Routledge
Taylor & Francis Group

Society & Natural Resources
An International Journal

ISSN: 0894-1920 (Print) 1521-0723 (Online) Journal homepage: www.tandfonline.com/journals/usnr20

Gender Differences in Perceptions of Environmental Changes in West Kalimantan, Indonesia: Existing and Shifting Social Roles

Anastasia Voronkova, Adam E. Miller, Radisti A. Praptiwi, Putri D. L. Pratiwi, Jito Sugardjito, Mathew P. White & Karyn Morrissey

To cite this article: Anastasia Voronkova, Adam E. Miller, Radisti A. Praptiwi, Putri D. L. Pratiwi, Jito Sugardjito, Mathew P. White & Karyn Morrissey (23 Jul 2025): Gender Differences in Perceptions of Environmental Changes in West Kalimantan, Indonesia: Existing and Shifting Social Roles, Society & Natural Resources, DOI: 10.1080/08941920.2025.2534958

To link to this article: https://doi.org/10.1080/08941920.2025.2534958

SOCIETY & NATURAL RESOURCES
https://doi.org/10.1080/08941920.2025.2534958

Routledge
Taylor & Francis Group

Gender Differences in Perceptions of Environmental Changes in West Kalimantan, Indonesia: Existing and Shifting Social Roles

Anastasia Voronkova[a], Adam E. Miller[b], Radisti A. Praptiwi[c], Putri D. L. Pratiwi[b], Jito Sugardjito[d], Mathew P. White[e], and Karyn Morrissey[f]

[a]School of Psychology, University of Plymouth, Plymouth, United Kingdom; [b]Yayasan Planet Indonesia, Kubu Raya, West Kalimantan, Indonesia; [c]Research Centre for Ecology and Ethnobiology, The National Research and Innovation Agency (BRIN), Jakarta, Indonesia; [d]Centre for Sustainable Energy and Resources Management, Universitas Nasional, Jakarta, Indonesia; [e]Department of Clinical and Health Psychology, University of Vienna, Vienna, Austria; [f]J.E. Cairnes School of Business and Economics, University of Galway, Ireland

ABSTRACT

Gendered norms, knowledge, and between-gender relationships can impact climate change adaptation/mitigation at the individual and community level. Indonesia, particularly West Kalimantan, is significantly affected by climate change and is committed to combating it with attention to equality and equity. Focusing on a case-study site in West Kalimantan, we explored gendered perceptions of environmental changes and whether and how those are shaped by social roles and contextual factors. Through four focus groups and a survey, we found a variety of gender differences in perceptions of local issues but also generational changes in men in the expression of those differences. However, governance issues were found to unite both genders in the perception of impact on them as an agrarian community. We highlight the evolving nature of gender differences and unifying similarities in interactions with environmental changes, and stress the need to intentionally include men and women's experiences in local planning and policy.

ARTICLE HISTORY
Received 6 April 2023
Accepted 8 June 2025

KEYWORDS
Climate change; environmental perceptions; farming; gender differences; Indonesia; West Kalimantan

Introduction

From climate change to pollution, biodiversity and habitat loss, the global and local environmental changes induced by human land use do not impact communities, nor individuals within communities uniformly, and as such these changes will not be perceived or experienced in the same way within communities (Agarwal 1997; Nightingale 2006). A variety of contextual and socioeconomic factors, including issues such as food security, land management type and economic status have been found to influence people's interactions with environmental changes (Liu et al. 2021). These factors further interact with existing social norms, roles, and intersecting identities

CONTACT Anastasia Voronkova ana.voronkova@plymouth.ac.uk School of Psychology, University of Plymouth, Plymouth, United Kingdom.

within communities, and thus shape people's experience and response to environmental challenges. To this end, gender has been found to strongly shape individual's interaction and thus perceptions of the environment, and environmental change (Meinzen-Dick, Kovarik, and Quisumbing 2014).

Gender socialization, the process that provides men and women with the idea of what is masculine and feminine, accompanied by certain values, norms and beliefs has been presented as an explanation for how such interactions and perceptions are shaped (Xiao and McCright 2012). However, gender socialization, and the associated values and beliefs it generates regarding men and women's roles and identities differs widely between and within regions and countries. For example, research in urbanized areas of the Global North (USA, United Kingdom, France, Poland, etc.), has often found women to be more concerned than men about environmental issues (Davison et al. 2021; Mohai 1992; Potts et al. 2016; Roberts et al. 2021; Schultz 2001). But the same pattern has been found to be more nuanced in the Global South. For example, in urban China men were found to be more environmentally concerned than women, but women cared more about pollution issues (Xiao and Hong 2012). In rural forest communities in Northern Thailand, modest differences existed in perceptions of the forest and land management, but with no consistent pro-environmental concern of either group (Flaherty and Filipchuk 1993). In contrast, very noticeable differences were found in agricultural communities in Caribbean islands, especially with women being more aware of problems that affected their domestic duties (Janet Henshall Momsen 1993, 199).

Such difference between the Global North and Global South and within the Global South, may be explained by the intersection of wider social and economic circumstances and differentials in access to resources and assets (Meinzen-Dick, Kovarik, and Quisumbing 2014). In the Volta Region of Ghana, for example, both men and women were affected by environmental changes, but for women it meant increased time burden searching for resources, while for men it was expressed through forced work migration (Arku and Arku 2010). Nightingale (2006) describes how leaf litter harvesting in Nepal is determined by the intersection of gender, age, caste, and marital status, with women of higher caste collecting smaller amounts of litter; but for both of them the ultimate decision-making was reserved for their husbands. In India, Agarwal (1992) found that the perceptions and experience of environmental degradation of women in rural and urban households were drastically different and bound to economic circumstance.

To be truly inclusive and equitable, environmental policies, particularly those directed at assisting environmental change mitigation and adaptation, must apply a gender sensitive developmental process. Based on the growing literature highlighting that gender strongly defines a person's interaction, knowledge and experience of environmental change the aim of this study was to examine: 1) how West Kalimantan community members perceived changes in their environment and interacted with those changes in their livelihoods, 2) whether those perceptions differed between men and women and 3) what part the gendered division of roles may have played in those differences.

We do not aim to generalize our results outside of the case study site, but instead offer Indonesia and West Kalimantan in particular as an interesting case study location due to the already visible impacts of climate change and accompanying environmental changes on communities.

Indonesia

Significantly affected by climate change, Indonesia has pledged to reduce greenhouse gas emissions by 29% by 2030. It is primarily to be achieved through the reduction of de-forestation and emissions associated with the degradation of forests, peatland and mangroves (Resosudarmo et al. 2019; Wijaya et al. 2017) by investing heavily into reducing forest fires (Gokkon 2015) and regulating timber concessions (OECD 2019). At the same time, attention is also being paid to the equality and equity aspects of climate change mitigation. For example, when preparing for COP13 in Bali in 2007, the Indonesian Minister for the Environment stressed the importance of including gender into the upcoming international dialogue.

Kalimantan is one of the Indonesian centers of mining and palm oil production, both of which directly conflict with the goals of climate change mitigation and may exacerbate environmental and livelihood issues (Austin et al. 2015; Toumbourou, Dressler, and Werner 2022). As a result, Kalimantan is one of the two Indonesian islands that has suffered the most forest loss (OECD 2019). In the last decade in West Kalimantan, research has demonstrated an increase in solar radiation, daily temperature, and humidity, coupled with changes in the rainfall pattern (Herawati, Suripin, and Suharyanto 2015; Sipayung et al. 2018). Changes like this have detrimental effects on livelihoods, forcing communities to adapt quickly to save their income and well-being (Höing and Radjawali 2017; Malik, Mertz, and Fensholt 2017). To understand how men and women may respond to such changes, it is important to understand whether and how they perceive the changes and pressures in their everyday lives and how it interlaps with their material realities.

Gender roles in Indonesia vary depending on location. Elmhirst (1998) observed differences between two neighboring communities – migrated Javanese and indigenous Lampungese – in the division of gendered occupations and rights, the key finding being the fluidity of the roles dictated by environmental and social changes. This fluidity in some cases can lead to the blurring of boundaries, as is the case with younger generation in Selayar regency experiencing changes in livelihood patterns dictated by development agendas through the move toward more service-based occupations (i.e. from fishing to tourism) (Fortnam et al. 2022). Praptiwi et al. (2021) found that young adults in a biosphere reserve in Selayar, South Sulawesi, both male and female, were equally enthusiastic about the move away from fisheries, which they perceive to be an "outdated" form of living. Villamor et al. (2014) studied a matrilineal agriculture community of Sumatra, where contrary to examples from other South-East Asian countries (Brown 2011; Djoudi and Brockhaus 2011) women held more access and control over the land than men did and took more radical decisions in terms of land use change. This highlights the necessity to pay attention to local circumstances: in our case, Kalimantan.

Methods

Case-Study Site

The study site was in the Kubu Raya regency of West Kalimantan province, Indonesia. The regency covers 6,895 km^2 and has a population of 622,217 people. The area is

well-known for its forest resources and rich biodiversity. The case-study site chosen for this project was a village located in in the district Teluk Pakedai of Kubu Raya. In view of the sensitive information disclosed by some project participants, the name of the village will not be disclosed, and it will hereafter be referred to as "the village". It is populated by 2046 residents, 962 men and 1084 women spread across 485 households. The area is generally populated by people from Sulawesi that migrated to West Kalimantan in search of farmlands and fishing ground more than 100 years ago (Ammarell 2000). The main ethnic groups are Melayu and Bugis.

The village is built around a river that serves both as a source of water and as one of the main routes into the other villages and the capital of West Kalimantan, Pontianak. It takes approximately 6 hours to get to Pontianak by motorcycle or 2 hours by a speedboat. Community members travel to neighboring villages and the capital somewhat regularly, mostly using motorcycles or by taking a slow boat (~8 hours), as while speedboat is faster, it is more expensive. Phone signal in the village is very limited, but the community center has Wi-Fi.

The main occupation and source of income in the village is farming (rice, coconut, corn) and, to a lesser extent, fishing. The mangroves and fisheries are communally owned, secured in 2017 through Indonesia social forestry scheme, while the farming grounds in the village boundaries are attributed to the heads of households (predominantly men) through land rights tenure cards.

This research project was conducted in collaboration with a development NGO providing integrated conservation interventions. The village was among the locations where the partner NGO was planning to conduct an alternative livelihood intervention. The data collection for this study was performed prior to the start of any aspects of the intervention.

The study was approved by the lead researcher's university Research Ethics Committee. The lead researcher was granted a research permit from the Ministry of Research and Technology of the Republic of Indonesia.

Research Instruments

This research used a mixed method design with focus groups informing the development of and contextualizing the survey (Tashakkori and Teddlie 2010; Teye 2012).

Focus Groups

Four focus groups were conducted that explored participants' environmental concerns, attitudes, and motivations regarding the environmental state of the village and natural resources. All participants were permanent residents in the case study site and aged 18 and over. Between six and ten villagers were invited to each of the four focus groups by the lead researcher and research team personally visiting potential participants' houses. The focus groups were stratified by gender and based on the median age in Indonesia (World Economics 2024) age, under and over 30 years of age to mitigate potential uneven power relationships and allow people speak more freely (Kitzinger 1995; O.Nyumba et al. 2018). Focus groups used both Bahasa Indonesia and Bahasa Melayu, a local dialect of the Indonesian language and the facilitation team could speak both languages fluently.

During the 30+ male focus group a sister (30+) of one of the male participants joined the discussion. As asking her to leave would have been disrespectful, the focus group continued with her involvement. She appeared comfortable speaking in a group of men, and the men were vocal in expressing their opinions too. Furthermore, in the 30+ female focus group more participants arrived than originally invited (N = 16), as some participants invited friends. While unexpected, the larger sized group was accommodated.

Focus groups were recorded, transcribed and translated into English, and thematic analysis was conducted in NVIVO12. In the analysis, we focused specifically on the topics of gender and adaptation through the lens of perceived impact on one's everyday life, as from the literature review it was clear that the difference in duties and tasks influenced people's experience of environmental changes. Thematic analysis was first performed by the lead author focusing on the broad factors affecting one's everyday life and adaptation to ongoing changes. The key themes were then recorded with attention to the identity of the speakers. To aid the authenticity and understanding of the local context, the analysis and interpretation of the themes was done in close collaboration with the NGO, many members of which come from the villages in the same area as the case-study site.

Questionnaire

Following the focus groups, a structured survey was designed and administered to the villagers with 300 questionnaire responses collected. As our outcomes of interest, the environmental section of the questionnaire included the following measurements:

Environmental Concern. Since the experience of environmental changes is strongly place-dependent (Hansen and Bi 2017), to explore participants' environmental concern with attention to possible place differences, we asked them to assess the perceived quality of the natural environment at four different geographical scales: 1) the local village; 2) the local district; 3) the Island of Borneo; and 4) the entire archipelago of Indonesia on a scale from 0 = *poor* to 7 *very good* (e.g. (Brehm, Eisenhauer, and Krannich 2006)). This allowed us to see whether the environmental degradation was perceived to be happening only locally or on higher levels as well, up to the country level.

Perceived Influence of Environmental Issues. To explore their perceptions of the seriousness of environmental issues, respondents were asked to rate a number of environmental issues (e.g. the loss of forest and lack of rain) on a scale from 0 = *not at all serious* to 7 = *very serious* depending on how serious they perceived the influence of each of them was on their life in the village (adapted from (White 2016)).

Perceived Resource Availability Changes. To explore the villagers perceptions of changes in natural resources, respondents were asked to rate a number of statements reflecting natural resource fluctuation on a scale from 0 = *completely disagree* to 7 = *completely agree* (adapted from (Torell, Myers, and McNalley 2013)).

Perceived Causes of Environmental Issues. To examine villagers perceptions of reasons behind the covered environmental issues, participants were asked to rate statements

reflecting the contribution of a variety of causes to the environmental issues in their area on a scale from 0 = *contributes not at all* to 7 = *contributes a great deal* (adapted from (White 2016)).

Data on each participants' age, gender, education level, main source of income and length of residence in the village was collected. Descriptive values for all questions were generated. Mean values of environmental concern, perceived seriousness of environmental issues, perceived resource availability changes and perceived causes of environmental issues were compared between genders using Bonferroni-corrected Student t-test. The completed questionnaires were analyzed in R 4.0.2.

Results

The questionnaire was completed by 300 respondents (226 women and 74 men). The age of respondents ranged from 18 to 82, with the majority aged between 25 and 49 years old. The age distribution for women was similar to the age distribution in the Kubu Raya region; however, younger men were under-represented and older men over-represented in the sample compared to Badan Pusat Statistik data. As one can see from the further data, this could be connected younger men being more likely to travel to perform seasonal labor. 74.3% of the respondents had no or an elementary level of formal education; 84.0% lived in the village for more than 10 years at the time of the data collection.

Perceived Changes in the Environment

Overview of the Changes

To start with, we summarized the general (rather than gender-specific) narrative of the changes happening in the village. Beginning with data from the focus groups, villagers talked at length about the environmental challenges they faced and the effect they had on their lives:

> It's all about the unpredictable climate change. Sometimes it's hot, but out of the blue, there would be rain. It rains, then suddenly it changes to hot weather. This season would usually be the rainy season, but it has been almost one month of no rain (male > 30yrs).

Participants noted the lack of rain was further exacerbating the heat, which was getting more extreme every year. Deforestation was also mentioned repeatedly during the focus groups – namely the loss of peat forest shielding the village from the sea. Participants connected such loss to another problem: salinization of freshwater sources.

> Before this, back in the day, we would not encounter any salinized water because there was plenty of forest. The peat was also plentiful. Now everything has become barren, everything has been cut down. So even if we build a pond or a well, it's still difficult because the water will dry up quickly (female > 30 yrs).

Participants said that while saltwater had been invading the local rivers and ponds for the last 10–11 years, but at the start it would only reach the village during the 1–2 months drought periods. Now, however, a lot of the freshwater sources are salinized. That resulted in the loss of farming productivity:

> The plants die. The local coconuts, if they are exposed to salt water, the fruits that used to grow big now grow smaller. The quality of the coconut is also going down, the coconut water used to be sweet, now it is briny (male < 30 yrs).

Villagers therefore needed to spend more time either growing crops than usual to account for their lowered price or obtaining freshwater and protecting the plants from saltwater intrusion. The combination of deforestation and environmental stressors was also forcing wildlife out of its natural habitats. A variety of animals were reported to be intruding on the village territory, ranging from snakes and monkeys to, once, a bear. The animals were damaging the crops and posing a danger to farmers.

This range of issues was reflected in the environmental concern of the participants of the survey. For instance, when assessing the quality of the environment on several levels (village – district – province – country), the respondents gave the district (M(SD) = 4.53(1.21); $t(491) = 4.19^{***}$), island (M(SD) = 4.73(1.48); $t(313) = 4.81^{***}$), and country (M(SD) = 4.54(1.69); $t(250) = 3.09^{**}$) significantly higher scores compared to the village (M(SD) = 4.05(1.37)).

Figure 1 demonstrates the ranking of mean ratings of environmental issues on how serious the participants thought the influence of each of those was on the life in their village. The three highest scoring problems were "crop raiders (animals)" (animals invading the village's territory and eating/damaging crops), "lack of forest", and "lack of rain".

Gender Differences in Perceptions of Environmental Change and Impacts

In the focus groups women unanimously described themselves as homemakers that were responsible for cooking, cleaning, and looking after the children. The women spoke of the impact of dirty saline water on them and their work, obstructing the process, making their hands itch, and discoloring skin. They also stressed how much

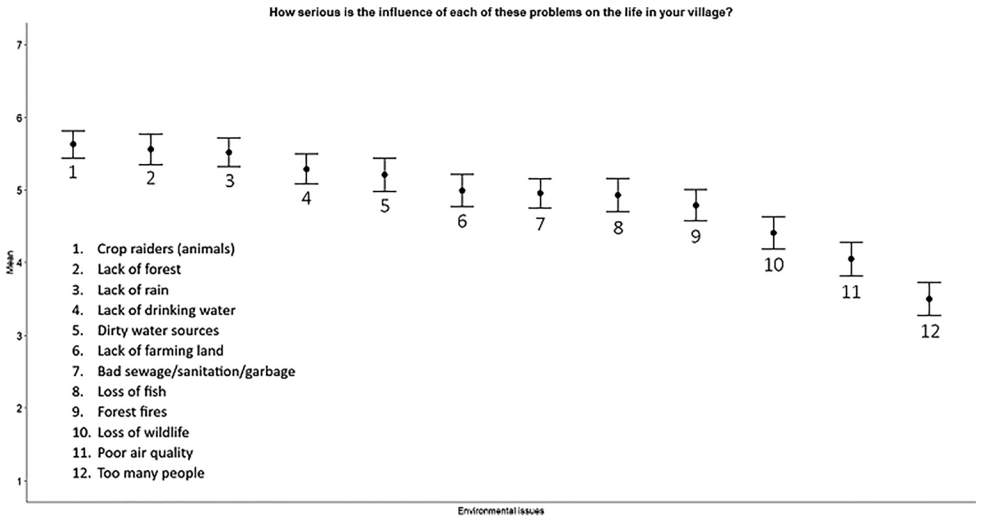

Figure 1. Environmental problems in the village as rated by the mean scores given to their influence on the life in the village.

time it took to obtain fresh water, which sometimes required traveling by boat, and how they had to prioritize who got it:

> We try our best to find fresh water to use. We try to find it, even if we only find a bucket of fresh water; we keep it for the children (female > 30yrs).

Women often participated in farming activities through supporting labor, such as making copra (dried, white coconut flesh) or even had their own fields. This was done in addition to their household tasks:

> Sometimes it's the housewives who have many things to do. Especially for obtaining the water, especially during the drought. Sometimes when the men are too busy working, if they had to wait for the men, they might not have water at all (male > 30yrs).

Despite all the tasks assigned to them, women themselves often saw their roles as just "helping":

- So who has the biggest role to put food to the table? (Moderator)

- Of course, the husbands. We're only helping (female > 30yrs).

- If no husband, then we work by ourselves (female > 30yrs).

Men, in turn, spoke more of the loss of non-water resources and of the difference between "then" and "now", particularly regarding what they felt was a loss of previous ease of using natural resources freely:

> Back then, there was plenty of forest. The people lived at the front up there. People back then if they wanted to get into the forest, they just cut down the trees (male >30 yrs).

Described as the main wage providers of their families, men spoke of the reduction in income generating activities due to environmental change. They noted that fishing had become inefficient due to its unpredictable yield, resulting in a loss of livelihood flexibility.

> In the past, we hunted fish and crabs. Due to the industrial waste reaching the water, there's no more fish nor crabs. It can be said that they're now extinct. Back in the days, the shrimps were huge. Nowadays, even small shrimps are difficult to find (male <30 yrs).

The decline in fish stocks now meant that farming was the key source of income in the village, adding further pressure to the already limited farming territory. This led to young men experiencing troubles getting their own piece of land and having to either work on somebody else's territory or find jobs outside of the village.

> Only some people own land. The elderly have their own land, we only work on it. So the new people cannot open their own land (male <30 yrs).

The differences between male and female participants' perceptions of the impact of environmental change on village life were reflected in the survey. Here we see that women gave a significantly more positive assessment of the environment compared to men (see Table 1).

Between participant t-tests stratified by gender found that men perceived the influence of "lack of forest" as significantly more influential on the village life ($M = 6.21$)

Table 1. Assessment of the quality of the environment on four geographical levels: descriptive statistics using between person *t*-test for equality of means to compare gender scores.

	Men		Women		
Level	N	M (SD)	N	M (SD)	*t*-test
The village	68	3.54 (1.24)	220	4.20 (1.37)	$t(122.0) = -3.74^{**}$
Kubu Raya	54	4.07 (1.36)	163	4.68 (1.12)	$t(78.1) = -2.97^{*}$
Kalimantan	35	4.09 (1.54)	127	4.91 (1.42)	$t(50.9) = -2.83^{*}$
Indonesia	34	4.24 (1.80)	115	4.63 (1.80)	$t(78.6) = -1.48^{ns}$

*p < .05 **p < .01
The significance levels were adjusted for multiple comparisons (Bonferroni method)

than women (M = 5.33), while women perceived the influence of the "lack of rain" (M = 5.76) as more important compared to men (M = 4.77).

Regarding the decline of natural resources, compared to women, men tended to more strongly see environmental change via changes in animal movement ($t(149.5) = 4.17^{***}$), the amount of forest available ($t(160.8) = 5.27^{***}$) and fish stocks ($t(165.0) = 5.80^{***}$).

However, there was a distinct generational difference among the male participants regarding the most pressing environmental issue. In the focus groups older men immediately referred to farming problems, while younger men spoke of the lack of clean water supply. They directly raised the problem of its impact on women's health:

> Because the ones who need water the most, the ones who get affected the most by saltwater are women, compared to men. Because the women have to do the washing up, cooking, and for their bathroom business. It might affect their reproduction organs (male <30 yrs).

This generational difference was reflected in the survey, with men under 30 assigning significantly higher value to the influence of inadequate sanitation in the village compared to men over 30 ($t(22.86)^{1} = 3.49^{***}$).

Compounding Issues: Local Governance and Environmental Change

While the focus groups were meant to predominately explore the effect of environmental change, the overlapping theme of local governance was repeatedly mentioned. Focus group members stressed that the multiple pressures they were experiencing were born not only out of environmental issues, but also governmental regulations, specifically 'the burning ban'. The ban is related to Law 32 of 2009 (69.1.h) prohibiting swidden agriculture, the practice where vegetation is cut, the stumps are burnt, and then new crops are planted. The local government made an allowance that a maximum land area of two hectares per family head may be burnt per day, and that the area must be planted with local varieties of plants and surrounded by firebreaks. The law was perceived as unreasonable by many villagers:

> The law does not say that the land cannot be burnt at all. It can, according to the set amount of hectares. But then it is not possible for us all to do it. For example, for the ones who want to plant corns, today we burn two hectares, and then tomorrow two hectares, that's just not possible (female >30 yrs).

Participants believed that corn will not grow if the land is not burned beforehand and the ashes used to enrich the soil. Using land burning as an alternative to expensive

fertilizers was perceived by villagers as a sustainable option, unfairly impeded by the ban. Focus group participants could not see an alternative solution to burning and admitted to burning the land in secret. The enforcement of the ban (through drone monitoring and police detentions) was resented.

> We, the owners of the forest, are scared because we are continuously being watched. It's like we're some sort of foreigners working on our own land. We are always on our guard, as if this is not our own place (female > 30yrs).
>
> (Moderator) So there has been supervision?
>
> Yes. Even though this land belongs to no other but us (female > 30yrs).

Resentment for the ban was coupled with the presence of a palm-oil company that took over a significant part of the forest, having been sold that territory by the previous village leader.

> When we, the village people, sorry to say this, were faced with the higher ups, when we were invited to the hotel, with all the AC and convenience, we found it difficult to voice our opinion. So the paper was shown our way, and they said please sign this, you would get this much; the destiny of our people was gone with it (male >30 yrs).

The palm-oil company was perceived as an additional source of pressure on the availability of farming grounds (by taking over part of the land), as well as on the farming process itself, as the company was accused of monitoring the villagers and putting out their fires.

> For instance, the fire hasn't reached the end of the field, but it will be put out by water already by the company. We want the company to take care of their palm tree field. If we set fire on our land, then so be it. Just keep a watch over your own land, don't bother what is rightfully ours (female > 30yrs).

Participants also felt a lack of control over the future of their children, particularly regarding their ability to send their children to school or for further education. There was a palpable sense of socioeconomic disparity among the focus groups members, explaining that they need to plant corn because they are "not middle-class" and therefore need it for food, not just for selling; or suggesting that the fire ban comes from "big people with money" who do not need to farm and are bothered by the smell of smoke.

The survey responses further highlighted the villagers' perception and role of industry on environmental change. Here, both men and women believed (with no significant differences between genders) that industrial growth without due care for the environment (M(SD) = 5.66(1.41)) was the main driver of environmental change; followed by people's lack of knowledge (M(SD) = 5.23(1.47)) and government's lack of action (M(SD) = 5.18(1.72)).

Discussion

Gendered Perceptions

This study explored and highlighted the gendered nature of perceptions of climate change in West Kalimantan. We found that while both men and women were

concerned about the impact of environmental change and alleviating its effects, they were concerned about different aspects of it, for example women prioritized water and men forest resources. This was noticeably driven by the gendered division of labor, with women being responsible more for household tasks, including cleaning, while men ventured more into the forest (Arku and Arku 2010; Janet H. Momsen 1993; Nightingale 2006). Within an Indonesian context, the results are consistent with a previous study in Papua, that found that men were more familiar with the influence of climate variability on wildlife to hunt, and women knowing more about the effect on cultivated grounds (Boissière et al. 2013).

However, while in other locations like the Caribbean and British Columbia women expressed more concern for the quality of the environment (Mohai 1992; Scannell and Gifford 2013), our data suggest that in West Kalimantan men were more sensitive and perceived the state of the environment to be worse in the village, the district and the island compared to women. Both men and women, nevertheless, perceived the environment to be worse in the village compared to other levels. This is likely connected to patterns of travel and migration. First, while there are ongoing peaks and troughs in overall migration numbers in Indonesia, number of internal migrants from rural areas is consistently lower than from urban areas (Pardede, McCann, and Venhorst 2020). Since many of the participants in our study have not traveled far from their village, this could explain the generally higher level of concern for the environmental state of the village compared to other areas of Indonesia. Consistent with previous research (Wajdi, Mulder, and Adioetomo 2017), we found that the lack of available farming land meant that young men are more likely to travel. With relatively more travel experience beyond the village, this may explain why the men in our sample were more aware of the environmental situation beyond their village than women.

It is important to note that we did not prime participants by asking them about climate change specifically. Instead, we asked them to talk about any environment-related issues [masalah yang bapak hadapi dan alami tentang lingkungan] they experienced. "Unpredictable climate" [iklim yang tidak menentu] was brought up by the participants naturally, as they experience it first-hand. In contrast to a previous study done in Indonesia, Papua, where participants considered climate change to have little impact on their life compared to policy decisions and industrial resource extraction (Boissière et al. 2013), in this project people saw climate change as one of the comparably important issues in their region, generating or exacerbating many other environmental problems, as well as policy pitfalls. Apart from geographical variations, another distinction may explain this difference: Boissiere et al.'s (2013) study highlights participants' reliance on local migration to adapt to environmental changes. Conversely, in our scenario, respondents were constrained to particular territories due to land ownership, rendering them less adaptable to climate fluctuations and thus more vulnerable.

Going beyond Gender

Age

Men and women's perceptions of environmental changes and gendered livelihoods were further nuanced by age. There was a noticeable generational difference in the

perception of men and women's roles. Older men subscribed to the idea of men being the main breadwinners of the households, not viewing women as real income generators even when they were involved in the farming process, something observed in the previous research on agricultural communities, e.g. in Uzbekistan and Nepal (Gunchinmaa, Hamdamova, and van Koppen 2011; Zwarteveen and Neupane 1996). In contrast, younger men saw their wives as partners sharing the burden of providing for their household equally. This wider perception appeared to let younger men see the extent and impact of the changing environment more broadly, for example younger men assigned more importance to the lack of clean drinking water important to women. This may be connected to the increased pressures requiring more collaboration within the couple, as previously recorded in Indonesia (Elmhirst 1998). However, as stressed by Muñoz Boudet et al. (2013) for agricultural communities, increased collaboration does not mean gendered expectations are decreasing within households and communities. Instead, women have more, not fewer tasks, as they were still responsible for the household and children.

Socio-Economic Disparity

We found that in an agrarian community the overarching issue of governance power relations and income inequality affected both genders. Male and female farmers felt equally forced into behaving in a certain way by outside powers – the government and oil-palm company – without a valid choice being provided to them. The absence of choice was coupled with a feeling of lack of necessary information about alternatives to support their livelihoods, such as alternative methods of farming/fertilizing/etc. This, combined with the enforcement of regulations without what the villagers saw as a clear explanation, has led to the villagers feeling powerless over their life and livelihoods and unable to adapt to the environmental changes. Thung (2019) discusses how decentralization of forest governance in Indonesia has led to multiple contradictions between local governments and the Ministry of Forestry, resulting in confusing and ambiguous recommendations for local communities. Such confusion was evident in our study – the rights and obligations of different stakeholders were unclear to the participants. Decentralization may also make it harder to monitor and control forceful oil palm land conversion (Thung 2019) evidenced in our study, as well as other research in Papua and Kalimantan (Obidzinski et al. 2012), leading to tensions and conflicts across Indonesia (The Gecko Project 2023).

Here we see that differences in socio-economic circumstances may have a stronger impact on environmental concern than gender roles, with men and women facing the same governance pressures and lack of firmly enforced land rights. While the case-study village had substantial recognized land rights (for instance, their forests are no longer under the state management but are under community management as the primary rightsholder), they still must report management of the area to the state. Furthermore, many farmers lack having an official certificate (SHM - *surat hak miliki*) for their land because they lack the administrative data to apply for an SHM (e.g., birth certificate), as it may be hard to obtain for poorer population members (Kusumaningrum, Wandasari, and Sari 2021; Ministry of Environment and Forestry (Indonesia))) 2021a, 2021b). In response, the government aims to hand out SHMs directly (Al-Farraby

2022); however, it is a long process, and in the meantime control over the land use decisions remains complicated.

Implications for Policy and Practice

Our findings on gendered roles within households and communities and the differing impacts and priorities that derive from these roles can and should be used to drive practically applicable solutions for equitable climate change mitigation in Indonesia. For example, while providing access to clean drinking water will undoubtedly benefit all community members, women will have the best understanding about where and how enhanced access to water should be organized for maximum community benefit (Demetriades and Esplen 2009). As such, women should be included in decision-planning and decision-making process – with the same being true for men, e.g., regarding restoring forest resources. In turn, not accounting for the gendered nature of the task may lead to diminished or perverse outcomes, as for example described by Nightingale (2006) where restrictions placed on leaf litter harvesting in Nepal disproportionality impacted women and made them reluctant to comply.

The present study also calls attention to governance and industry-born issues resulting from policies created and conducted in a way that overlooks not just the gendered aspects of people's interaction with the environment, but the needs of local communities in general. The issue of oil-palm extraction governance problems, while particularly pressing in Indonesia (Putri et al. 2022), goes beyond it to the rest of South-East Asia (Ivancic and Koh 2016), with researchers calling for more attention to local people's livelihoods and wellbeing, if sustainable palm-oil production is to be achieved. As demand for territories for food production, including palm oil, is growing in multiple countries and regions (Angelsen 2010), it is important to find options that empower indigenous land users to acquire the benefits of their land resources without neglecting conservation goals.

Finally, whilst research in East Jakarta found that the economic need resulting from a changing climate can soften gender norms (Boudet et al. 2013), with male and female roles becoming more similar, their rights may not be undergoing the same transformation. The land tenure cards for the farming grounds in the case-study village are given out to the heads of households, which are overwhelmingly male. This process is extensively described by Dewi et al. (2020) in West Java, where despite participating in all the same productive activities female farmers were overlooked in terms of registration rights. This issue is further highlighted by a systematic review focusing on the Global South that found that while more women are entering traditionally male spheres of labor, like farming, the technologies and systems are still not women-friendly (Haque, Kumar, and Bhullar 2023). This demonstrates that although various intersections of identity are undoubtedly at play, gendered traditions often form the bedrock of many systems and require a deliberate governmental effort to reform them. A case study in Sri-Lankan demonstrates how empowering social capital and targeted training programs facilitated women's participation in rainforest conservation and development activities (Nuggehalli and Prokopy 2009). This shows how lack of socio-cultural hindrance allow women to express and act on their environmental concern successfully (Chan, Pong, and Tam 2019); something that would benefit most conservation programs or policy interventions.

Limitations and Implications for Future Research

As a case study of gender roles and their contribution to differences in experience and perceptions of environmental change in one village, we were able to generate a detailed, holistic account of the experience of a disadvantaged community facing a variety of environmental and policy-born constraints. As this research study advocates for increased attention to localized context-based lived experiences of people, the goal was not to develop generalizable results, but rather to highlight the complicated interaction between gender, age, socioeconomic circumstances and overarching governance issues when developing policies and interventions to combat environmental change. That said, our case-study is relevant to other regions in Indonesia, e.g. the island of Sumatera, and beyond experiencing similar environmental challenges and resource extraction issues (Sayer et al. 2012).

Future research on the impacts of environmental changes should continue paying attention to different identities relevant to the location and the context, but especially to the shifting patterns of those identities and what they mean for the local equality and equity. The generational change in environmental perceptions evidenced in this study may be a continuous process potentially resulting in significant changes in gendered spheres of influence. This process needs to be studied further to reflect the new priorities and entry points for interventions. Lack of records of change in such perceptions may lead to failure to record and consequently examine the process of perceptional shift, indications of which were found for Indonesia in this and two other studies (Fortnam et al. 2022; Praptiwi et al. 2021).

Our findings also underscore the villagers' keen awareness of the existing environmental and governance issues, coupled with both men and women's agrarian livelihoods depending on fixing those issues. This could serve as a strong base for exploring the development of participatory governance, in particular strategies to harness and fortify the required community cooperation, and village autonomy in governance structures, especially in contexts where top-down governance is prevalent. Successful models observed elsewhere in Indonesia include targeting octopus fisheries in Sulawesi, where community partnership and a co-management approach were combined with great success, allowing the locals to spearhead conservation efforts with significant impact (Dudayev, Lukmanul Hakim, and Rufiati 2023). Investigating methods to replicate and enhance such community-led initiatives with attention to the evolving cooperation between men and women could offer valuable insights for sustainable development and governance frameworks.

Note

1. Welch approximation used for the degrees of freedom due to difference in variance between the groups.

Acknowledgements

The authors of the paper express gratitude to all Yayasan Planet Indonesia staff members who assisted in the study data collection.

Ethical Approval

This manuscript has not been published elsewhere and has not been submitted simultaneously for publication elsewhere. This study received an ethical approval from the University of Exeter ethics committee Apr19/B/187Δ1. Anastasia Voronkova had a research permit granted by the Indonesian Ministry of Research and Technology.

Funding

This study was supported by the UK Government's Global Challenges Research Fund (GCRF) as a part of the Blue Communities project NE/P021107/1, and the University of Exeter Medical School funding.

References

Agarwal, B. 1997. Gender, environment and poverty interlinks regional variations and temporal shifts in rural India. *World Development* 25 (1):23–52. doi: 10.1016/S0305-750X(96)00084-8.

Al-Farraby, R. M. I. 2022. Presiden Jokowi Serahkan 1,5 Juta Sertifikat Hak Atas Tanah. Presiden RI. December 1. 2022. https://www.presidenri.go.id/siaran-pers/presiden-jokowi-serahkan-15-juta-sertifikat-hak-atas-tanah/.

Ammarell, G. 2000. Bugis migration, ethnic conflict, and national integration.

Angelsen, A. 2010. Policies for reduced deforestation and their impact on agricultural production. *Proceedings of the National Academy of Sciences of the United States of America* 107 (46):19639–44. doi: 10.1073/pnas.0912014107.

Arku, F. S., and C. Arku. 2010. I cannot drink water on an empty stomach: A gender perspective on living with drought. *Gender & Development* 18 (1):115–24. doi: 10.1080/13552071003600091.

Austin, K. G., P. S. Kasibhatla, D. L. Urban, F. Stolle, and J. Vincent. 2015. Reconciling oil palm expansion and climate change mitigation in Kalimantan, Indonesia. *PloS One* 10 (5):e0127963. doi: 10.1371/journal.pone.0127963.

Boissière, M., B. Locatelli, D. Sheil, M. Padmanaba, and E. Sadjudin. 2013. Local perceptions of climate variability and change in tropical forests of Papua, Indonesia. *Ecology and Society* 18 (4) http://www.jstor.org/stable/26269394. doi: 10.5751/ES-05822-180413.

Boudet, M., A. María, P. Petesch, and C. Turk. 2013. *On norms and agency: Conversations about gender equality with women and men in 20 countries*. Directions in Development Human Development. Washington, DC: World Bank.

Brehm, J. M., B. W. Eisenhauer, and R. S. Krannich. 2006. Community attachments as predictors of local environmental concern: The case for multiple dimensions of attachment. *American Behavioral Scientist* 50 (2):142–65. doi: 10.1177/0002764206290630.

Brown, H. C. P. 2011. Gender, climate change and REDD+ in the Congo Basin Forests of Central Africa. *International Forestry Review* 13 (2):163–76. doi: 10.1505/146554811797406651.

Chan, H.-W., V. Pong, and K.-P. Tam. 2019. Cross-national variation of gender differences in environmental concern: Testing the sociocultural hindrance hypothesis. *Environment and Behavior* 51 (1):81–108. doi: 10.1177/0013916517735149.

Davison, S. M. C., M. P. White, S. Pahl, T. Taylor, K. Fielding, B. R. Roberts, T. Economou, O. McMeel, P. Kellett, and L. E. Fleming. 2021. Public concern about, and desire for research into, the human health effects of marine plastic pollution: Results from a 15-country survey across Europe and Australia. *Global Environmental Change* 69 (July):102309. doi: 10.1016/j.gloenvcha.2021.102309.

Demetriades, J., and E. Esplen. 2009. The gender dimensions of poverty and climate change adaptation. *IDS Bulletin* 39 (4):24–31. doi: 10.1111/j.1759-5436.2008.tb00473.x.

Dewi, K. H., S. N. I. Raharjo, Desmiwati, K. A. Hendarto, Aam. Aminah, T. A. Wisudayati, H. Royani, A. D. S. Hasibuan, and D. R. Sari. 2020. Roles and voices of farmers in the "special

purpose" forest area in Indonesia: Strengthening gender responsive policy. *Asian Journal of Women's Studies* 26 (4):444–65. 10.1080/12259276.2020.1844972.
Djoudi, H., and M. Brockhaus. 2011. Is adaptation to climate change gender neutral? Lessons from communities dependent on livestock and forests in Northern Mali. *International Forestry Review* 13 (2):123–35. doi: 10.1505/146554811797406606.
Dudayev, R., L. Lukmanul Hakim, and I. Rufiati. 2023. Participatory fisheries governance in Indonesia: Are octopus fisheries leading the way? *Marine Policy* 147 (January):105338. doi: 10.1016/j.marpol.2022.105338.
Elmhirst, R. 1998. Reconciling feminist theory and gendered resource management in Indonesia. *Area* 30 (3):225–35. doi: 10.1111/j.1475-4762.1998.tb00067.x.
Flaherty, M. S., and V. R. Filipchuk. 1993. Forest management in Northern Thailand: A rural Thai perspective. *Geoforum* 24 (3):263–75. doi: 10.1016/0016-7185(93)90020-I.
Fortnam, M., L. Evans, A. M. Amira Mas Ayu, L. Bastian, T. Chaigneau, L. Creencia, H. C. Goh, B. Gonzales, K. Madarcos, C. Maharja, et al. 2022. Polycentricity in practice: Marine governance transitions in Southeast Asia. *Environmental Science & Policy* 137 (November):87–98. doi: 10.1016/j.envsci.2022.08.010.
Gokkon, B. 2015. Plan to ban land burning sparks concern about Indigenous people. Jakarta Globe. November 12, 2015. https://jakartaglobe.id/news/indonesian-plan-ban-land-burning-sparks-concern-indigenous-people.
Gunchinmaa, T., D. Hamdamova, and B. van Koppen. 2011. Gender in irrigated farming. *Gender, Technology and Development* 15 (2):201–22. doi: 10.1177/097185241101500202.
Hansen, A., and P. Bi. 2017. Climate change adaptation: No one size fits all. *The Lancet. Planetary Health* 1 (9):e353–54–e354. doi: 10.1016/S2542-5196(17)30160-2.
Haque, A. T. M. S., L. Kumar, and N. Bhullar. 2023. Gendered perceptions of climate change and agricultural adaptation practices: A systematic review. *Climate and Development* 15 (10):885–902. doi: 10.1080/17565529.2023.2176185.
Henny, Herawati, Suripin, Suharyanto. 2015. 'Impact of climate change on streamflow in the tropical lowland of Kapuas River, West Borneo, Indonesia'. *Procedia Engineering* 125:185–192. doi: 10.1016/j.proeng.2015.11.027.
Höing, A., and I. Radjawali. 2017. Flexible livelihood strategies coming to an end? The case of forest-dependent communities in Central and West Kalimantan. In *Continuity under change in Dayak societies*, 73–95. Wiesbaden: Springer Fachmedien Wiesbaden. doi: 10.1007/978-3-658-18295-3_3.
Ida Aju Pradnja, Resosudarmo, Luca, Tacconi, Sean, Sloan, Faridh Almuhayat Uhib, Hamdani, Iis, Alviya, Muhammad Zahrul, Muttaqin, Subarudi, 2019. Indonesia's land reform: Implications for local livelihoods and climate change. *Forest Policy and Economics, Assessing Policies to Reduce Emissions from Land Use Change in Indonesia*, 108 (November):101903. doi: 10.1016/j.forpol.2019.04.007.
Ivancic, H., and L. P. Koh. 2016. Evolution of sustainable palm oil policy in Southeast Asia. *Cogent Environmental Science* 2 (1):1195032. doi: 10.1080/23311843.2016.1195032.
Kitzinger, J. 1995. Qualitative research: introducing focus groups. *BMJ (Clinical Research ed.)* 311 (7000):299–302. doi: 10.1136/bmj.311.7000.299.
Kusumaningrum, S., W. Wandasari, and W. Sari. 2021. Structural barriers and governance factors block Indonesian getting identity documents—But there are solutions. The Conversation, June 2, 2021. http://theconversation.com/structural-barriers-and-governance-factors-block-indonesian-getting-identity-documents-but-there-are-solutions-160700.
Liu, J.-Y., S. Fujimori, K. Takahashi, T. Hasegawa, W. Wu, Y. Geng, J. Takakura, and T. Masui. 2021. The importance of socioeconomic conditions in mitigating climate change impacts and achieving sustainable development goals. *Environmental Research Letters* 16 (1):014010. doi: 10.1088/1748-9326/abcac4.
Malik, A., O. Mertz, and R. Fensholt. 2017. Mangrove forest decline: consequences for livelihoods and environment in South Sulawesi. *Regional Environmental Change* 17 (1):157–69. doi: 10.1007/s10113-016-0989-0.
Meinzen-Dick, R., C. Kovarik, and A. R. Quisumbing. 2014. Gender and sustainability. *Annual Review of Environment and Resources* 39 (1):29–55. doi: 10.1146/annurev-environ-101813-013240.

Ministry of Environment and Forestry (Indonesia). 2021a. Pengembangan Usaha Perhutanan Sosial (2021). 195. http://sinav.usahahutan.id/index.php/frontend/.195.
Ministry of Environment and Forestry (Indonesia). 2021b. Peta Indicative Area Perhutanan Sosial (2021). 196. http://webgis.menlhk.go.id:8080/kemenhut/index.php/id/peta/petapiaps.
Mohai, P. 1992. Men, women, and the environment: An examination of the gender gap in environmental concern and activism. *Society & Natural Resources* 5 (1):1–19. doi: 10.1080/08941929209380772.
Momsen, J. H. 1993. Gender and environmental perception in the Eastern Caribbean. In *The development process in small island states*, 57–70. London: Routledge.
Nightingale, A. 2006. The nature of gender: Work, gender, and environment. *Environment and Planning D: Society and Space* 24 (2):165–85. doi: 10.1068/d01k.
Nuggehalli, R. K., and L. S. Prokopy. 2009. Motivating factors and facilitating conditions explaining women's participation in co-management of Sri Lankan forests. *Forest Policy and Economics* 11 (4):288–93. doi: 10.1016/j.forpol.2009.05.002.
O.Nyumba, T., K. Wilson, C. J. Derrick, and N. Mukherjee. 2018. The use of focus group discussion methodology: Insights from two decades of application in conservation. *Methods in Ecology and Evolution* 9 (1):20–32. doi: 10.1111/2041-210X.12860.
Obidzinski, K., R. Andriani, H. Komarudin, and A. Andrianto. 2012. Environmental and social impacts of oil palm plantations and their implications for biofuel production in Indonesia. *Ecology and Society* 17 (1):art25. doi: 10.5751/ES-04775-170125.
OECD. 2019. *OECD green growth policy review of Indonesia 2019*. OECD Environmental Performance Reviews. Paris: OECD. doi: 10.1787/1eee39bc-en.
Pardede, E. L., P. McCann, and V. A. Venhorst. 2020. Internal migration in Indonesia: New insights from longitudinal data. *Asian Population Studies* 16 (3):287–309. doi: 10.1080/17441730.2020.1774139.
Potts, T., C. Pita, T. O'Higgins, and L. Mee. 2016. Who cares? European attitudes towards marine and coastal environments. *Marine Policy* 72 (October):59–66. doi: 10.1016/j.marpol.2016.06.012.
Praptiwi, R. A., C. Maharja, M. Fortnam, T. Chaigneau, L. Evans, L. Garniati, and J. Sugardjito. 2021. Tourism-based alternative livelihoods for small island communities transitioning towards a blue economy. *Sustainability* 13 (12):6655. doi: 10.3390/su13126655.
Putri, E. I. K., A. H. Dharmawan, O. Hospes, B. E. Yulian, R. Amalia, D. I. Mardiyaningsih, R. A. Kinseng, F. Tonny, E. P. Pramudya, F. Rahmadian, et al. 2022. The Oil palm governance: challenges of sustainability policy in Indonesia. *Sustainability* 14 (3):1820. doi: 10.3390/su14031820.
Roberts, B. R., M. P. White, S. M. C. Davison, O. McMeel, C. Eatock, P. Kellett, J.-B. Calewaert, and L. E. Fleming. 2021. Public preferences for policy intervention to protect public health from maritime activities: A 14 European country study. *Global Environmental Change* 71 (November):102397. doi: 10.1016/j.gloenvcha.2021.102397.
Sayer, J., J. Ghazoul, P. Nelson, and A. Klintuni Boedhihartono. 2012. Oil palm expansion transforms tropical landscapes and livelihoods. *Global Food Security* 1 (2):114–9. doi: 10.1016/j.gfs.2012.10.003.
Scannell, L., and R. Gifford. 2013. Personally relevant climate change: The role of place attachment and local versus global message framing in engagement. *Environment and Behavior* 45 (1):60–85. doi: 10.1177/0013916511421196.
Schultz, W. P. 2001. The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology* 21 (4):327–39. doi: 10.1006/jevp.2001.0227.
Sipayung, S. B., A. Nurlatifah, B. Siswanto, and L. S. Slamet. 2018. Analysis of climate change impact on rainfall pattern of Sambas District, West Kalimantan. *IOP Conference Series: Earth and Environmental Science* 149 (1):012029. doi: 10.1088/1755-1315/149/1/012029.
Tashakkori, A., and C. Teddlie. 2010. Putting the human back in "Human Research Methodology": The researcher in mixed methods research. *Journal of Mixed Methods Research* 4 (4):271–7. doi: 10.1177/1558689810382532.
Teye, J. K. 2012. Benefits, Challenges, and dynamism of positionalities associated with mixed methods research in developing countries: Evidence from Ghana. *Journal of Mixed Methods Research* 6 (4):379–91. doi: 10.1177/1558689812453332.

The Gecko Project. 2023. Get the data: How we built a database of conflicts driven by Indonesia's palm oil smallholder scheme'. 2023. https://thegeckoproject.org/articles/get-the-data-how-we-built-a-database-of-conflicts-driven-by-indonesia-s-palm-oil-smallholder-scheme/.

Thung, P. 2019. *Decentralization of government and forestry in Indonesia*. Bogor, Indonesia: CIFOR.

Torell, E., A. Myers, and C. McNalley. 2013. *A tool for conducting population, health and environment behavior monitoring surveys*. Narragansett: University of Rhode Island.

Toumbourou, T. D., W. H. Dressler, and T. T. Werner. 2022. Plantations enabling mines: Incremental industrial extraction, social differentiation and livelihood change in East Kalimantan, Indonesia. *Land Use Policy* 119 (August):106157. doi: 10.1016/j.landusepol.2022.106157.

Villamor, Grace B., Febrina Desrianti, Ratna Akiefnawati, Sacha Amaruzaman, and Meine van Noordwijk. 2014. 'Gender Influences Decisions to Change Land Use Practices in the Tropical Forest Margins of Jambi, Indonesia'. *Mitigation and Adaptation Strategies for Global Change* 19 (6): 733–55. doi: 10.1007/s11027-013-9478-7.

Wajdi, N., C. H. Mulder, and S. M. Adioetomo. 2017. Inter-regional migration in Indonesia: A micro approach. *Journal of Population Research* 34 (3):253–77. doi: 10.1007/s12546-017-9191-6.

White, M. 2016. Ghana population, consumption and environment (PCE) survey, 2002: Version 1. ICPSR - Interuniversity Consortium for Political and Social Research. doi: 10.3886/ICPSR34830.V1.

Wijaya, A., H. Chrysolite, M. Ge, C. K. Wibowo, A. Pradana, and A. F. Utami. 2017. How can Indonesia achieve its climate change mitigation goal? An analysis of potential emissions reductions from energy and land-use policies. April. https://www.wri.org/research/how-can-indonesia-achieve-its-climate-change-mitigation-goal-analysis-potential-emissions.

World Economics. 2024. Indonesia's median age. 2024. https://www.worldeconomics.com/Demographics/Median-Age/Indonesia.aspx.

Xiao, C., and A. M. McCright. 2012. Explaining Gender differences in concern about environmental problems in the United States. *Society & Natural Resources* 25 (11):1067–84. doi: 10.1080/08941920.2011.651191.

Xiao, C., and D. Hong. 2012. Gender and concern for environmental issues in urban China. *Society & Natural Resources* 25 (5):468–82. doi: 10.1080/08941920.2011.565455.

Zwarteveen, M., and N. Neupane. 1996. Free-riders or victims: Women's nonparticipation in irrigation management in Nepal's Chhattis Mauja irrigation scheme. January.