8 Environmental Justice and Pesticides

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Introduction

Agricultural intensification in Nepal has led to a high application of pesticides, which pollute the land, water, and soil and degrade the health of agroecosystems and peasants (Acharya et al. 2022; Bhandari et al. 2020, 2019; Atreya et al. 2011) (see Figure 8.1). Pesticide consumption has increased over ten-folds since 2000, and the import trend has been increasing over the years. The national average pesticide use is estimated to be around 400 grams of active ingredient per hectare

Figure 8.1 Pesticide-laden beans ready for transportation to market.

Photo credit: Authors.

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(PPD 2018). However, in some areas, extremely high use of pesticides has been reported for vegetables (Bhandari et al. 2018). As of July 2022, a total of 24 chemical pesticides are banned for use and 165 are registered for agricultural use in Nepal (PQPMC 2023). Of the registered pesticides, approximately 34% are insecticides, followed by 26% fungicides, 9% biopesticides, 8% herbicides, and others (acaricides, nematicides, bactericides, rodenticides, molluscicides, and herbal pesticides). Almost half of these registered pesticides belong to Class II (moderately hazardous) of the WHO classification (WHO 2020). A large amount of pesticide is used in vegetable crops (>90%), followed by cereal crops (Aryal et al. 2021; Ghimire and GC 2018). The rate of pesticide consumption per unit of land is still lower in Nepal than in other parts of the world; however, this is changing.

While there are some positive benefits of pest control such as increased income and improved livelihoods, pesticide use also brings several environmental and health-related impacts and economic burdens (Atreya et al. 2012). For example, a significant positive association has been established between a history of pesticide use and multiple chronic health problems (Atreya et al. 2020; de-Assis et al. 2020). Furthermore, Nepali farmers rarely show complete adherence to safety measures during pesticide handling and application (Atreya et al. 2022; Bhandari et al. 2018).

Due to the well-observed negative consequences of pesticide use, the Nepali government has been promoting alternative pest control measures such as integrated pest management (IPM) and biopesticides, which are less costly and more environmentally friendly (Paudel et al. 2020), but these alternatives have not been well adopted by farmers for numerous reasons, such as lowered yields and the inconvenience on large and/or remote farms. For such reasons, chemical pesticides continue to be the most preferred plant protection technique, resulting in various environmental, health, and social burdens.

The health and pollution risks to humans and the environment and the associated burdens are disproportionately distributed between particular social groups, resulting in environmental injustice. For example, Atreya et al. (2013) demonstrated that small-scale households were deprived of the benefits of pesticide use and also incurred their greatest health and environmental burden. Similarly, Atreya (2007) and Garcia (2003) found a significant difference in pesticide use and safety measures between men and women. Environmental justice in pesticide use can only be achieved if all social groups have equal and fair access to information, income benefits, and livelihood opportunities, and do not face inequitable risks to their health and the environment.

In Nepal, several studies (Atreya et al. 2022 and references therein) have considered household-level use of pesticides and pesticide handling practices, but very few of them have addressed the distribution of the health and environmental burden across society (but see, Atreya et al., 2013). Most studies have assumed that "farmers" are homogeneous units in their analysis and interpretation; however, the benefits and burdens of pesticide use, health impacts, and environmental pollution can differ according to caste and gender, among other differences. The means and statistics from such studies only denote the population as a whole and therefore the unequal distributions of exposure, risk and opportunities to the vulnerable

sub-groups within the population generally remain unrepresented (Gochfeld and Burger 2011). Limited studies have examined pesticide use and social marginalization in terms of the distribution of associated benefits and burdens, the recognition of opportunities and problems, and the participation in its management.

The objective of this paper is to assess whether the risk of agricultural chemical pesticide use differs according to factors of social marginalization, mainly by gender and caste. In turn, this will help develop a fundamental understanding of environmental justice regarding pesticide use in Nepal. We analyze three dimensions (Isgren and Andersson 2021) of environmental injustice: (i) distribution-how goods (benefits) and bads (burdens) are distributed between groups?

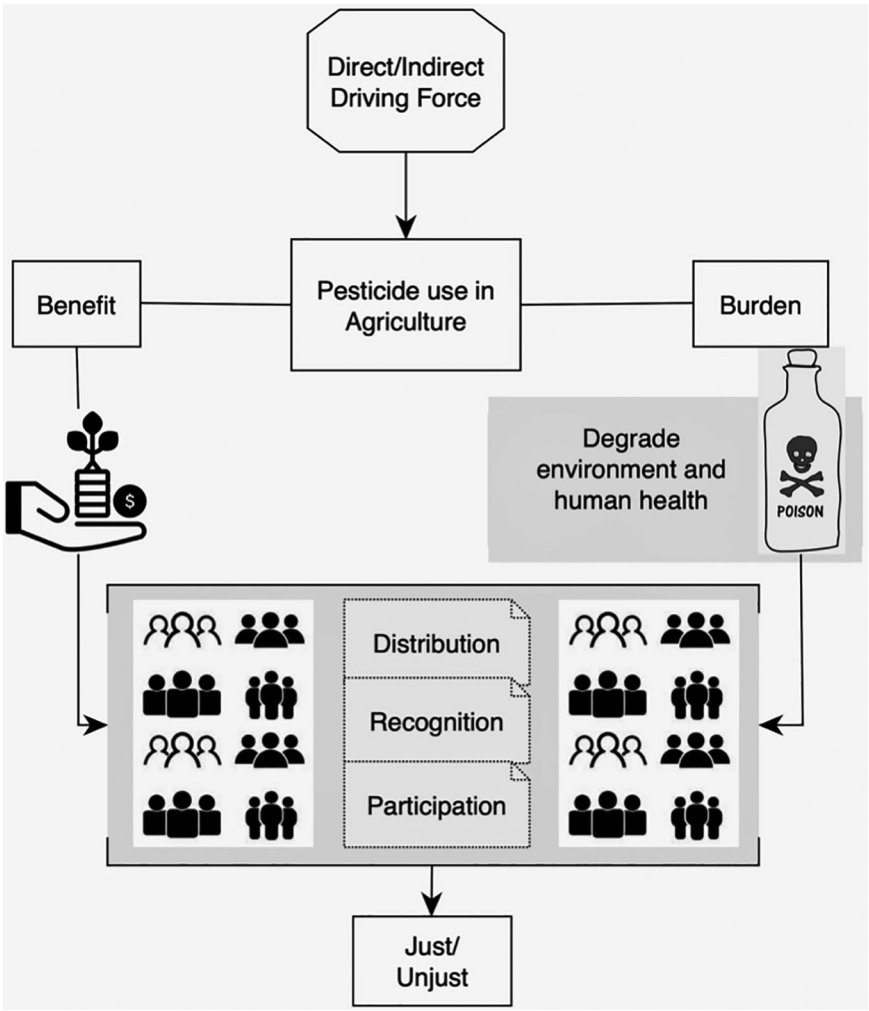

Figure 8.2 Revisiting pesticide use from an environmental justice lens.

Source: Authors' visualization.

(ii) recognition – how good(s) and bad(s) are perceived between groups? and (iii) participation – how do groups participate in decision-making regarding managing goods and bads? (See Figure 8.2).

Study Area

This chapter is based on case studies of Mahadevsthan farmers, a former Village Development Committee (rural municipality) in Kavre district, in the middle mountain area, east of Kathmandu. Numerous farmers in Mahadevsthan practice commercial vegetable production for Kathmandu markets and have used chemical pesticides for several decades. Mahadevsthan farmers generally belong to three ethnic groups: Brahmin-Chhetri-Thakuri or BCT (so-called "privileged caste group"), Janajati (indigenous caste group), and Dalits (the so-called "oppressed caste group" who have been historically marginalized as "untouchables"). To study the differences between groups from the perspective of justice, we included farmers belonging to these three caste groups. We also included male and female focus group discussions from all the caste groups to explore gendered differences in perspectives, practice, and experience.

Methods

We conducted 11 focus group discussions or FGDs (2 Dalit groups, 2 Danuwar Janajati groups, 1 Tamang Janajati group, 3 (1 BCT, and 2 mixed-castes) males only, and 3 (1 BCT and 2 mixed castes) females only; and 12 key informant interviews with different key stakeholders, farmers trained in IPM, high-pesticide users, and commercial farmers. Interviews and discussions were facilitated by a team member and discussion notes were written by another, and interviews were also recorded. Prior informed consent was obtained verbally from each of the participants at the time of recording. Interview and discussion summaries were written for all 23 recordings. The entire conversation was not transcribed, but the relevant information and important quotes from the participants were translated into English.

Results

The burdens and benefits of chemical pesticide use in agriculture were disproportionately distributed by gender and caste. See Tables 8.1 and 8.2.

Pesticide Use and Gender

Male members of the family are generally in charge of pesticide handling, spraying, and related decision-making when males live at home, which largely depends on the type of family and the occupation of the husband. Although generally men apply pesticides, the participation of women in pesticide handling is not negligible, and women are also at risk of exposure through handling, application, and indirectly during farm work right after pesticide application when residue levels in farms are high enough to cause acute health problems. In the case of male absenteeism (often

Table 8.1 Disproportionate distribution of the effect of pesticide use between men and women

Dimensions	*Men*	*Women*
Distribution of benefits and burdens (e.g., vegetable income, and risk of exposure)	Responsible for the handling of pesticides in most households, hence more exposure.	Responsible for pesticide handling in most households with male absenteeism.
Recognition of health risk and safety	Health risk is less acknowledged; less adherence to safety precautions (associated with the definition of masculinity).Health risk is part of "agricultural life."	Higher recognition of health burdens, but limited adherence to safety measures.
Participation in management (e.g., Jholmol and IPM)	Domination in decision-making and management; however, intra-household interplay has a role.	Limited access to training and awareness programs, thus less involvement.

due to labor migration out of the country), women are the only applicators. In the case of hired labor for pesticide applications, almost all farmers preferred men.

Although acute health symptoms are observed in both men and women, interviewees believed women to be more vulnerable to certain life situations, mainly during sensitive reproductive stages such as pregnancy, postpartum, or menstruation cycles. The increased vulnerability of women to pesticide use was also attributed to the clothing style of women from Nepali villages. "Many of the women here do not wear underwear and are more vulnerable to getting sick from pesticides. Many women in the area are suffering from cervical cancer and related diseases," said a participant belonging to the BCT caste group and working as a community health volunteer, while another BCT participant in the next FGD also agreed. Farmers in lowland areas (*besi*, where pesticide use is comparatively higher compared to higher areas) reported an increase in cervical cancer cases in the community due to the excessive and frequent use of pesticides.

Many male participants in FGDs reflected that they were strong enough to digest the pesticides and that it would not affect them much compared to women participants who said it inevitably affected their health. A participant in male-only FGD said, "I have tasted Dithane *[mancozeb, a fungicide]* and nothing happened to me as a result." Likewise, an IPM-trained male farmer during KII stated that he had been exposed to Metacid (methyl parathion, a highly toxic insecticide, banned in Nepal since 2007) and felt severe burns in the stomach, and now he has completely abandoned the use of chemical pesticides due to health consciousness.

Regarding the distribution of training opportunities, women's access to IPM training varies depending on their ethnicity and place of residence. Many of the BCT women had attended IPM training; however, women from the Danuwar and Dalit groups had rarely received such opportunities. Even among BCT women trained with IPM, knowledge of the pesticide toxicity labels on the containers, for example, was very low (10%). This suggests a lower knowledge of women and even fewer opportunities for women of marginalized caste groups.

Table 8.2 Disproportionate distribution of the effect of pesticide use between ethnicities

	Brahmin Chhetri Thakuri	*Janajati*	*Dalits*
Distribution of benefits and burdens (e.g., vegetable income and risk of exposure)	Significant improvement in livelihood through pesticide use in commercial vegetable farming (high landholding and increased production); and less risk to health because more training and safety advice is received.	Tapping opportunities to improve livelihoods to some extent (less landholding, so renting BCT's land for production); high health risk due to inadequate trainings; have lost some parts of their income share from ecosystem services (e.g., fishing).	Less benefited by the opportunity to increase the yield using pesticides (marginal landholding and rental access); Less direct health risk, as pesticides are not used much in subsistence farming.
Recognition of health risk and safety	Good recognition and analysis of pesticide-related benefits and burdens; Health safety is still less prioritized after adequate participation in awareness programs.	Very poor understanding and recognition of benefits and burdens.	Lowest level of understanding and recognition of benefits and burdens.
Participation in management (e.g., Jholmol and IPM)	Increased participation in training and cooperative initiatives related to IPM and other ecological alternatives, although adoption is not satisfactory due to perceived drudgery.	Lesser participation in IPM trainings, local cooperative initiatives related to IPM, and other alternatives	Least participation due to poverty, neglect, and systematic marginalization.

Male domination was observed in pesticide decision-making and management, especially in the BCT households. For example, an IPM-trained BCT female said that her husband sprayed chemical pesticides on her farm without her approval because neighbors applied chemicals. Likewise, a Dalit woman stated that her husband takes care of all activities related to pesticides, whereas another Dalit woman opposed it, and stated that it varies. But in the BCT women FGD, many participants said that intra-household interplay (e.g., male absenteeism) determines the primary applicator and subsequent pesticide-related decision-making process.

Pesticide Use and Ethnicity

In the study area, Dalits were less engaged in commercial agriculture and therefore less involved in pesticide use due to their small landholdings and the relatively high ownership of more marginal land. However, the Janajati caste groups are more involved in commercial farming, both on their own and leased land, resulting in more pesticide exposure and the possibility of experiencing higher burdens.

Both Dalits and Janajatis receive fewer opportunities to receive knowledge, such as training, and benefits, such as government subsidies and other opportunities, suggesting greater risk due to their limited knowledge and awareness of pesticide toxicity and safety. Farmers in these caste groups also wrongly perceived minimal health risks from unsafe pesticide use and pesticide pollution. According to an agricultural veterinary personnel (agrovet),

> The indigenous minority of Danuwar often wants quick results and demands more toxic pesticides (*kada*). Pesticide-related programs, such as IPM training and awareness-raising programs, are more concentrated in the lowlands (*besi*), where Danuwars are less, and thus have not reached out properly to these farmers.

In male-only FGD, a Tamang farmer said, "We use a dose a little higher than recommended by the agrovet personnel" and also reported that the doctor associated his health problem with his previous exposure to pesticides: "When I went for a health check-up for neural and blood circulation problems, the doctor related it to the use of pesticides." On the contrary, some farmers believe that agrovets have a tendency to sell more pesticides to uninformed farmers and that the amount of pesticides given for the same problem is different for IPM-trained and untrained farmers. In the FGD with Tamang group, many participants stated that: "When trained farmers go to buy pesticides, agrovet gives them only one pesticide; otherwise, agrovet asks to mix various pesticides and sell more than one pesticide. You know it is just like buying drugs from private medicals."

BCT farmers perceive and recognize the threat of chemical pesticides due to their greater participation in related training and awareness-raising programs. However, they still use minimal PPE due to concerns about convenience and discomfort, which results in increased exposure and health burdens. In comparison, BCT farmers trained in IPM use PPE more effectively and have a higher risk perception, resulting in the lowest health risk. Unfortunately, compared to other production methods, IPM techniques are less widely used due to their lower crop yield, high labor cost and labor shortage, more work, and low market premiums.

Regarding economic burden, especially for the Danuwars, their primary and traditional income opportunity, namely fishing, has been compromised due to pesticide pollution in irrigated rice fields and rivers, but it is less recognized and realized.

> In the past, my father and my elder brother would practice fishing using *"chhitri or thitri"* [an almost cylindrical shaped trap made up of Indian gooseberry twigs to trap small fish from rice fields and rivers] on other people's land and sometimes even sell them to *Tamaghat and Panchkhal* [adjacent market outlets].

"Mostly the harvested fishes were consumed at homes for better nutrition, but in the case of surplus, a household used to sell on average 30 kg in a paddy growing

season." When asked how many households currently use *çhhitri*, they replied saying only two out of hundreds. This reduction in fishing is mainly due to the use of pesticides and chemical pollution. "It is due to the toxic pesticide, why not? Otherwise, there used to be so many fish and snakes in the past. Now people cultivate the land and use a lot of pesticides. Such toxic chemicals have killed them," said a key informant.

Discussion

Historically, national and subnational policies and cultural norms have favored men, higher caste and class groups, and other elite sections of society in agriculture and other sectors, and these disparities have continued with increased globalization and trade liberalization. Cultural discrimination, economic exploitation, social exclusion, and political oppression issues have often been critiqued, yet still exist in Nepal (Gurung 2009). This exclusion has led to systematic marginalization of women and ethnic minorities, and the impacts are observed in, but not limited to, resource use and societal benefits. Studying pesticide use and associated impacts shows that this marginalization leads to disproportionate impacts, both positive and negative. In our research, we found that men and women have different levels of participation in making decisions, and this difference becomes even greater based on the ethnic background of farmers. This means that women belonging to certain groups that have historically been treated unfairly have the least say in handling issues related to pesticides.

Risk perception and safety precautions, two important ways to minimize the health burden of pesticide use, are distributed differently based on gender and ethnicity. Knowledge appears to be lacking in ethnic groups of marginalized strata. Likewise, participation in risk management and control over decision-making is lacking both among women and among these same caste groups. In other words, the access to knowledge-generating opportunities is mostly biased toward privileged caste groups, and the participation in decision-making is also biased towards households from these groups and men from such households. This is perhaps a result of the general elite capture of opportunities and the *bhagbanda* (benefit sharing) among influential people in the society (Acharya et al. 2022). Men generally are responsible for handling pesticides, but even with better knowledge and awareness of associated health risks, fewer of them adhered to safety behaviors when using pesticides, in line with the findings of previous studies (Wang et al. 2017). This exclusion in participation in knowledge generation and management further impacts the recognition of problems and solutions, burdens, and benefits among the different groups we studied.

In addition, livelihood degradation is one of the gravest outcomes of pesticide consumption, in which privileged farmers receive better opportunities to earn a living from pesticide use, while it diminishes the livelihood opportunities for those belonging to more marginalized caste groups, such as the Danuwars in Kavre. This latter caste group traditionally relied on fishing activities, which meant that they would have free access to fish even on the land of other privileged people, since

they themselves had limited landholdings. However, this income and nutrition opportunity no longer exists for Danuwars, as pesticide pollution has led to a massive decline in fish population, leading to the only remaining option where they could rent the land from farmers of privileged caste groups with relatively large landholding, further generating passive income for those families and limited profit for the Danuwars who actually farm the land.

Active participation of the privileged community (Brahmin/Chhetri) in IPM practices like *jholmol* initially gained a lot of attention. Their proactive involvement was a positive change. However, a problem arose as they started doing less and less farming. This happened because many of their children went to work/study in other countries, which reduced the amount of work they could do on the farm. These migrant family members also encouraged their parents to do fewer farming (key informants). The Janajati community faced a different challenge. They did not learn as much during the training phase, so they adopted *jholmol* more slowly. Similarly, the Dalit community has also faced difficulties using *jholmol*. The Dalits had the least access to *jholmol* because other communities and programs ignored them, and they also faced economic difficulties. They were systematically neglected in participation to learn about *jholmol* during the training phase, and now they are moving away from traditional farming and looking for work in off-farm jobs. This complicated situation shows how different factors such as money, culture, and knowledge affect how these different communities are able to use eco-friendly farming methods.

Finally, there are some external elements to consider, such as the profit-making private sector which directly or indirectly influences the use of pesticides, the use of safety equipment, the dose, and, in turn, the exposure to pesticides. With poor extension services in these communities, privately run agrovets take over the role of government extension services, enjoy a monopoly on the market, and thereby control the agri-food system. This has a significant impact on both the environment and the health of people. Similarly, the introduction of a holistic and system-thinking approach in local municipalities is suggested for the management of pesticide injustice. For example, local municipalities at present have three different functional sections: health, agriculture, and veterinary; and coordination and interaction between them are weak because of overlaps and inconsistencies in the allocated functions. Therefore, we suggest either establishing good coordination or merging these functional units for overall monitoring of pesticide use and evaluation of its benefits and burdens to society. Otherwise, the unregulated introduction of seeds, chemicals, and technologies will threaten local agrobiodiversity and the rich genetic agricultural and environmental resources that support livelihood, health, culture, and other aspects of farmer life, especially the poor and marginalized, and further intensify environmental injustice.

Conclusions

Both men and women are exposed to pesticides, but women have a higher health risk due to their exposure to pesticides during vulnerable life stages. Men of privileged castes participate in most training and awareness-raising programs, are more

aware of the danger of pesticides, but adhere less to the safety precautions in pesticide handling. Women are less aware but adopt higher safety measures because they perceive a greater danger of exposure to pesticides.

Most of the opportunities, including IPM training and other support systems, are highly received by BCT, but BCT lands are often cultivated by indigenous groups, and therefore are at greater risk of exposure. Dalits, on the other hand, are less exposed to pesticides because they have smaller farms. Danuwar, an indigenous group, has found that pesticides have almost completely destroyed local fishing, their traditional subsistence method.

These dynamics are complex; therefore, ensuring a just interaction between pesticide use, the environment, and people's health is difficult to achieve with traditional extension and awareness approaches. We recommend more holistic and inclusive and accessible training, education, and awareness programs by designing and implementing interventions tailored to pesticide use in agriculture and acknowledging the burdens of negative effects of pesticide use in the policy decision (e.g., social benefit-cost analysis), especially at the time of pesticide registration and approval. These programs must address the ongoing legacy of caste and gender discrimination in access to information and resources.

Scientific studies that analyze group differences in pesticide exposure and impacts and those that involve clinical studies are limited in Nepal, highlighting the need for more such clinical studies to better understand the health burden of pesticides. In general, internalizing the multidisciplinary aspects of pesticide-related issues and focusing on the "agriculture-health" nexus should be the top priority to ensure a just agriculture system for both people and the environment.

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