First, the Chipko Movement arose and gained traction as a result of a clear, desperate situation. In this case, the Chipko Movement was initially triggered by government policies that would result in increased rates of deforestation at dangerous levels in terms of extreme weather events and lack of sustainable sustenance. The high rates of felling were leading to two clearly negative impacts: (1) flooding that could be dangerous for people living in surrounding areas and for agricultural success (2) destruction and restriction of fuel sources for food and warmth. When considering other instances of environmental damage and whether women can and likely want to play a significant role in the resolution, it is important to consider whether the identified ecological crisis is obvious to local communities. In the case of water and air pollution caused by *chulhas*, the dangers are certainly proven but the effects may not be clear and desperate for rural communities.

This case study shows that mobilization is more likely to occur when a stark and dramatic problem needs to be addressed. While the women during the Chipko Movement faced a clear and present danger that physically could not be ignored, the problem with traditional cookstoves is far less obvious. Then, the question this lesson poses is, "How do we make this issue look and feel like a community-wide issue?" This will become more clear in a later section of this paper, but in general, the issue of *chulhas* contributing to air pollution would more likely be addressed if women become more educated about the issue. An education about this issue can grant the clear and present danger that is necessary to start a social movement. Efforts to publicize the negative health effects can look like classroom programs, educational hotspots, handing out

flyers, among several other ideas. This could also involve some work in collaboration with international NGOs to promote similar goals.

Second, the Chipko Movement predominantly consisted of and was led by women because the environmental problem — dangerous rates of felling — posed a significant risk to women's ability to fulfill one or more of their social and familial responsibilities — collecting fuel and fodder. While this is clear in the case of the Chipko Movement, evidence for this may be more clouded in the case of rural women's use of the *chulhas*. Rural women's current usage of traditional cookstoves successfully completes the task of cooking a palatable meal; however, *chulhas* fail at successfully allowing women to cook a meal that does not pose serious health concerns, especially to women, that are caused by high rates of air pollution, as discussed at the beginning of this paper. Women's social and familial responsibility to cook for their families can be completed, but not in an ideal way because it causes negative health effects, especially to women, and could indicate women's inability to fulfill these responsibilities for a longer period of their lifetimes. Therefore, part of the solution must include a goal to educate women the clear and present danger of their current cooking methods: although the task of making food can be completed, the process of task completion causes dangerous side effects to people's health, especially women's health.

Third, these environmental problems posed clear problems that strong, female leaders took advantage of to mobilize on a broader scale. During the Chipko Movement, Guara Devi took advantage of the ecological damage caused by increased rates of government-backed felling in order to protect women's abilities to fulfill their social and familial obligations *and* to propel women's issues forward as a whole through the recognition that "Ecology is permanent economy." In the case of *chulhas*, it could be argued that supporting a strong leader to encourage

community involvement could lead to more positive outcomes, especially because local community voices are important to maintain and advocate for culturally sensitive solutions. Another interesting aspect of Guara Devi's leadership is her lack of formal education, which highlights that a formal education (at least in terms of leadership) is not necessary. As such, women who are capable leaders of a social movement, like the Chipko Movement, by creating a platform for a specific issue can multiply their impact by raising awareness for other women's issues as well.

Fourth, while Chipko Movement arose at around the same time as the women's movement in India, the latter largely worked together to change the status quo and advocate for issues more related to urban women's issues than rural women's issues. This provides insight on the importance of recognizing that women's issues cannot be pursued through a monolithic perspective — but rather understood as a heterogeneous set of preferences based on different regions, classes, and castes.[54] When it comes to a sense of failed responsibility caused by ecological desperation, poor rural and tribal women are likely to be directly responsible for collecting fuel and fodder.[55] Unlike urban women, rural and tribal women are also more likely to develop ecological knowledge passed down from generation to generation from mothers to daughters. As such, rural women should be particularly viewed as both victims of environmental degradation and "repositories of knowledge about nature, in ways distinct from men of their class."[56] This means that women are especially relevant to solving the problems of air and water pollution because of their particularly helpful scope of knowledge regarding their surrounding environment.

---

[54] Rao.
[55] Agarwal, Bina. "The gender and environment debate: Lessons from India." *Feminist studies* 18, no. 1 (1992): 119-158.
[56] Ibid.

It is important to consider all of these factors that contributed to the success of the Chipko Movement in order to recognize the circumstances that are fulfilled in the instance of attempting to transition rural women to more sustainable cookstoves and other environmental issues that directly affect rural women. Where circumstances are not comparable, it should be noted in an attempt to supplement another circumstance's potential shortcomings.

Case Study 2: Non-Governmental Organization Effect on Hygiene in Kerala

The case reported here is a study conducted by an NGO which sought to analyze the long-term sustainability of behavior change as a result of non-governmental organization work through hygiene classes in the Indian province of Kerala.[57] It is important to note that Kerala is one of the more progressive and matriarchal states in India. In this study, the NGO that sought to reach goals of defecation sanitation and toilet construction was the Socio-Economic Units Foundation (SEUF), a professional NGO working with communities in Kerala to promote socio-economic development with a focus on water, environmental sanitation, and empowerment of deprived groups.

SEUF's goal was to provide permanent toilets to 50 percent of the poorest households and promote good hygiene practices among all households through government and community groups. They conducted programming in 7 *panchayats* (administrative areas).[58] In the collection of their data, SEUF surveyed a total of 515 women and all family members living in 345 households.[59] In this study, the implementation of the SEUF sanitation program included four

---

[57] Cairncross, Sandy, Kathleen Shordt, Suma Zacharia, and Beena Kumari Govindan. "What causes sustainable changes in hygiene behaviour? A cross-sectional study from Kerala, India." *Social science & medicine* 61, no. 10 (2005): 2212-2220.
[58] Ibid.
[59] Ibid.

steps: (1) selection of panchayats and introductory meetings to collect preliminary data regarding the region and help with planning (2) mobilization through community organizations and health education (3) construction of latrines through pit digging and material purchasing (4) post construction data collection regarding the use and maintenance of latrines with follow-up monitoring and documentation.

During their programming, water supply activities included group meetings, exhibitions, health camps, films, street dramas, health clubs, and medical camps that were in session for two to 12 months.[60] The health education components of this study were managed by the SEUF and were carried out by health staff and Indian Development Service (nursery) workers. SEUF also made sure to train local youth clubs, voluntary agencies, ward members, and especially women's clubs about health and hygiene so they could spread the message as well. In fact, "special efforts were made to involve women, not only as a target audience, but in the organization of activities at local level… was done in recognition of women's central role as guardians of their households' health and hygiene."[61] These activities were organized in coordination with local government officials and people living within these communities before toilet construction began. They helped design programs, provided accounting services, organized tenders, collected funds, and organized local activities.[62]

A significant part of the programming included health education, which sought to inform people about toilets, toilet construction, costs, health benefits, dangers of open defecation. The three classes included health and hygiene, technical aspects of construction, and toilet maintenance. During these classes, special attention was paid towards women because it is

[60] Ibid.
[61] Ibid.
[62] Ibid.

"common practice in the water and sanitation sector…. Done in recognition of women's central role as guardians of their households' health and hygiene, as drawers and users of water, as inculcators of hygiene habits in their children and as those who stand to gain the most from sanitation in terms of privacy security and self-respect."[63]

In the study, the organization measured household women's knowledge of and practice of handwashing and latrine use as compared to exposure level to intervention through participation in classes, video/slideshows, drama, competitions, women involved in the organization, masons who were trained in latrine construction also sharing sanitation messages, and the number of home visits; all of these categorical variables showed a positive association with handwashing by all women of the household.[64] On the other hand, men did not show any significant correlation between level of intervention exposure and increased handwashing.[65]

Additionally, the study also showed that participants of the intervention classes had a more hygienic understanding of handwashing and latrine use than before training and women living in other panchayats at the time of the research.[66] To illustrate, the study showed that after intervention classes, 57.7 percent of women voted that they always wash both hands with soap and 84.6 percent of women when asked demonstrated proper handwashing technique (rubbing both hands together with soap and water).[67] The study also shows that 89.5 percent of women reported that they always use a proper latrine (meaning one that flushes or disposes waste safely). In general, survey respondents were more likely to show knowledge and implementation of correct handwashing technique in households where women reported correct handwashing

[63] Ibid.
[64] Ibid.
[65] Ibid.
[66] Ibid.
[67] Ibid.

technique.[68] Also, the practice of handwashing with soap is significantly more common in panchayats where people participated in intervention classes than communities that did not participate in any similar classes.[69] In contrast to the people living in panchayats that did participate in intervention courses, people living in Panmana, a panchayat with relatively higher than average socioeconomic status, was used as a control case, which showed that only seven percent of women and girls and three percent of men and boys reported correct handwashing technique.[70] This shows that there is a significant difference in hygiene between panchayats that did participate in intervention courses and those that did not — even taking into account socioeconomic status. The NGO's organization of the construction of the latrines likely contributes to this outcome.

This case study can shed light on three important lessons regarding the involvement of NGOs, educational activities, and special attention towards women's support and understanding: women's influence on men and children in their family and on the community and other women at large. Clearly women have influence on household practices.

First, this case study illustrates the strong influence that women's household practices can have on people living within the home. Women's influence on household practices could stem from their expected responsibilities as caretakers of the home. Evidence from the case study regarding Women's household influence may not be part of the women's mobilization story, but it is still important because it certainly has domestic implications that show how people change their everyday actions to follow sanitation practices that do not contribute to specifically water pollution.

---

[68] Ibid.
[69] Ibid.
[70] Ibid.

Second, this case study highlights a key point that is part of the women's mobilization story: women's ability to influence other women and their influence on training each other and their families. In this case study with SEUF and the province of Kerala, women were encouraged to mobilize to educate others. SEUF especially focused on mobilizing already established organizations like local women's clubs to contribute to the educational programs. This is key for two reasons: (1) just like grassroots movements like the Chipko Movement, this highlights the importance of, effectiveness of, and motivation behind local involvement and organizational efforts (2) this case study illustrates the productivity and efficacy of directly involving women in programming that involves health and hygiene. These local women's organizations were also encouraged to focus their educational programming towards women because they would demonstrate having a higher impact than men on the hygiene and health practices of other family members.

Third, this case study shows that NGOs can be instrumental in educating people about hygiene and sanitation problems. These educational programs show significant differences in sanitation practices between those who participated in educational programming and those who did not. Similar educational programs as those explained in this case study can be replicated to show the health problems that traditional cookstoves are responsible for, and could influence people's desires to change their methods. This case study exhibits that knowing why a practice is healthier contributes to likelihood of practice.

Overall, this case study illustrates the avenues in which non-governmental organizations can contribute to creating solutions for a health issue that include a focus on women's involvement as a part of the solution and largely affects regular household practices — which women clearly have a more significant role in managing, in rural communities of India.

Suggested Solutions

The suggested solutions of this paper can be broken down into two sections. First, this paper seeks to suggest some solutions that could be beneficial towards the specific issue of traditional cookstoves causing severe air pollution issues that negatively impact women's health. Their health is largely impacted by their social expectation to cook for family households — making this air pollution issue a women's issue. Regarding the specific issue of traditional cookstoves in India, this paper suggests the ample replacement of such cookstoves in favor of potentially more efficient biomass cookstoves, LPG cookstoves, electronic cookstoves, or any other more advanced technology that causes significantly less air pollution than of the traditional biomass cookstoves that are predominantly used in rural India by women. This can be achieved through the mobilization of women and female leaders in the avenue of grassroots movements and potentially with the help of NGOs that also focus their efforts on mobilizing women. The difficult challenge of convincing women to switch from traditional cookstoves to more efficient, modern cookstoves can potentially be addressed through women's educational programming that highlights the potential for modern cookstoves to still approximate the flavor and tradition that traditional *chulhas* have in the past. In previous iterations of attempting to have women adopt modern cookstoves, Indian governments focused too heavily on the distribution of modern cookstoves without enough focus on actually persuading women — the primary users of cookstoves.

Second, this paper also seeks to contribute some suggestions for issues that dually require a scientific understanding of air and water pollution and prioritize reaching women. Solutions to

combat water and air pollution regarding sanitation, health, and maintenance of household and families, especially in rural areas must involve the empowerment and contributions of women.

Conclusion

In essence, this paper assesses the multitude of negative health effects that water and air pollution can cause — especially pollutants that, when emitted, are more likely to negatively impact women than men. Several pollutant causes are much worse for women than men because of women's expected responsibilities in their households. Thus, women can and should have a greater impact on the mobilization for these air and water pollution problems. Solutions can most significantly improve women's health, but they can also benefit children and men's health.

However, this paper suggests that women need to be mobilized on the issues of air and water pollution for reasons beyond just pollution in and of itself, too. If women pave the way on these crucial community and health issues, they can mobilize this momentum in other factors that affect women's lives, too. Such success can empower and embolden women to seek answers to women's issues like girls education, violence against women, marriage equality, among countless others. In fact, there are multiple benefits if women are mobilized around a particular issue that can then help create a platform for women to address countless other issues as well, because mobilizing in an effort to solve the issues of water and air pollution are similarly problems that challenge the status quo — seeking sweeping support from and changes made by governments.

Additional research also needs to be conducted surrounding the specifics of maintaining the cultural integrity of traditional meals with the transition to modern, more efficient cookstoves. Further research can be conducted to additionally advance the intertwined issues of

water and air pollution, and how these problems can benefit from women's involvement and in turn also promote women's rights.

Works Cited

Agarwal, Bina. "The gender and environment debate: Lessons from India." *Feminist studies* 18, no. 1 (1992): 119-158.

Anju, Agrawal, Pandey Ravi S, and Sharma Bechan. "Water pollution with special reference to pesticide contamination in India." *Journal of Water Resource and Protection* 2010 (2010).

Bickerstaff, Karen, and Gordon Walker. "Public understandings of air pollution: the 'localisation'of environmental risk." *Global environmental change* 11, no. 2 (2001): 133-145.

Cairncross, Sandy, Kathleen Shordt, Suma Zacharia, and Beena Kumari Govindan. "What causes sustainable changes in hygiene behaviour? A cross-sectional study from Kerala, India." *Social science & medicine* 61, no. 10 (2005): 2212-2220.

Clasen, Thomas, Douglas Fabini, Sophie Boisson, Jay Taneja, Joshua Song, Elisabeth Aichinger, Anthony Bui et al. "Making sanitation count: developing and testing a device for assessing latrine use in low-income settings." *Environmental science & technology* 46, no. 6 (2012): 3295-3303.

Ghertner, D. Asher. "Technology and tricks: Intra-household technology implementation and gender struggles." *Gender, technology and development* 10, no. 3 (2006): 281-311.

"Health and Environmental Effects of Particulate Matter (PM)." Environmental Protection Agency.

Khandelwal, Meena, Matthew E. Hill Jr, Paul Greenough, Jerry Anthony, Misha Quill, Marc Linderman, and H. S. Udaykumar. "Why have improved cook-stove initiatives in India failed?." *World Development* 92 (2017): 13-27.

Mayton, D. M., and M. Daniel. "Gandhi as peacebuilder: The social psychology of satyagraha." *Peace, conflict, and violence: Peace psychology for the 21st century* (2001): 307-313.

Mehetre, Sonam A., N. L. Panwar, Deepak Sharma, and Himanshu Kumar. "Improved biomass cookstoves for sustainable development: A review." *Renewable and Sustainable Energy Reviews* 73 (2017): 672-687.

Harva

Mohapatra, Sandeep, and Leo Simon. "Intra-household bargaining over household technology adoption." *Review of Economics of the Household* 15, no. 4 (2017): 1263-1290.

Mondal, Nandan Kumar, Bidisha Mukherjee, Debangshu Das, and Manas Ranjan Ray. "Micronucleus formation, DNA damage and repair in premenopausal women chronically exposed to high level of indoor air pollution from biomass fuel use in rural India." *Mutation Research/Genetic Toxicology and Environmental Mutagenesis* 697, no. 1-2 (2010): 47-54.

Passantino, Eleonora. "Ecofeminism in India: from the Chipko Movement to the Case of Narmada Valley Development Project." Bachelor's thesis, Università Ca'Foscari Venezia, 2017.

Parikh, Jyoti. "Hardships and health impacts on women due to traditional cooking fuels: A case study of Himachal Pradesh, India." *Energy Policy* 39, no. 12 (2011): 7587-7594.

Rao, Manisha. "Ecofeminism at the crossroads in India: A review." *Dep* 20, no. 12 (2012): 124-142.

Sehgal, Meena, Suliankatchi Abdulkader Rizwan, and Anand Krishnan. "Disease burden due to biomass cooking-fuel-related household air pollution among women in India." *Global health action* 7, no. 1 (2014): 25326.

Siddiqui, A. R., K. Lee, D. Bennett, Xiaowei Yang, K. H. Brown, Z. A. Bhutta, and Ellen B. Gold. "Indoor carbon monoxide and PM2. 5 concentrations by cooking fuels in Pakistan." *Indoor air* 19, no. 1 (2009): 75-82.

Singh, Upma, Shikha Singh, Rishikesh K. Tiwari, and Ravi S. Pandey. "Water pollution due to discharge of industrial effluents with special reference to Uttar Pradesh, India–a review." *International Archive of Applied Sciences and Technology* 9, no. 4 (2018): 111-121.

Smith, Kirk R., A. L. Aggarwal, and R. M. Dave. "Air pollution and rural biomass fuels in developing countries: a pilot village study in India and implications for research and policy." *Atmospheric Environment (1967)* 17, no. 11 (1983): 2343-2362.

Thapa, Deependra Kaji, and Anke Niehof. "Women's autonomy and husbands' involvement in maternal health care in Nepal." *Social Science & Medicine* 93 (2013): 1-10.

Tickner, J. Ann. *Gender in international relations: Feminist perspectives on achieving global security*. Columbia University Press, 1992.

Venkataraman, Chandra, Ambuj D. Sagar, Gazala Habib, Nick Lam, and Kirk R. Smith. "The Indian national initiative for advanced biomass cookstoves: the benefits of clean combustion." *Energy for sustainable development* 14, no. 2 (2010): 63-72.

Zhang, Junfeng, and Kirk R. Smith. "Household air pollution from coal and biomass fuels in China: measurements, health impacts, and interventions." *Environmental health perspectives* 115, no. 6 (2007): 848-855.