

The Gender of Fuelwood: Headloads and Truckloads in India

Research on cookstoves in India rests on a deeply gendered image of rural women carrying headloads of fuelwood from nearby forests back to their kitchens, where they use it for cooking on traditional biomass stoves (*chulha* in Hindi) that fill their homes with dangerous pollutants. Together, fuelwood collection and cooking, represent a longstanding concern about the nexus of biomass stoves, forest degradation, and anthropogenic climate change, as well as illness due to smoke and particulate matter from cooking fires (Desai, Mehta & Smith, 2004; Subramanian, 2014; Yadama, 2013). In rural India, women with headloads of firewood are everywhere in plain sight, and a host of problems are attributed to their wood-burning activities. Stemming from our investigation of cookstoves in southern Rajasthan, this study originated in our curiosity about the informal economy of headloads. Expecting that women not only burn but also sell some of the wood they collect, we wanted to understand the extent of this informal economy that provides women with income and links them to broader markets.

We argue in this paper that biofuel cookstoves have become iconic of environmental and health problems caused by burning biomass and that this results in multiple erasures, puts the blame for health and environmental problems on rural women’s cooking habits, and justifies interventions in their kitchens that may or may not be welcome. As the *chulha* has become a development category (Shrestha, 1995), its users have been defined as backward and are targeted for reform through cookstove improvement projects. This has led researchers and advocates to focus too intensely on this singular, domestic site of wood burning while ignoring other uses of fuelwood.

This version was published (with a few additional revisions) as “The Gender of Development” (2022) by Meena Khandelwal, Matthew E. Hill, Jr., Margaret Beck, Sanoop Valappanandi, and Hrushikesh Mahapatra. *Journal of South Asian Development* 17(2): 230-259.

Studies of the chulha-fuelwood nexus are motivated by two primary concerns, both of which, we suggest, can be better addressed by expanding the frame. First, to improve health, reducing the exposure of women and children to harmful emissions from cooking fires should rightly be a primary goal of government, energy research and development. Despite the significant impact of India’s LPG subsidy scheme (Pradhan Mantri Ujjwala Yojana) and rural electrification programs (Rural Electricity Supply Technology Mission), it is clear that access to gas and electric energy is tied to gender, class, caste, and transportation constraints, such that even families with LPG hook-up and electricity access continue to rely heavily on their biomass stoves (e.g., Chatti, Archer, Lennon & Dove, 2017; Khandelwal and Lain, 2017; Sarangi, Palit, Goswami & Jain, 2017; Smith & Jain, 2019). The widespread practice of using multiple stove and fuel combinations within a single household or ‘stove stacking’ suggests that most people still face significant risks in mortality and morbidity associated with burning biomass. We accept what appears to be a consensus among public health researchers about the severe negative health impacts of breathing the smoke emitted from chulhas, but our study highlights the wide range of sites, beyond the domestic hearth in rural areas, where fuelwood is burned. For instance, cities and towns have been understudied. The increasing rate of urbanization means that we must focus more attention on the formal and informal economies embedded in household decisions regarding wood and related materials in urban areas.

Second, to address deforestation and climate change, cookstove improvement advocates have encouraged people to adopt ‘efficient’ biomass-burning stoves or to replace firewood completely with solar, biogas, or LPG – all deemed ‘clean’ energy in comparison to fuelwood for cooking purposes.¹ For over a century, colonial foresters across Africa and South Asia falsely identified local wood cutting as the reason for forest degradation to justify state control of forests

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(Simon and Peterson, 2019). In the 1970s and 1980s, two concerns converged across much of the developing world: forest conservation and poverty reduction (Crewe, 1997). The Indian government intervened to reduce demands from axe-wielding, rural women with the twin goals of stemming environmental degradation throughout the country and raising living standards of poor people. The colonial and western view of forests as pristine, stable, and equilibrated persisted in India’s postcolonial forest administration after independence, as did the assumption that human use is degrading to forests (Rai 2014, p.150; Palit 1996). According to a scholar and retired Rajasthan Forest Service official, the transition in government at the time of independence was destructive to forests and wild animals in many parts of Rajasthan. People no longer feared British/local rulers, and the new system was still being formed. Thus, they freely entered the forest to fell trees, hunt animals, and collect various forest products. During this vulnerable period, Rajasthan’s forests faced irreparable damage.² Research on the historic-structural conditions of poverty and forest scarcity (e.g., Blaikie, 1985; Dewes, 1989; Leach & Mearns, 1988; Thompson Warburton & Hatley, 1986) has challenged the argument that household fuelwood use caused deforestation, but the simplistic narrative persisted (e.g., Simon and Peterson, 2019). In the last 20 years, discredited explanations that traditional cookstoves are a key driver of environmental degradation remain a foundation for national and international programs to distribute fuel efficient cookstoves to millions of people across India (Hanbar & Karve, 2002; Clean Cooking Alliance, 2020). Simon and Peterson argue that these fictions persist because governments, NGOs, and private corporations find them useful justifications for their international and localized development programmes, as they simultaneously deflect responsibility away from other activities responsible for forest loss, including colonial forestry practices, modern agricultural land clearing, commercial timber logging, production of charcoal

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and other fuels, and dam building (2019, p. 47). Similarly, a focus on traditional wood-burning cookstoves not only appeals to the desire for simple, technological solutions, but directs responsibility downward rather than upward towards more powerful actors.

Because burning wood releases carbon into the atmosphere, climate change has only intensified concerns about deforestation. Powerful transnational actors such as USAID, the World Bank and the International Monetary Fund have promoted market-based solutions to climate change, including carbon trading and biodiversity offsets. Researching US foreign aid to Madagascar, Corson traces how governmental and private donors 1) prioritize easily measured interventions such as expanding protected areas in Madagascar, 2) provide neither time nor funding for serious consultation with local populations about these projects, and 3) define environmental conservation as a foreign problem associated with peasants rather than powerful actors. so that American politicians need not antagonize powerful campaign donors or constituents whose interests may be threatened by environmental protections (Corson 2018, p.938). For example, Reducing Emissions from Deforestation and Degradation (REDD+) schemes set up a system of payments for environmental services. Policies involving payments for ecosystem services threaten to disrupt a decades-long trend towards decentralizing forest management in Global South countries which allows local people more rights and responsibilities to protect both forests and livelihoods (Phelps, Webb and Agrawal 2010). Lele (2013) points out numerous pragmatic and moral problems with the idea that the world’s biggest emitters can pay off others to fix the problem. But there is also a gendered dimension. Research in Burkina Faso shows that many REDD+ programs focus on non-timber forest products (NTFP) such as fuelwood and identify women as playing a key role in addressing deforestation (Westholm 2016, p. 512). In India, woodcutting is associated with women, and many stove

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improvement projects have been motivated by the pursuit of market-based carbon credits which could, in the eyes of advocates, make forest protection economically sustainable. Such projects involve prescriptions for women to change their behavior.

Loss and burning of trees are dire problems, but burning wood is burning wood, whether in small, home chulhas or large, commercial brick or ceramic kilns operated by men. The balance of benefits between wood and LPG, a fossil fuel, may look different depending on whether women are the primary actors. Moreover, as suggested by recent ecological approaches that emphasize complexity and uncertainties (Scoones, 1999), it remains to be shown (not assumed) that it is always a bad thing to burn wood for cooking. We see ambiguities. In Mewar Biodiversity Park, for example, the forest protection committee allows local villagers to come and collect fuelwood once a year with the twin goals of building goodwill and diminishing forest fires by clearing dry wood from the forest floor. And in some cases, the word ‘pruning’ rather than ‘cutting’ is an appropriate description of fuelwood harvesting. Considering the entire commodity chain involving both materials and people may reveal that burning wood obtained locally is more efficient and less harmful than burning fossil fuels transported across countries, seas, and continents. It is likely that most of the fuelwood and fodder extracted from forests by local people is dried vegetation, thus not necessarily a driver of deforestation (Nagothu, 2001, pp. 330-31). Indeed, in some areas, villagers primarily focus on collecting and burning locally abundant (‘invasive’) species like *vilayati* or ‘foreign’ *babul* (*prosopis juliflora*).³ The wood flowing to urban areas from villages, however, is more likely to be green, desirable standing tree species and thus more harmful to resources and biodiversity.

Currently, the Government of India’s (GoI) ongoing Pradhan Mantri Ujjwala Yojana (PMUY) campaign launched in 2016 by the Ministry of Petroleum and Natural Gas aims to bring

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about a shift away from solid biomass and toward LPG cooking, making inroads into even small, remote villages (Dabadge, Sreenivas & Josey, 2018). The Ujjwala campaign is popular, as LPG cooking appears to be universally aspirational for women who do not have it. Despite the massive increase in LPG stoves and fuel canisters now found in poor, rural households, it is increasingly acknowledged that the practice of cooking with biomass will continue in the foreseeable future, as will efforts to improve the efficiency of biomass cookstoves, albeit on the sidelines of Ujjwala’s visibility in policy and media. Despite the success of Ujjwala in distributing LPG stoves and the first gas cylinder, stove stacking and fuel mixing are widespread, and health and environmental concerns about the burning of solid biomass persist (Chinkarkar, Jain & Mani, 2021; Gupta, Vyas, Hathi, et al., 2020).

Efforts to reduce biofuel use in South Asia go back over seventy years and have focused intensely on women, domestic cooking, and villages proximate to forests. Typically, informal reproductive labor (paid and unpaid) of cutting fuelwood, processing and cooking food, childcare, and so on is invisible, but in this case women’s subsistence activity is hyper-visible and targeted for reform. Motivations to improve stoves are varied and have shifted over time (Khandelwal, Hill, Greenough, et al., 2017). Promoters of ‘clean’ or ‘efficient’ or ‘smokeless’ stoves have aimed to improve the health of women and children, reduce deforestation and fuelwood shortages, relieve women of labourious domestic work, educate girls and, more recently, stem climate change. Success is measured as adequate production of an improved cookstove (IC) at a certain price point, and then efficient distribution into the hands of end users: women in rural villages. This approach takes a dynamic suite of interrelated problems such as poverty, deforestation, global warming, health of women and children, and increasing labour demands, and tries to solve them with ICs. That these technologies are introduced into dynamic,

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gendered, hierarchical communities is insufficiently understood or ignored entirely (Ghertner, 2006, p. 283). The seductive idea of technological fixes for development problems creates a race for breakthroughs, whether ICs or LPG, whereas a slower approach involving citizens themselves, especially people with little access to cash, would attend to local knowledge, livelihoods, and impacts (Leach & Scoones, 2006, p. 25; Collier, Cross, et al., 2017; Wyer, Barbercheck, et al., 2009, p. 303).

The goal of reducing biofuel use for cooking is not the problem per se, as emissions from biomass-fueled stoves have negative impacts on human health and alter local and global environments. Incomplete combustion from traditional biomass cookstoves exposes billions of people to fine-particulate matter, which is a leading cause of premature mortality and contributes to anthropogenic black carbon in the atmosphere (e.g., Chowdhury, Dey, et al., 2019; Masera, Bailis, et al., 2015). We argue, however, that stove interventions are limited by their pertinacious focus on rural women’s headloads. The analytical frame that drives research and interventions rests on an over-simplified and empirically questionable narrative targeting the domestic activities of rural women as the unit of analysis and problem. We call for a broader research focus on fuelwood that investigates the following as connected: urban fuelwood use in relation to villages; commercial, institutional, and ritual wood burning in relation to domestic cooking; men in relation to women. The assumption that home chulhas are a key driver of ill health, environmental degradation, and climate change supports the persistent divide between the perspectives of local land users on the one hand, and on the other, prevailing (global) science and policy perspectives that blame local populations for environmental destruction (Leach & Fairhead, 2016, p. 152). We suggest that examining the broad range of actors and activities

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connected to wood burning would distribute the blame more fairly and thus contribute to a pro-poor forest science (Kaimowitz, 2002).

Legitimate concerns about burning fuelwood in India will not be addressed by focusing narrowly on village women’s household cooking, which resembles the kind of narrowing of vision Scott (1998) describes as ‘seeing like a state’. Concerns about fuelwood use tend to focus intensely on women, while men and their wood-related activities constitute a peripheral interest, usually associated with workplace health issues (e.g., Das, Hasan, et al., 2017; Miglani, Kumar, et al., 2019). Furthermore, to simplify deployment of interventions, development problems are often treated as if they occur in just one setting. In this case, wood-burning cookstoves are identified as a rural home cooking problem and artificially separated from urban sites.

This focus on village women’s cooking is too narrow if we are to understand and address problems caused by burning fuelwood in India, for cookstove campaigns target villages and not cities, domestic cooking and not commercial uses, women and not men. Based on ethnographic research in Rajasthan and Odisha, we document large amounts of firewood being burned in and around both cities and small towns, identifying the central role of state governments in moving firewood from forests to cities, the practice of firewood harvesting in urbanized contexts, and urban practices of firewood exchange. We then identify a range of commercial, institutional, and religious activities involving fuelwood use – and men’s role as key actors. Finally, we conclude that cookstove interventions, expressed as concern for women, require robust gender analysis.

Methodology

Our call to expand the study of fuelwood use beyond villages, rural kitchens and women emerges from a collaborative and ethnographic approach. Our six months of ethnographic research over

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the course of seven years exemplifies ‘patchwork ethnography’ (Günel, Varma & Watanabe, 2020) rather than participant-observation in the classic sense of long-term immersion in a community. However, one of us (Khandelwal) has previously conducted long-term, immersive research in another region of India and was the only author involved in each period of field research for this study. Moreover, our methods are deeply anthropological in that they encourage us to question our own prior theories (Shah, 2017, p. 47) and to stray from our original research aim to understand *what actually happens* with the wood that women harvest. Thus, in July 2019 we visited a farmers’ market in Odisha in search of rural women selling headloads. Not finding any, we instead chatted with vendors about their products, and one conversation with a woman selling clay vessels led us to pottery kilns. A subsequent conversation with a potter led us to incorporate the wood depot system, and so on, as detailed below.

While our inquiry into fuelwood began in southern Rajasthan, this essay incorporates fieldwork in Odisha where forests and firewood are more abundant. We followed wood and those who use it in Rajasthan and Odisha to understand how small-scale use of wood for both subsistence use (household cooking, heating, and light) and market activity (commodity exchange) varies within the broader context of gender, household economies, and geographic variation in fuel type and availability. We focus on Udaipur district in the western state of Rajasthan and Angul District in the eastern state of Odisha. These districts have comparable demographic and socioeconomic characteristics but offer stark differences in environment and wood availability. Both Udaipur and Angul have population densities below the Indian average. Udaipur in arid Rajasthan is a ‘wood-poor’ region, due to both climate and anthropogenic deforestation. In contrast, Angul in wet, tropical Odisha is a ‘wood rich’ region, having abundant forests with moderate to very high tree densities (Forest Survey of India, 2017). Both Udaipur

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and Angul have struggled to provide safe, reliable, and affordable energy access to all village and urban households.

This project was a multi-sited study that was carried out through multiple visits in both winter and summer months along existing roadway corridors linking urban regional centers to remote rural villages: NH 23 and 55 in Angul District and NH 27 and Highway 32 in Udaipur District. Along these transportation corridors, people, raw materials, goods, and information move within and between urban centers (Angul and Udaipur), small towns on the periphery of urban centers (Cheliapada near Angul; Badgaon, Bedla, Chota Bedla, Molela, Amberi, Gogunda near Udaipur), and more distant, rural villages (Tumani, Bantala, Jayapur, Paiksahi, Hinsaloi in Odisha; Karech, Rawachh in Rajasthan). People have different types of access to forest and non-wood fuels at different points along these corridors. Rural villagers often have little cash to purchase wood or other fuels, but they generally live closest to forests where they collect wood directly. Residents of small towns usually live far from forests but can more easily access local markets where wood and other fuels are sold (albeit at relatively high prices). In addition, small towns often have multiple commercial operations (wood depots, sawmills, furniture makers, construction businesses) that transport, use, store, process, and sell wood. Urban residents may be distant from forests but have access to large markets where wood or other fuels can be purchased at moderate prices. Numerous small and large commercial, religious, and governmental operations in urban centers use wood and vast quantities of timber, and finished wood products move in and out of these urban areas every day. Trees exist even around large urban centers, in small, forested areas and along the edges of house lots. In Rajasthan and Odisha, we have visited homes and forests, shops and factories, restaurants and government offices in villages, small towns, and cities. Given the multiplicity of researchers and sites, our

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conversations about fuelwood have occurred in multiple languages (English, Hindi, Mewari, Oriya).

Beyond Villages

A common theme in scientific studies and government reports is that households using solid biomass for fuel are concentrated in rural areas of economically developing countries. The International Energy Agency’s *World Energy Outlook* reports, while acknowledging that household poverty is strongly correlated with burning of wood or other solid biomass to cook or heat homes, nevertheless emphasize that the vast majority of fuelwood use occurs in rural areas (IEA, 2016). A World Bank study on household cooking fuel choice reiterates that it is rural areas in developing countries where heavy use of fuelwood for cooking persists (Malla & Timilsina, 2014). In India too, there has been a strong historic focus on rural households as the primary location of fuelwood use (Das & Pal, 2019, p. 415). This would appear a reasonable assumption given a large rural population that uses biomass extensively, but we suggest that this focus has foreclosed a host of research questions about urban, institutional, and industrial uses of fuelwood.

Despite Mahatma Gandhi’s famous observation that ‘India lives in its villages’, India is increasingly urban (Tandel, Hiranandani & Kapoor, 2019). The Government of India (GoI) uses two systems to measure urban and rural populations. Administratively, all residential settlements governed by *panchayats* are defined as ‘rural’ (Tandel et al. 2019, p. 71). However, the Census of India defines the ‘rural section’ as any place with a population under 5,000, a population density less than 400 people per sq km, and over a quarter of the male working population engaged in agricultural pursuits (Census of India, 2011). Depending on the definition used, India

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had either 26 per cent or 31 per cent of its population living in an urban area during the 2011 Census. However, Tandel et al. (2019) estimate that if the Indian government used a population threshold for urban areas more in line with other developing nations (population over 2500), the actual share of the population living in urban areas would be closer to 65 per cent. Regardless of the vagaries of census procedures, urban centers in India are large and expanding rapidly, with migration to cities as both cause and effect of urban growth as rural people are displaced from livelihoods and workers are needed for construction, gardening, domestic service, and so on. While Gandhi’s political vision centered on rural communities has been widely criticized for minimizing caste oppression in rural India and the value of Adivasi forms of social life (Jodhka 2002), our point is simply that it is less true than ever, even if many migrants working in cities claim their ancestral village as home (*ghar*).

Over three decades ago, Manibog highlighted urban and commercial fuelwood use (1984, p. 221), and Sathaye and Meyers observed a rural bias in biofuel research (1987, p. 86), but the bias persists. For example, the ‘Access to Clean Cooking Energy and Electricity – Survey of States’ study in 2014-2018, which surveyed energy use among more than 8500 households across six states in India (Jain, Ray, et al., 2015; Jain, Tripathi, et al., 2018), specifically focused on observations from ‘small and large villages’ based on population size. Even this excellent study did not sample large urban centers, although wood and other biofuels are used in both urban and rural settings. The WHO estimates that in all developing countries, 30 per cent people in urban areas and 81 per cent in rural areas rely on biomass as their primary fuel (Legros, Havet, et al., 2009). Percentages vary with economic status and regional infrastructure; in the most economically disadvantaged regions, over 95 per cent of rural households and nearly 70 per cent in urban households use wood, charcoal, dung, or coal as their primary fuel (Legros et al, 2009,

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p.19). Among the poorest urban households in India, it is estimated that nearly 80 per cent still rely on biomass as a key fuel source; biofuel use completely disappears only among the most well-off households (de la Rue du Can, Letschert, et al., 2009; Pachauri & Jiang, 2008; Smith & Jain, 2019; Gupta, Gupta & Sarangi 2020).

Our research documents in India what the WHO describes globally: copious amounts of fuelwood are burned in cities, peri-urban areas, and small towns.⁴ It is often presumed that urban consumers purchase rather than produce fuels (e.g., Leach & Mearns, 1988), but the situation is more complicated. Wood buyers, transporters and traders do, of course, bring wood into urban centers and sell it as timber, cut lumber, fuelwood, and other products. The wood materials sold as fuel from these commercial operations are generally the nonmarketable waste produced during the manufacture of lumber. While a city dweller may buy a small bundle of firewood and even carry it home on their head, this bundle would have reached the vendor by truckload, not headload. Moreover, cash-poor urban residents also collect fuelwood for cooking in and around cities, from their own land, proximate forests, the private land of others (with or without permission), or public spaces. Some perceive wood for cooking as scarce (relative to LPG), and others perceive it as abundant. Focusing only on rural villages in cookstove improvement efforts ignores the practice of cooking with firewood in cities, urban borderlands, worksites, small-scale factories, restaurants, temples, and schools. We need to trace the ‘woody’ connections between cities and villages.

State Management and Commercial Sale of Fuelwood

The state governments of India are central players in moving timber and wood products from forests to cities. Since the Indian Forest Act of 1927 (IFA), they have regulated various

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aspects of forest management. Under the IFA, explains Suykens, ‘reserve forests’ were most strictly protected against timber harvesting and other interference, while ‘village forests’ granted rights of use to local populations but came with a duty to protect forests and a strict system of permits and penalties that made local communities dependent on forest officers. A third category of ‘protected forests’ were protected and regulated by the government for commercial timber logging (Suykens, 2009, p.387).

The Odisha Forest Development Corporation Limited (OFDC Ltd.) was organized in 1982 based on the preexisting Odisha Forest Corporation (1962). The goals of OFDC are to generate revenue for the government, exploit forest resources in a scientific manner, ensure fair wages to forest workers, and promote forest-based industries.⁵ The Rajasthan Forest (Produce) Transit Rules (1957) established the institutional structure for wood depots in the state to regulate the cutting, transport, and sale of forest products from Forest Department plantations, as Sivaram and Nayana (2013) describe for Kerala. The depots also auction wood seized from illegal sawmills and timber extraction activities. While a forest department official in Odisha told us that the timber mafia has finally been stopped, ongoing news reports of the illegal and violent activities of forest mafias and wood smugglers in the state suggest otherwise. Aside from the important study of illegal timber trade in Assam by Dutta and Suykens (2017), we have found little research documenting how wood moves between illegal and legal status. In addition to seizure of contraband wood, trees may also be felled intentionally, as part of legal land clearing for urban development, or accidentally, due to storms. In heavily forested and cyclone-prone Odisha, large storms along the coast of the Indian Ocean wreak havoc on trees. Intentional felling can be equally dramatic: an NGO staff member said that over 4000 trees were cleared in Odisha for the renovation of a fertilizer factory. A highway on which we traveled in Odisha, still

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under construction in January 2020, was littered with enormous stumps of century-old trees.

Though uprooted stumps the size of elephants remained, strewn about helter-skelter along the roadside, the trunks and branches would have been taken by truck to a government wood depot to be auctioned for transformation into lumber and fuelwood.

We have found no secondary literature on the organization of wood depots, but our field research reveals that the depots sell wood to potters, carpenters, furniture makers, wood sellers and sawmill owners in various urban and peri-urban localities through auctions. In most states, ordinary people cannot purchase firewood directly from depots (e.g., Rawat, Vishvakarma & Todaria, 2009), though reports suggest that in Kerala a small number of people are getting their firewood directly from depots (see Komala & Prasad, 2014). The right to buy directly from a depot is highly regulated, requiring permits and site visits.⁶ Depot managers describe it as a government undertaking separate from the Forest Department; it is a corporation that earns a profit and pays staff from these earnings. However, it is the Forest Department that marks the trees for harvesting, a few hundred at a time, during the monsoon season, then the wood depot cuts trees after October. As one wood depot manager explained, the Forest Department exists to protect the forest, and the corporation is the business wing of the Forest Department. Our discussions with foresters suggest that the number of wood depots have declined in India due to the greater emphasis on forest protection, and this is consistent with our discovery that India is now a major importer of timber, which arrives by ship from as far as Ghana and Ecuador, is cut in India, then exported as lumber to other countries. Still, some wood from these state-regulated depots is eventually sold as fuelwood in urban areas.

A wood depot visited in southern Rajasthan had only bamboo grown on plantations up for auction, but those in Odisha were impressive in the quantity, size, and variety of wood

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materials for sale. In one field were enormous stacks of logs, 25-150 in one lot, that would be listed on the website (e-tender) for sale and auctioned off to the public (Figure 1). Smaller branches were cut in uniform lengths and neatly ‘staged’ in 3’ x 3’ x 6’ lots. Once wood merchants and sawmill owners purchase lots from a wood depot and obtain a permit to transport it by trucks to their businesses in towns and cities, it becomes two products: cut wood for building or furniture making, and fuel for burning. Sawmill owners and wood merchants we met in both Rajasthan and Odisha said that they sell fuelwood to poor people who need it for household cooking, to event caterers and others cooking for large groups, and, finally, to mourners who need wood for funeral pyres. One sawmill owner also mentioned selling scrap wood and sawdust to government contractors to use in brick-making kilns and to melt tar for road construction.

Those involved in wood trade say that local supply of wood has declined due to increased government regulation and enforcement and that demand for wood has also declined due to expansion of LPG for cooking and metal and ply for construction. We were surprised to learn (after several trips to Udaipur) of three sawmills within a kilometer of our hotel in a central part of the city; if not looking for them it would have been easy to walk by their massive entrance gates and not notice they were there. It is difficult find published information on sawmills, but a high-ranking Forest Department official said there are around 400 sawmills in Udaipur district alone.⁷ We expect that Odisha has an even higher density of sawmills because there is more forest. Sawmills (Figure 2) and wood merchants sell fuelwood, reporting sale of 1-2 quintals per day, to people in cities who are burning it for cooking and other purposes.

Collection of Fuelwood

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We have also been surprised to learn that fuelwood collection is not limited to villages. In July 2018, we spoke with a Bhil woman working in the office of a small NGO in Udaipur. ‘Lacchi’ resides in a peri-urban neighborhood; such areas are often referred to as ‘villages’ in common parlance though only a 15-minute auto-rikshaw ride from the center of the city.⁸ Lacchi was a young mother of two who, after her husband died, moved in with her parents, her brother and his wife on the outskirts of Udaipur in a home without LPG. She built the household chulha from mud but at the time of our conversation was cooking with an inexpensive earthen pot (*matka*) sold for storing drinking water. Demonstrating how it is done, she picked up an old, discarded *matka*, set it on a low cement wall, sat down beside it, and began tapping gently with a metal utensil to make an opening on one side (so fuel can be added) to create a functional stove, thus producing a cheap, portable stove that can be used outside but easily moved inside in case of rain. She said this clay pot (*matkawala*) chulha is found in every house in her neighborhood. Wood is not available near Lacchi’s home due to deforestation and private ownership of land, so she cuts wood from the neighborhood near the office and takes it home by hiring an auto-rikshaw. She did not present this as a hardship.⁹ Trees in open lots or parks, along roadsides, or on private property need periodic trimming, so cutting branches can be easy and, in some instances, helpful.

We have visited three neighborhoods on the outskirts of Udaipur multiple times (2015, 2018, 2019). Stacks of firewood and twigs are everywhere, along walls, in the corner of yards, leaned against homes, piled atop roofs. Most houses are built in the modern (*pakka*), cement style. The more prosperous families have motorcycles. Children might know a few English words, but otherwise our conversations took place in Hindi mixed with a bit of Mewari. Stove stacking is the norm; most people in these areas had acquired LPG in recent years, which they

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kept inside, but also used a chulha which was built outside in a courtyard. Many people reserve gas to make tea, to prepare something quickly for unexpected guests, and to use during the rainy season when chulha and firewood may get wet.

What surprised us more than the use of chulhas in these areas is the discovery that so many people cut wood themselves rather than buying it. In a peri-urban neighborhood we visited in 2015, a few kilometers north of Fatehpara Circle, an older husband and wife living in a household of ten people said they rarely buy wood for fuel. Instead, they scavenged twigs and branches from nearby bushes and trees; they showed us multiple large stacks of bound twigs and branches stored along a fence around the house. The vegetation around their own home was already cut back, and the husband told us that if they need more fuel, he would have to go to his neighbors’ houses or a nearby abandoned lot to cut more. Though we could not confirm it, he assured us that his neighbors were quite happy to have someone trim overgrown trees and bushes on their property.

In a Gameti Adivasi neighborhood visited in 2018, a young daughter-in-law (married six years) said that her family has never bought wood and that she walks 2 km to the forest to collect firewood.¹⁰ She goes during winter and summer, sometimes twice in a single day, to stock fuel to feed her large household of 10-12 people. She complained about the chulha’s smoke but noted that it saves money and produces charcoal that is useful for heating water and pressing clothes – and food cooked over fire tastes good. She said everyone in the community collects firewood for their own use – no one sells it. Those who have goats allow the animals to graze while they cut wood, suggesting that fuelwood harvesting may or may not be the primary reason for trips to forestland. We then spoke with a neighbor, a middle-aged woman who similarly has a mud chulha outside and LPG inside: she goes, taking her goats, to collect wood and fodder from the

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‘*jungle*’ most days. It seems that most collect some wood and only the most prosperous families rely primarily on LPG. In an upper-caste Rajput home in an adjacent community, the father (an auto-rickshaw driver) showed us his chulha and explained that his wife had gone to collect fodder from their agricultural land but that the women of his household also go to collect firewood and fodder from two nearby forests. The man said that procuring fuelwood was not a problem, and if they were unable to find (dry) wood, he would simply buy scraps from a furniture maker (at 2-3 rupees per kilo) and bring it home in his auto. Though most people in his neighborhood have an LPG set up at home, they rely heavily on wood for cooking.

As we have seen in many urban sites, migrant workers often use wood to cook in makeshift or portable chulhas. People without a permanent residence, and those who live and/or cook at their workplace, often set up a temporary chulha, perhaps five bricks arranged in a U-shape, for cooking with firewood. We learned that migrant workers living three km outside of Udaipur along the roadside cook with wood they collect themselves. We have observed these practices among itinerant people as well as among workers and staff at wood retail shops, wood depots and sawmills – places where fuel is readily available (see Figure 3). An Angul furniture store has a factory behind the showroom where the carpenters worked. The owner showed us the storeroom of lumber and noted that his staff of 30 employees all live and eat on site, using a chulha and waste wood from the production process to cook. This practice is not limited to workers who live on site, for we met a family of recyclers/rag pickers living in a makeshift shelter (*jhopadi*) with plastic sheeting for a roof; family members collect fuel from the wooded area behind a school, which irritates the teachers. Nor is fuel collection limited to poor people. We noticed a chulha outside the office of a Forest Ranger in Rajasthan that looked like it has been used recently. When we inquired, he laughed at the irony and said it is used only for parties.

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Some mentioned that meat is generally cooked outside on a chulha, even if LPG is available.

Many of these chulhas are inexpensive and/or portable, such as the *matkawala* chulha used by migrant workers or the stove fashioned out of an oil tin used by a vendor at a market (Figure 4).

Typically, the fuel is wood, and it is just as likely to be harvested as purchased.

Exchange of Fuelwood

Fuelwood collection occurs on the edges of cities (not just the edges of forests), but people may purchase firewood, collect it, or engage an eclectic set of practices to procure wood to meet their basic cooking needs. One July morning in 2018, we were in a taxi headed to Karech village with our driver Ramesh who lives in Udaipur near Fatehpura Circle. As we chatted about cooking practices, he said his family has a wood-burning chulha at home and volunteered that when he returns alone from Mount Abu after dropping tourists, in an empty car, he purchases bundles of wood from Adivasis selling on the roadside and brings them home in the car trunk. This example begins with the standard narrative of Adivasi women collecting headloads of wood, but then they sell it for cash to a (male) city dweller who transports it home in a car. Ramesh noted that all his neighbors have LPG, but when they run out of fuel, he shares his stock of wood with them until they can get their tank refilled (few have a second canister).

During multiple research trips, we have found drivers (of cars and auto-rikshaws, hired on the street or employed by our partner NGO FES) to be knowledgeable about practices in their communities, able to obtain information through their social networks, curious about our project, and generous in sharing their insights with us while on the road. One July morning in 2018, while on route to a Bhil village in southern Rajasthan, we stopped at the ancestral home of our driver, ‘Govind’, for chai. Though he lived in the city with his wife and three young children, he

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belonged to a prosperous Rajput family of landowners. A good water supply (wells) enabled the family to cultivate sugarcane. Govind proudly pointed to the home improvements and expansion underway. The signs of upward mobility and modernization were all around: a home constructed of cement, a sofa for seating, literate daughters-in-law, two toilets in a free-standing structure (one for ladies, one for gents), a television.

Amidst the architectural modernization of Govind’s home, the kitchen was a striking exception. Its walls were mud, the roof was clay tile, and one side of the three-walled structure was completely open to the courtyard, a rustic open-air room sandwiched between two cement structures. An LPG stove was set up on one side and a mud chulha built into the corner, both in active use. Family members both harvest wood from their own land and buy it by the bundle (*mool*) from Adivasis. The women of the family insisted they never go to the jungle themselves to collect wood – not only are they afraid to go to the jungle but it is also far from their home. A daughter-in-law, Sheela, reported that she feared going to the jungle because of lions and insisted that ‘only Adivasi people bring wood’. Govind added that they bring more in the winter and less during the monsoon season. Govind’s family needs wood because they mix it with dried cattle dung (*gobar*) for slow-burning fuel to heat milk. In exchange for wood, Adivasi women request 60 rupees per bundle along with buttermilk because they have no buffalos of their own. Govind chimed in to say that at 900 rupees per cylinder gas is very costly, indicating that he is not eligible for the subsidized rate.

Sheela said there is no problem at all with smoke in using the mud chulha because of the tile roof, though openings in the tile roof means that the chulha gets wet during the rainy season when she relies more heavily on gas. Sheela’s mother-in-law confirmed that they obtained LPG 4-5 years previously but mostly cook on the mud chulha except during the rainy season. She

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never went to the forest for wood even in childhood, because ‘Rajputs don’t go to the jungle.’

The older woman added that the forest was very far (15 km) from their home and that it was

Gametis (Adivasis) who cut wood in forest, then carry it on their heads to nearby areas to sell.

Sheela reiterated that only Adivasis collect wood from forests and sell it, explaining that they

have no fear and that they always do this kind of work—in addition to engaging in construction

work ‘building homes for Rajputs like us’. If they don’t have employment, she explained, they

collect more wood. If they take up wage labour, they have less time to collect wood. In the

monsoon they collect wood because a lot of wood falls down due to rain, but it is ‘green’ and not

useful for cooking so they don’t sell it. We heard similar comments in one of the less remote

villages: Adivasi women exchange headloads of wood for cash and buttermilk. In yet another

village, a group of women told us that younger women who have come as brides are afraid of

going to the jungle, hence the families had to get LPG for them. Not only is fuelwood bought and

sold by the bundle, but it can also in some instances be a gift. In some communities, when a

person dies, villagers bring small amounts of wood for the family so that enough is accumulated

for a cremation which requires 4-5 quintals.

Beyond Home Kitchens

Not only is household cooking with firewood common in urbanized areas, but there are

other firewood uses beyond the hearth that remain under-studied: commercial and institutional

cooking by restaurants, schools, and temples; artisanal and industrial use in pottery and brick

kilns; religious and ritual use for both temple cooking and cremation. In this section we provide a

brief overview of these various contexts in which firewood is commonly burned.

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Commercial and Institutional Cooking, Across the Urban-Rural Landscape

We believe it is fairly common in Rajasthan and Odisha (and perhaps throughout India) for firewood to be the primary cooking fuel in institutions where meals are prepared for large groups such as colleges and schools; this is due to the availability of wood (or coal in Odisha) and its low cost compared to gas. In 2019, we visited a rural government primary school in Odisha where the meal for children was being cooked using wood. The headmaster explained that the government-provided budget for firewood is only 12 rupees per day (for 30 students) when he needed at least 50, so he pays a villager monthly to provide firewood to the school, and parents also contribute. Even though this school was near a forest, it was a challenge to obtain fuel for cooking; the headmaster said he would love to have LPG. It is laudable that PMUY offers LPG subsidies directly to women in BPL (Below Poverty Line) households, but this singular focus on households overlooks institutional uses of biomass for cooking.

Commercial cooking also commonly relies on firewood. This is as true for small roadside food stands offering cheap meals and snacks across rural-urban areas (Figure 5) as it is for upscale establishments with printed menus offering grilled delicacies and wood-fired pizza to affluent customers. Despite the cosmopolitan status of such pizza, we heard owners, managers, and lower-level employees (who were more likely to have a chulha at home) emphasize similarities between a pizza oven and chulha in the use of firewood as well as taste. The owner of one establishment contrasted the ‘natural and ancient taste’ of pizza cooked using wood with the ‘commercialized’ pizza sold by vendors such as Dominoes that use gas. As urbanization increases, he mused, so too does the popularity of old and ancient things. His hired cook commutes 60 km to his job from a village where his mother collects fuelwood from a nearby forest for cooking *roti* (flatbread), even though there is LPG in the home. He emphasized the

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pizza oven’s similarity to the chulha: it is built from mud (*mitti*); both pizza and roti are cooked with wood; the taste is the same. Staff at another such restaurant also likened the pizza oven to village methods of cooking. Staff at both restaurants buy wood locally from sawmills (5-7 rupees per kilo in 2018). For the 30-70 customers who order pizza each day, the owner of one establishment spends about 180 rupees to buy the 30-40 kgs of wood needed daily. The other restaurant, more upscale than the first, uses scrap wood to fuel the oven which was on display in the seating area, with a few sticks and small branches attractively staged in front of the oven ‘just for show purposes’, according to a waiter.

Burning Wood in Commercial Enterprise

Aside from cooking, wood is an important fuel in small-scale commercial enterprises, both as firewood and as charcoal. Two examples of non-food items ‘cooked’ with wood are pottery vessels and bricks. Our discovery that pottery and brick industries are important sites of fuelwood use emerged from open-ended anthropological methods of inquiry. One morning in 2018, we went to the Angul Haat (a weekly country market) looking for women selling bundles of firewood and found none. Rather than leaving, we walked around the market chatting with as many vendors as possible about the products they had laid out on the ground or on stands: vegetables, pickles, clay pots, tote bags stitched from plastic fertilizer sacks, and forest products such as bamboo matting, brooms, and baskets. Several pottery vendors reported that they use fuelwood to fire their kilns, and one elderly woman invited us to visit her family’s home-based terra cotta industry 8 km away from the market.

We left the market and set off in search of the woman’s home just outside the city.¹¹ Her middle-aged son was busy making small clay pots for a Hindu temple but paused his work to

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show us his wheel and kiln. The kiln is shaped like an enormous chulha, approximately 6 meters at its widest point inside, with one thick semicircular wall made of brick and one opening in the wall for air flow. It is fired once a month, filled with dry pots stacked upside down and 3-6 quintals of wood. It burns slowly for three days, releasing a lot of smoke. The potter purchases fuelwood (and some coal) for both their kiln and kitchen chulha at around 500 rupees per quintal and another 200 for transport. As traditional artisans, they used to obtain wood for their kilns from the government for free, but no longer.¹² Since the village committee enclosed the nearby forest about 15 years earlier to protect it, the potter buys wood from what he referred to simply as ‘the depot’. Occasionally, though, he buys a whole tree from a property owner, using logs for the kiln and small pieces for the chulha. This conversation prompted us to expand our study beyond the informal economy of women’s headloads. A few weeks later, in Rajasthan, we spoke with more than seven families of potters in three locations. Molela is a village famous for terra cotta about 50 km from Udaipur. While electric kilns are in use elsewhere, all the potters in the village burn wood, which is needed, they say, to regulate the heat. A potter in Gogunda fired vessels in the open and estimated using nearly 3 quintals of wood for a stack of 200 pots. He purchased wood in bundles directly from Adivasis.

Brick-making also requires wood, charcoal and considerable labour. In one brick-making enterprise we visited in Rajasthan, a dozen or so families – temporary migrants from Uttar Pradesh – lived on site with their children and formed a work group to shape and fire bricks under direction of the male landowner. Tens of thousands of bricks are made and stacked in 15 days and then fired in informal ‘kilns’ of fuel placed around the mounds of bricks in such a way that the bricks themselves form the kiln. Evidence of large quantities of fuelwood was everywhere – not twigs and branches but tree trunks and stumps too large for humans to carry.

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At another Rajasthan operation, workers of the Prajapat caste explained that charcoal is placed inside a mound of approximately 500,000 bricks and wood stacked around the outside – with a cost of 60,000-70,000 rupees for the wood and charcoal. A team of ten women, squatting on the ground and inching backwards methodically as they worked, formed roughly 10,000 bricks a day using a metal mold; their men carried fresh loads of clay to them, dumped from a truck that brought it from agricultural fields. These bricks would be fired after a four-month working season.¹³ While many told us that fly-ash bricks are now the norm, made with compression rather than firing, we did not have to look hard to find brick-making operations with kilns; many used to be in the cities but have been moved further out due to smoke. The manager of one brick kiln 10 km outside of Udaipur said that there were about 10 brick kilns in the area that use agro-waste as fuel and another 20 that use wood. Wanjule, et al. (2015) estimate that India has over 100,000 brick kilns employing some 15 million workers and that the industry is growing. Clearly, a lot of wood is being burned to provide energy for such industries (May-Tobin, 2011)

Charcoal is another commercial product made by burning firewood, not only used to produce bricks but also sold in urban settings to restaurateurs and *dhobis* who iron clothes using heavy charcoal-heated presses. Writing about charcoal production and use in Madagascar, Walsh notes that charcoal is a very inefficient way to access wood energy but that it is an excellent commodity that that ‘it is lightweight, easily transported, easily stored, and constantly in demand among Madagascar’s growing urban population’ (Walsh, 2019, p.112). We found this to be true in Rajasthan as well. No rural households we visited made charcoal for their own use, although some people made it to sell. In an area 100 km north of Udaipur, migrant and local laborers cooperated with landowners to cut invasive species and make charcoal from the cuttings, splitting the product with the landowner. A small group of three – one woman and two men –

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collected for around 15 days, stacking it in a conical shape, then burned this wood for about five days to produce 7-8 sacks of charcoal. Each sack of 50 kgs sells for 400-500 rupees, or 8-10 rupees per kg.

Use of charcoal in urban homes is declining in India. An Udaipur merchant we interviewed said that when his family entered the charcoal business in 1967, charcoal was used in every urban household because in comparison to wood it burns easily and releases less smoke – which ignores the smoke and particulate matter released (elsewhere) in the charcoal production process. Prior to this, the merchant said, when people were using wood their eyes burned from the smoke and wet firewood took a long time to burn. Today gas has largely replaced charcoal for home use, but he continues to sell charcoal (sourced from within Rajasthan) for industry and commercial cooking, particularly for tandoori cuisine and catered events such as weddings. Our conversations with several caterers, restaurateurs and charcoal vendors in Delhi also suggest massive use of charcoal for catering and cooking in restaurants that serve tandoori cuisine. According to one Delhi caterer, his industry shifted from firewood to charcoal 15-20 years ago. In cities, charcoal offers advantages: it is easily transported to event venues in a sack, releases less smoke, and does not attract insects. It is also, we suggest, an integral part of the fuelwood landscape.

Religious and Ritual Uses of Fuelwood

Also overlooked in the focus on cookstoves are religious and ritual uses of wood in India. While artisan and craft production may be grounded in religious guidelines involving fuel, and indeed one potter we met mentioned scriptural rules for firing pottery using wood, we focus here on two examples: cooking in Hindu temples and Hindu cremation rites. Hindu beliefs about the

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purity of wood fuel in comparison to LPG (Chatti, Archer, et al., 2017, p.31) are not generalizable to all groups or religions. Still, given that many Islamic mosques, Sikh gurdwaras and Christian churches across India engage in large-scale cooking for everyday meals and/or feasts, we believe that religious institutions are unrecognized sites of fuelwood use.

Our visit to the Jagganath temple complex in Angul revealed that the temple requires wood for two key purposes. First, the truck-sized chariots used to carry deities through the town during an annual festival are made of wood, including the wheels. While the larger, more famous Jagganath temple in Puri builds its chariots anew each year, in Angul a chariot is repaired and reused for 7-8 years. Village Forest Committees (that manage local village forests) or individuals obtain permission from a forest officer to donate wood for this purpose, and scraps from chariot-construction may be burned in the temple kitchen. The more significant use of wood for the temple is cooking. A temple official, whose own family has used LPG for four decades, referenced a scriptural basis for using wood to prepare food for the deities. In Hindu temples, deities are cared for by priests or devotees: they are fed, sung to, bathed, and put to sleep at night. Food is offered first to the god or goddess then given to people as *prasad* (the leftovers of the deity contain their blessing). The Brahmins in charge of the kitchen built the mud chulha in which they burn about two or three quintals of firewood daily, and temple officials obtain wood via auction from the Orissa Forest Corporation. The official thought this reliance on wood for cooking was standard among temples in the region.

Further expanding our inquiry, we observed that Hindu cremations account for a significant amount of wood being burned every day. India’s devastating wave of Covid-19 deaths in May 2021, with western media’s fixation on images of mass funeral pyres, has suddenly drawn attention to this ritual use of fuelwood. A merchant whose business sits near the

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entrance of Udaipur’s primary cremation ground sells fuelwood for both cremation and cooking fuel. A cremation, he explained, requires a mix of larger and smaller wood pieces and a mix of dry and ‘wet’ (green) wood, despite Forest Department restrictions on cutting the latter. If only dry wood is used, then the pyre will burn too quickly, and the corpse will remain. A single cremation requires 5-6 quintals of wood. The merchant said that the number of cremations is 3-10 per week but varies a lot and increases in the winter. His family sometimes provides wood at no charge to poor people who also have the option of a free gas cremation provided by a charitable organization, though the latter is almost never used except in the case of unclaimed bodies. The merchant buys wood via the government tender system and had just purchased a big lot from a local college that was clearing trees for new buildings. The government put an ad in the paper that ‘a lot’ was available for auction, and only those with permits are allowed to bid. We also visited the main cremation ground in Angul, managed by a charitable organization, where fuelwood is sold on site by the caretakers. They provide the needed wood for 2500 rupees (approximately 5 quintals), which is about half the price of wood on the open market. Additionally, if a tree falls and the property owner wishes to donate it, the organization will cut the tree and transport it to the cremation ground, and the government may also donate wood that is of less value. This cremation ground is open to anyone regardless of caste and conducts 5-20 cremations each month. There is no gas or electric crematorium in the Angul area due to availability of wood, but modern furnaces (gas and electric) are available in major metropolitan areas. And yet, journalists reported in 2019 that the overwhelming majority of the approximately 80,000 cremations that take place in Delhi alone each year are done with wood.

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Beyond Women

Feminist analysis attends to gender identities and systems as well as the co-construction of femininity and masculinity in relation to other aspects of positionality such as caste (Westholm 2016). Feminist scholars have drawn attention to the broader structural dynamics of women’s fuelwood work in rural India (Agarwal, 1986; Gururani, 2002; Swaminathan, 1999), but their insights on energy poverty are incorporated into mainstream discourse as emotive imagery, invoking empathy to justify technological interventions without offering information about how women understand their firewood-related activities. In the process, women are cast as hardworking victims and the researchers as experts on women’s experience of energy poverty (Listo, 2018, p.12). Technically-oriented research on the cookstove-fuelwood nexus suffers from a singular focus on women’s cooking habits that is based on a binary view of gender (women as a homogenous category, distinct from men) with little attention to ethnicity, education level, or age, which we found to be key points of difference. This not only reinforces a state-community dichotomy in research on forest governance (Lele and Menon 2014, p.405), but it also renders wider fuelwood economies and male activities irrelevant.

To what extent are male-identified people involved in cutting, trading, and burning wood for cooking and other purposes? We offer some preliminary observations. First, men can and do cook. They are professional cooks in many institutional contexts, including restaurants and catering. They cook when livelihood needs take them away from home for a day to sell at a farmer’s market or for months to work at a furniture factory. Sometimes, they cook at home for a variety of reasons, as the young Bhil man we observed taking obvious pleasure in preparing *dal-bhatti* while his wife sat nursing their newborn. Numerous sawmill owners in towns and cities told us that ‘poor people’ buy wood, but we should explore who these people are and on what

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devices they cook. Clearly, women do most household cooking, but it is a leap of logic to then proceed as if women are the only ones who harvest and burn firewood due to traditional gender roles. A recent study based on research in rural North India found that men commonly cut wood (Gupta, Vyas, et al., 2020). Documenting large-scale institutional cooking (often in urban settings) might lead us to discover that men burn more wood than women – generating a new set of research questions.

Second, the uses of fuelwood discussed above, beyond cooking, are predominantly male activities. The potters we encountered in Rajasthan and Odisha, and those interviewed in previous anthropological studies (Kramer, 1997), are all male, although women clearly participate in household pottery production. In brick-making, women often do the work of forming bricks one-by-one for a paltry wage, while men monopolize the positions of control and the financial gain of these commercial activities. Similarly, we encountered women in the charcoal production chain, but men seemed to be the ones profiting from the sale and resale of this commodity. Charcoal is produced in villages, but the Udaipur vendor we interviewed purchased it from ‘a middle-man who gets it done in the village for us,’ paying 22-23 rupees per kg. As noted earlier, villagers sell charcoal to the middleman for 8-10 rupees per kg. After sorting the charcoal to remove dust, the Rajasthan vendor sells it at 30 rupees per kg. These figures suggest that the middleman (and he is likely a man) occupies the most profitable place in the chain, receiving at least double from the vendor what he spent purchasing from the villagers.

Men are deeply enmeshed in landscapes of fuelwood use in India, though their activities escape investigation as gendered. The focus on cookstove improvement to address the problems caused by wood burning implies that household cooks (women) are responsible these problems. Fuelwood is often a byproduct of timber extraction and development projects, but research on

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villages and households neglects the links between timber and deforestation, or between timber and fuelwood. The activities described above incorporate significant quantities of wood that may very well match or exceed the wood collected by rural households; further empirical research is needed to confirm this. Compared to lumber, fuelwood is difficult to measure, as it comes in sticks, branches and scraps that vary in size and shape, so it is more often measured in terms of headloads, cartloads, or purchase prices (Wood & Baldwin, 1985, p.410). In India and more broadly, women tend to engage in small-scale, scattered, and informal trading of wood, while men control large, commercial enterprises (Zeb Babar 2001). To the extent that these activities are part of a formal and/or cash economy, they fall in the domain of masculinity. Research in Burkina Faso, where most households rely on fuelwood for cooking and heating, suggests the need for more nuanced analyses of gender dynamics in fuelwood economies. In one study, wood harvesting is a more formal activity conducted by men, while women were more involved in the informal activity of trading and transporting wood (Puentes-Rodriguez, et al 2017). Criticizing the binary male-female approach to gender, Westholm argues that women are more involved in NTFP markets precisely because they are not very profitable, but if such products become more profitable (as is the goal of many environmental-cum-poverty reduction projects), men may take over such activities (Westholm 2016, 513). It is clear that in India, some women (perhaps primarily Adivasis women) sell and barter headloads of wood, but why focus so intensely on this and overlook large-scale economies of fuelwood – transported by the truckload?

Conclusion

The narrow focus on rural, domestic fuelwood use in research on energy and forests results in blaming the most marginalized women for a national and global problem at the same

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time that we cast them as victims ignorant of the harm caused by their wood collection activities.

A 1961 report released by the Dhebar Committee made up of members of Parliament and senior social workers speaks poignantly to the longevity of these power dynamics:

There is a constant propaganda that the tribal people are destroying the forest. We put this complaint to some unsophisticated tribals. They countered the complaint by asking how they could destroy the forest. They owned no trucks; they hardly had even a bullock-cart. The utmost that they could carry away was some wood to keep them warm in the winter months, to reconstruct or repair their huts and carry on their little cottage industries. Their fuel-needs for cooking, they said, were not much, because they had not much to cook. Having explained their own position they invariably turned to the amount of destruction that was taking place around them. They reiterated how the ex-zamindars, in violation of their agreements, and the forest rules and laws, devastated vast areas of forest land right in front of officials. They also related how the contractors stray outside the contracted coupes, carry head loads in excess of their authorized capacity and otherwise exploit both the forests and the tribals (cited in Guha, 2007, p. 3307).

Indian villages continue to be identified as sites of backwardness and targeted for modernization, even as they are romanticized as the site of authentic Indian culture via a touristic gaze. This is particularly true of Adivasi villages proximate to forests and women who harvest fuelwood for daily cooking. This conflation of wood-burning stoves and villages underlies research on cookstoves as well as the popular imagination in India. We need more empirical research,

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quantitative and qualitative, on fuelwood that does not take the wood-burning chulha as its foundational development category.

Given significant burning of wood outside the home, health programs designed to improve air quality must expand their current focus on rural women living below the poverty line to include the burning of scrap wood from sawmills and the workplace dust and pollutants that men, women, and children breathe while living and/or working at a brick kiln, an indoor sawmill, or other sites where firewood is burned. Indoor and ambient air quality and lack of use of personal protective equipment are closely linked to various respiratory and skin ailments among workers in sawmills and kilns (Adhikari, Sahu, et al., 2015; Sain and Meena, 2017). And yet, cookstove improvement projects tend to assume that cookstoves will not only improve women’s health but liberate them to engage in wage-earning work.

If other uses of fuelwood are of comparable or greater significance than cookstoves, as we suggest they are, then perhaps research and advocacy work should redirect some of its focus to promoting alternative fuels and more efficient combustion for these other, larger-scale uses. As we have mentioned, alternatives to fuelwood did come up in some of our conversations. One chef at a large hotel outside Delhi said that he now has an LPG-fueled tandoor oven and that it works well. A potter in Molela mentioned that in cities, some are using electric kilns for firing ceramics. Fly-ash bricks are now being produced and depend on compression rather than heating. Moreover, gas and electric crematoriums are now available.¹⁴ While efforts are being made to reduce the environmental harm of wood production in such sites as sawmills (Adhikari and Ozarska 2018), far more discursive and policy attention is targeted at women cooking on their chulhas. We suggest that there should be more efforts to change culture and behaviour on other fronts.

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Development projects based on the assumption that rural women’s cooking practices are a key driver of environmental harm do not simply fail to bring material benefits to rural women or forests, but they are likely to further subordinate rural and Adivasi women through increased surveillance of their daily activities that reinforces their domestic roles (Ghertner, 2006). In one village home in Rajasthan, family members showed us their cement-mud chulha built against a wall. Some people had come from outside, broken their old chulha, and built this ‘improved’ chulha in its place. They had no idea who these people were or what organization had sent them, but the improved chulha was lying unused: it was too large for their utensils and thus used more fuel rather than less, and they could not repair a crack on the side because mud did not adhere to the cement.

More broadly, women may enjoy some benefits from new cooking technologies but also lose autonomy when they shift from a chulha that they build and repair themselves fueled by wood they collect without monetary expense, to stoves and fuels that are embedded in capitalist economies and global markets. When ICs are integrated into microfinance schemes, they can result in women’s indebtedness. Cookstove improvement is generally part of a transnational development process where accountability tends to move upward toward donors, despite rhetoric about participatory development (Corson 2018, p.940). This upward accountability of donor-driven interventions has been well-documented by feminist scholars (Bernal and Grewal, 2014; Deo and McDuie-Ra, 2011; Sharma, 2008,).

Research on energy poverty or the fuelwood-forest-cookstove nexus has latched onto a ‘gender myth’ -- the notion of women as victims absent serious gender analysis (Listo, 2018), inadvertently supporting the goal of technology fixes such as ICs to reduce fuelwood use. Thus, much of the cookstove improvement literature adopts insights from feminist research without

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actually offering information about women’s experiences or any serious gender analysis. Our findings confirm the observation of Swapna Sarangi, head of FES office in Angul: ‘Women sell headloads, and men sell cartloads’. We could replace the trope of the village woman carrying her headload, the origin of our own inquiry, with that of a male fuel merchant clad in white and sitting in his chair observing a truck pull into his sawmill operation where a group of hired laborers wait to unload – or perhaps a crane that clutches tree trunks from the truck and moves them across the field, massive trunks swaying just above our heads. This commodity would not have been harvested by women and carried from the forest atop their heads; more likely, it came from a government wood depot or a construction site. One day, as we sat chatting with an Udaipur wood merchant in his office, a truckload of firewood arrived. The truck stopped against a backdrop of a 30-foot-high stack of fuelwood that was at least 50 feet long, cut uniformly in lengths of a meter, which he hopes to sell off before the termites devour it. Except for the researchers, there is not a woman in sight.

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Notes

¹ Gas cooking is also a source of indoor air pollution, though its potential negative impacts are curiously ignored in cookstove literature in developing countries and are beyond the scope of this paper (Vrijheid, Martinez, et al., 2012; Yu, Yang, et al., 2015).

² Dr. Satish Kumar Sharma, personal communication, 11 July 2019.

³ A few people mentioned that villagers burn Lantana (*Lantana camara*), but we were unable to confirm this. A forest researcher familiar with local practices said that *Juliflora* is the only invasive species useful for burning.

⁴ O'Reilly, Dhanju & Goel (2017) have proposed a distinction between ‘remote’ and ‘rural’ in the context of India, making the case that it is both geographic and material infrastructure that separates places defined as undeveloped and rural. This is helpful in explaining the widespread use of firewood in peri-urban areas of Udaipur that are not remote.

⁵ https://www.odishafdc.com/about_ofdc.php [accessed 10 December 2021].

⁶ In the last few years, some states in southern India have opened wood depots to the general public who may now purchase wood (certified for quality and legal origin) directly from a government depot, thereby bypassing the entrepreneurs in the middle and saving money (‘Purchase Quality Wood at Retail Price Directly from Wood Depots’, *Deccan Herald*, April 2, 2018; ‘Forest Depots to Turn into Wood Supermarkets’, *The Hindu*, July 17, 2017). At the time of writing, we heard of no such plans in Rajasthan or Odisha.

⁷ Sawmills (*ara machinewalas*) require permission from the Forest Department to open and are subject to inspections. Permits are required to cut wood, to operate a sawmill and to transport timber or cut wood.

⁸ Following the guidelines of anthropological research, we use pseudonyms to protect the identity of participants in our study except where interviewees have agreed to have their name used.

⁹ Because there is little wood on construction sites (cement and bricks are more common materials), she harvests wood from trees around the neighborhood.

¹⁰ The young woman said the place where she collects wood is government land, where the Forest Department forbids the cutting of green wood but allows collection of dry wood (*sukhi lakadi*).

¹¹ Cheliapada is a village of potters from the Kumbhar caste and home to some 40 families of potters.

¹² According to the potter, the government ended the scheme because it was not generating revenue.

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¹³ We presume that the women spend some days of the four months moving dried bricks, taking rest, etc. Winter and summer are the two brick-making seasons, avoiding the monsoons.

¹⁴ Research on alternative fuels should go beyond surveys to include direct observation. When we were at the Udaipur crematorium, the wood merchant kept referring to the alternative to wood as ‘*bijli*’ (electric) cremation – but when he showed us the infrastructure, we saw that it was fueled by LPG tanks even if the ignition was a button on the wall (hence the reference to *bijli*).