Following Primates: Approaching Conflict in Contested Regions

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Abstract

When conducting research in community-based settings, it is natural for conflict to arise as the practices, motivations, and imaginaries of researchers and local stakeholders converge. As designers, the question, then, is: "In what ways can we engage with conflict to arrive at constructive outcomes?" In this paper, we employ ethnography and a mapping workshop with an environmental research group facing conflicts at a contested ecological site. We unpack some of the ways in which local conflicts over data, mapping, and technologies around community-managed forests are intertwined with broader socio-political, historical, and value-based contestations. We find that conflict serves as a critical site for negotiating community engagement and configuring collaboration. Accordingly, we provide strategies for surfacing, navigating, and staying with conflict in contested settings. For community-based researchers, this requires resisting the natural tendency to seek an immediate resolution to the conflict, thereby creating room to deepen attachments to matters of concern.

CCS Concepts

• **Human-centered computing → Empirical studies in HCI**.

Keywords

Ethnography, Environmental Governance, Mapping, Conflict

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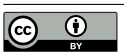
1 Introduction

An important challenge for HCI research is navigating the conflicts that arise when data-driven practices intersect with divergent and complex social realities. This is particularly relevant for contested, place-based commons where the practices of environmental research often interact, and, at times are at odds, with local livelihoods, community land management practices, cultural values, and historical power dynamics. Most design approaches are oriented towards ways by which conflict can be negotiated or ultimately resolved, especially within urban and digital contexts. Surfacing conflict in rural, majority-world settings [38] is critical yet understudied within design studies, especially where power imbalances and economic precarity can suppress productive means of approaching dispute [49]. This paper presents a study of conflicts surrounding environmental data practices in a contested Himalayan valley. We approach conflict as the frictions, disputes, and contestations that arise at the intersection of socio-ecological interactions and local resource governance. We demonstrate how conflicts over environmental research are deeply entangled with broader socio-cultural narratives and environmental governance, and consider how HCI researchers might respond.

This study draws from theoretical work on conflicts in design research to frame conflict as a productive site for inquiry rather than a problem looking for a resolution [11, 23, 30, 34]. In design, this has been translated into adversarial and agonistic methods that use artifacts, tools, and systems to materialize and provoke engagement with contentious social and political issues [11, 30]. Recent scholarship has positioned design as a mode of inquiry as a means to envision and devise responses to political and socio-environmental conflicts faced by communities [40, 77, 78]. These strategies shift the goal of design from providing seamless solutions to creating agonistic spaces where dissent and friction can be productively expressed and negotiated [11]. This is particularly vital within community-led governance practices in post-colonial contexts, where hegemonic legacies of governance, development, and conservation intersect with ongoing structures of power [2]. Indeed, conflict management is a core tenet of community governance of commonly-held resources [68]. As such, scholars have explored design practices that can support the ongoing work of commoning in situations where resources are collectively managed [13, 58]. This research extends these concepts by examining how a collaborative mapping process can facilitate a space to intentionally surface and mediate explicit and latent conflicts at a field site where disputes over the commons are frequent.

We contribute to this developing space of conflicts and design through an ethnography and mapping intervention with environmental researchers in Mandal Valley. Located in the Indian state of Uttarakhand within the western belt of the Himalayas, the valley serves as a critical site for environmental inquiry. The rich geography and cultural landscape converge the interests of multiple



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competing stakeholders, thereby making it a distinctively complex setting for study. By law and practice, the local communities in Mandal Valley manage resources of the surrounding forests through the village forest council (Van Panchayat). As part of their forest governance, local communities regularly interact with state forest regulators, tourists, researchers, and more-than-human actors. For the study, the first author joined an environmental research and conservation group, hereafter referred to by the pseudonym the Himalayan Research Project (HRP), functioning in the Mandal Valley. The author had joined HRP to assist in understanding and navigating conflicts and disruptions that the group faced with the local communities in conducting primate behavior research in the Valley. Toward the end of the ethnography, we facilitated a design workshop with HRP members, including invited researchers and several local community members employed as research assistants. Our goal, here, was to actively surface and work through these latent or existing conflicts [40]. Through collaborative mapping exercises in the workshop, we aimed to direct adversarial sentiments towards the co-creation of artifacts that could offer deeper understanding of the conflicts at play in the field site. This approach was used as a way to deconstruct and lay bare the latent power relationships, embedded social and cultural values, digital practices, and broader socio-historical contexts surrounding the conflicts.

In conducting the study, we found the initial framing of the conflicts as an antagonistic relationship between the researchers and the local community members, to be reductionist in nature. This initial conceptualization simplified the conflicts by overlooking their entangled relationship with the post-colonial socio-political and ecological fabric of Mandal Valley [2, 59]. In our findings, we first describe the ways in which environmental research in Mandal Valley operates on a contested terrain. The logics of conservation and environmental research is often at odds with local histories, livelihoods, broader private property reforms, and existing community land management practices [2, 20]. Second, we frame how power emerges and is enforced across multiple scales, from institutional state control to the micro-politics of everyday encounters at the field site. Third, we articulate how the tools, technologies, and methods of environmental research can decontextualize local meaning and become a site of conflict itself. We describe how the workshop enacted as a tangible arena where these tensions for HRP were collectively surfaced and re-understood through the co-creation of contestational objects [30]. Lastly, we discuss how collaborative mapping paved the way for reflexivity in research practice by aiding the participants in revisiting their positionalities as outsider researchers and, for others, as local community members. Here, we also describe the ways by which reflection, mediated by co-creating maps, helped untangle the ethical obligations of the participants and prefigured ways towards collaborations with the community.

This paper contributes to HCI by unpacking the relationships between digital practices, design workshops, and conflict. We provide an account of how digital practices within environmental science are a site of conflict, particularly within community-governed commons. Through our detailed ethnography, we demonstrate how tools and technologies used within environmental data science research enact a digital logic that can decontextualize local meaning and challenge community sovereignty over environmental governance. As such, conflicts are critical sites worth examining that can shed light on deep-seated social, historical, and political issues within contested settings. Working with conflicts over digital practices can be a way to address antagonistic elements and understand pathways towards collaborative engagements with communities. To do so, we argue for moving beyond immediate conflict resolution by designing spaces where participants can stay *with* conflict to cultivate deeper socio-political understandings of it. We outline four practical strategies for designers: articulating attachments through contestational objects [30], designing for pauses and 'between-ness' [4], adopting agonistic data practices that utilize narrative dimensions [26], and intervening in the making of environmental subjects ([2]) through reflexive spaces. Collectively, we advocate that HCI designers should embrace conflict and approach it in a strategic, deliberate, and patient manner, particularly in field settings marked by ongoing disputes and uncertainty.

2 Related Work

2.1 Conflict in design research

Prior scholarship in HCI, CSCW, and Participatory Design (PD) has linked conflict and related concepts, such as dissent, disagreements, and power differentials, to factors such as the heterogeneous makeup of communities, community norms, and the political nature of design [5, 6, 11, 27, 30, 34]. For instance, online community research attributes conflicts to implicit norms and explicit policies [33], heterogeneous group composition [34, 47, 56], interpersonal disagreements [5, 6, 24], and algorithmic tools like bots and artificial intelligence [22, 41]. However, design approaches treating conflict merely as a problem to be resolved in pursuit of consensus have been critiqued for "depoliticizing inherently political design questions about whose interests should be accounted for and how [67]." Conversely, a significant body of design scholarship frames conflict not as a deficit but as a generative force [11, 22, 25]. Making tensions explicit renders latent social issues visible, thereby creating productive spaces to negotiate a community's future directions [27, 57]. Yet, recent literature notes that design approaches often fail to "emphasize or even include surfacing and reporting conflicts as part of the practice [40]." Addressing this is essential in environmental research, where conflicts between the socio-ecological interactions, shared resource governance, and research practices are inevitable [44, Ch. 1].

A key theoretical development on supporting conflicts and preventing their depoliticization throughout the design process is the concept of agonism. Drawing from the political work of Chantal Mouffe [63], agonism posits that democratic life is characterized by the ongoing, yet legitimate, struggle between competing perspectives. As stated by Mouffe, "'agonistic democracy' requires accepting that conflict and division are inherent to politics and that there is no place where reconciliation could be definitively achieved as the full actualization of the unity of 'the people' [64]." Rather than seeking a rational consensus that suppresses dissent and smooths over tensions, an agonistic approach, instead, aims to create spaces where conflict can be expressed and negotiated productively.

For design practice, this shifts the objective away from resolving conflict and toward creating what DiSalvo, drawing on Mouffe, calls spaces of confrontation, where dissent can be productively expressed and engaged [30]. This concept of adversarial design critiques seamless, consensus-oriented design interventions and instead advocates for an approach that embraces friction and contestation. DiSalvo distinguishes between *design for politics*, which seeks to improve existing mechanisms of governance, such as designing better ballots, and *political design*, which operates within *the political*, i.e., the inherent and unavoidable aspects of antagonism in social relations [30, 64]. In our study, we approach adversarial design as a form of *political design* that materializes and provokes engagement with the messy, unsettled, and contested aspects of public life. Similarly, Donna Haraway has also described the importance of avoiding the traps of techno-solutionism and cynicism, and instead stirring up potent responses to pertinent issues by "staying with the trouble" [48]. Adversarial design is a practice that triggers contentious public issues through the design of *contestational objects* in order to reveal them for debate and productive political criticism. DiSalvo notes that the ongoing process of designing contestational objects is particularly useful for inquiring into the political condition and giving form to problematic situations [30, p. 116]. Our study draws from adversarial design by exploring how co-creating contestational objects through mapping can provide a way to express latent and entangled conflicts.

Adversarial and agonistic approaches in design are better understood as a relational inquiry that must be adapted to context. These perspectives argue that an effective democracy requires not eliminating conflict but creating spaces where differing views can be given form and negotiated [11, 77]. Methodologically, Björgvinsson et al. [11] frame this as "infrastructuring" and "thinging" i.e., the creation of long-term socio-material assemblies serving as arenas for agonistic expression. Examples include prototyping [25], playful interactions [19], and critical unmaking [76]. Of relevance to our study, approaches in mapping have been employed as an impactful way of opening up spaces for contestation [30, p. 12-13].

Le Dantec and DiSalvo [27] argue for design as a process, not as one ending in a product, but as supporting the long-term work of creating socio-technical resources that enable a public to identify social and material dependencies—or *attachments*—to issues and sustain itself against future challenges. To sustain these attachments amidst conflict, we draw on the concept of *Ma* [4], which, similarly, redirects attention from product to the process of becoming with. Through *Ma*, Akama [4] frames *silences* or *gaps* as active spaces where relations to each other and to matters of concern can be reconfigured. Similarly, Kuznetzov and Paulos' work on sensor probes exemplifies the necessity of forming attachments around localized environmental concerns [53]. Importantly, these studies indicate that eliciting and validating attachments can aid in eliciting underlying contestations. Recent work in HCI and PD mirrors this focus on surfacing conflicts to challenge hegemonic structures and support collective action [23, 40].

2.2 Situating design in post-colonial environmental governance

Approaching design within post-colonial environmental governance requires examining the nature of conflict in contexts where ecological interactions are often inseparable from social and political contestations [8]. Here, tensions between communities and more-than-humans have traditionally been framed as human-wildlife conflict (HWC). However, recent work has argued that HWC is frequently a manifestation of deeper human disputes over conservation priorities [71], land use, and social inequities [86, ch. 24]. While coexistence frameworks have been employed to emphasize tolerance and shared landscapes in such situations, we deliberately retain the framing of 'conflict' to reflect the active political struggle, agonistic elements, and steep power asymmetry present in post-colonial forest governance. We thus acknowledge the traumatic experiences inflicted by colonial conservation institutions, which have historically subjugated local communities to maltreatment originating from the notion of a human-nature dichotomy. Such legacies are to be taken into account when designing interventions. As such, research practice should ensure centering the existing ecological knowledge, kinship, and relational structure reflective of a human-environment continuity. This helps assure that the value of any life-form is not discounted again to further the agenda of exclusionary scientific environmental research [72].

Foregrounding political asymmetry and power relations has been a focus within the critical turn in HCI and other design scholarship. This work cautions against perceiving and approaching design separate from the historical, social, environmental, and political contexts in which it is situated [7, 32, 55, 80]. As such, scholars have argued that design should actively engage with, confront, and reconfigure structures of power [15, 42]. Similarly, post-colonial computing research highlights that design interventions cannot be divorced from complex legacies of state governance, economic development, and the definition of *community* itself [51]. Designers must therefore skillfully approach the concept of *participation* by understanding the existing technologies and power structures shaping the communities with which they engage [51, 83].

Building on these arguments, we draw upon Arun Agrawal's *Environmentality* to situate our work in relation to the history of forest governance in the post-colonial Indian Himalayas [2]. Agrawal argues that community participation towards environmental governance and issues, often through decentralized models, emerged from deliberate state strategies following the failure of more direct centralized control. Invoking Foucault's governmentality, Agrawal terms these strategies as *technologies of government*. A key aspect of technologies of government is how they contribute to the making of *environmental subjects*, that is, people who develop an environmentally oriented subject position. Agrawal [2] describes how environmental subjectivities—the beliefs, values, and sense of self in relation to the environment—are actively (re)produced through practices such as participating in local village councils, monitoring forests, and regulating resources. Other research from the Indian Himalayan region has examined how traditional administrative structures intersect with these *technologies of government* [52]. This work critiques top-down conservation initiatives that overstep on

people's rights to manage conservation narratives, advocating instead for bottom-up co-designed interventions. Such rights-based approaches, applicable in both rural and urban contexts [75], negotiate power through participation to foster relationships of equals rather than governed subjects. Another useful example is Mathur's work [59], which explores the challenges of implementing state law and governance in the same district (Chamoli) as our field site. Against this backdrop of environmental governance in the Indian Himalayas, the following sections detail our approach to exploring how these dynamics shaped interactions between community members and environmental researchers.

3 Research Approach

3.1 Site Description

The study site, Mandal Valley, consisting of 12 villages, is a heterogeneous landscape in the Garhwal Region of the Indian state of Uttarakhand, where agricultural fields, community forests, and sanctuary areas frequently transition into one another (see Figure 1). This valley forms part of the Middle Himalayas and is rich in faunal and floral diversity [31, 37, 81]. Currently, Mandal Valley is a site of convergence for multiple environmental research groups, whose workings intersect with the administrative boundaries of a wildlife sanctuary and reserve forest. This valley is located en route to the famous pilgrimage shrines of Kedarnath and Badrinath and itself harbors the pilgrimage sites of Rudranath, Tungnath, and Anusuya temple. Scientific scholarship emerging from the region has previously addressed topics such as multi-species interactions [81], human-wildlife coexistence [65], community empowerment, natural resource utilization, biodiversity preservation, evolutionary, and ecological research [9, 31]. The valley brings together researchers, pastoralists, pilgrims, tourists, government actors, the Forest Department (FD), the local community, and more-than-human life. As such, Mandal Valley serves as a site for environmentalism, conservation, tourism, development, and research. While this convergence inspires collaboration, it consequently results in various forms of conflict due to the diverging imaginaries of these interacting groups.

The livelihood practices of the communities residing in this valley are closely associated with and reliant on the community forests. Forest resources directly support the agricultural practices and livestock of the local community. Local communities in Mandal Valley have a long history of organizing to protect their forests whenever their access to resources is threatened. Historically, the grassroots initiatives in the valley played a critical role in shaping environmental governance and activism to negotiate forest rights with the state [74]. Notably, in 1973, locals responded to economic and political marginalization by sparking the Chipko (literally, "to stick to" and figuratively, in this case, "to hug") movement. This grew into a wider phenomenon as the collective action of women in the valley inspired other communities to protect their forests [60].

Socio-ecological relations in Mandal Valley are defined by a legacy of top-down policies that have systematically eroded local agency in governing forests and resources. Colonial-era laws, such as the Indian Forest Charter (1855), the establishment of the Imperial Forest Service (1862) [73], and the Indian Forest Acts (1865 & 1927), alongside post-colonial legislation like the Wildlife Protection Act (1972) and the Forest Conservation Act (1980), cemented a foundation of mistrust towards top-down bureaucracy and external authorities within forest communities in India. These laws, passed in the early part of the 20th century, drew a lot of resentment from the communities dwelling near forests in Uttarakhand. A committee proposed the formation of Van Panchayat (local forest governance councils) and instituted these bodies in 1931 under the District Scheduled Act of 1874. Initial Van Panchayats were formed in Kumaon, another administrative region of Uttarakhand. It was not until 1991 that the first Van Panchayat was formed in Garhwal, where Mandal Valley is located. [3]. The structured division of forest areas has been argued to be an arcane reality institutionalized during colonial rule to better quantify the forests and natural resources of the Indian Himalayas [2, 73]. In doing so, the decentralization of forest governance and creation of Van Panchayats became another way to govern local communities.

The management of Mandal Valley's community forests by the Van Panchayat has also faced similar issues regarding the dilution of local autonomy. These councils are entangled in a web of social and administrative relationships where state support comes at the cost of villager independence [1]. The state co-opted these communities into the preservation of forest resources by granting limited concessions while wresting the right to earn revenue from the forest for the state body. Thus, the Van Panchayats were assigned an area of forest, demarcated from the sanctuary forests, to be governed as commons. These areas were also subjugated to state and national wildlife and environmental laws. This distinction is of particular relevance to our study and depicts the confluence of multiple stakeholders and interests, making Mandal Valley a fertile site for conflicts to arise. This administrative web has only tightened with the latest amendments to the Forest Panchayat Rules in 2024, where these bodies are now open to influence from the village administration (Gram Panchayat), block-level administration, and forest and revenue department officers. Consequently, the Van Panchayat represents a complex form of multi-level state control rather than true self-governance. The physical boundaries of this control in the valley, often loosely marked by stone walls, serve less as demarcations of areas under community control and more as symbols of top-down forest governance and the community's continuous struggle for rights.

Environmental research in Mandal Valley operates primarily within and around the community forests and the Kedarnath sanctuary surrounding the local villages. HRP, an informal research group, has been active in this region since 2013. Although the project initially focused on the biodiversity of birds within the Mandal Valley, subsequent projects turned to studying the behavior of wild troops of the Central Himalayan Langur *(Semnopithecus schistaceus)* that are commonly found in the valley's forests (Figure 2). Over time, the project expanded as students and researchers joined to investigate broader themes of alloprimate development, primate ecology, and human-wildlife interactions. HRP has been sustained for nearly a decade as a collective of individual academic pursuits, supported by a patchwork of small, project-based grants and university-specific funding. Ecological studies on wildlife behavior in the valley rarely adhere to the forest demarcations in the valley; instead, the more-than-humans and the researchers studying

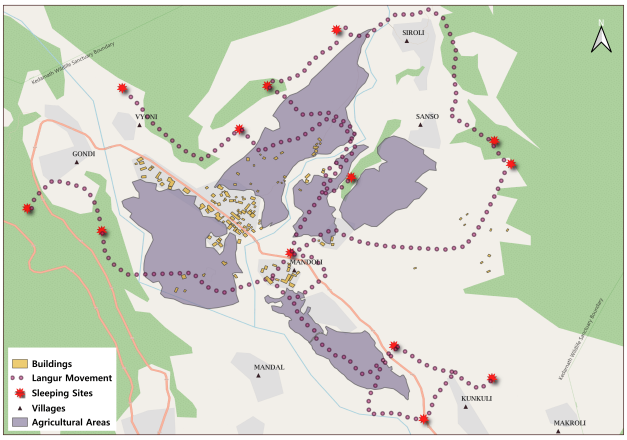

Figure 1: A map of Mandal Valley. The movement path of the Himalayan Langur troop criss-crosses the agricultural fields and passes near or through villages, as they traverse daily from one sleeping site to another. The community forests are not specifically marked in this map (partly owing to the lack of credible data). All areas in white can be considered as a community forest.

Figure 2: Several central himalayan langurs *(Semnopithecus schistaceus)* moving through the valley. In the picture they are in the community forest, having traversed through the agricultural fields and the roads.

them frequently traverse these boundaries. Consequently, the community forests and agricultural fields have become sites of frequent interaction and, at times, intense contention between researchers, more-than-humans, and local community members. For most local villagers these fields represent strictly human domains, and they maintain rigid boundaries regarding where animals should move. Because members of HRP follow the langurs across these boundaries, the villagers have developed conflictual sentiments toward the research initiative. Given the long duration of research activities in Mandal Valley, certain locals have become more critical and persistent in voicing their opposition to the research initiatives. Conversely, HRP has provided consistent employment and business (lodging, food) to select families. Given the region's economic precarity, this complicated the relationships between HRP, beneficiaries, and the broader community.

3.2 Research Methods

This study is based on eight months of qualitative research through an ethnography and a mapping workshop with HRP. Preliminary data for the study was collected in June 2023, followed by fieldwork that was conducted between January and July 2024. Our data included observational data supported through field notes, interviews, photos, audio recordings, and research maps. This data was complemented by environmental reports, scientific studies, and policy documentation concerning forest governance, human-wildlife interactions, and climate change in the region. Interviews were conducted in Hindi and English. English quotes used in this paper were translated by the first author. Throughout the study, the first author observed, interviewed, and conducted group discussions with members of HRP (Table 1). Field visits involved following the research group in their daily study of the Himalayan Langur. The first author also documented HRP's interactions with the community during their research activities, local gatherings such as festivals, and daily life. Additional interlocutors included Mandal Valley residents, officials of the FD, and local NGOs (non-governmental organization) members, with these discussions focusing on their environmental and development concerns and opinions of research activities in the valley.

In June 2024, we conducted a one-day mapping workshop with the ten members of HRP (Table 1). The workshop was designed after observing the conflicts at the field site during the ethnography. Due to the ongoing conflicts and rising tensions with the local community and the FD, we made a decision to limit participation in this workshop to members of HRP. The rationale here was to initially unpack the complexities of the conflicts as experienced by the group and cultivate reflexivity so as to prefigure future pathways of coexistence with the broader community. Involving external participants, such as the local community members who had been aggressive towards HRP or authorities like the FD, at this stage posed a risk of exacerbating power asymmetries and weakening existing social ties that HRP had with the community. While we acknowledge that this exclusion limits our findings to the perspectives of HRP members (more details in Section 6), the group's diverse composition was critical. Their varied educational backgrounds, genders, and distinct experiences with conservation, local conflict, and discrimination (based on race, caste, and class) provided essential insights to the study. It is also difficult to categorize HRP as a homogenous entity, with its members holding varying opinions, approaches to, and values regarding the conflicts they experienced. For instance, the research assistants from the local community shared crucial perspectives as individuals who embodied local experiences and were well cognizant of the contestations with the community. The workshop was conducted at a local residence just before the onset of the monsoon season, which halts

most HRP research activities; consequently, this paper presents insights from this single workshop.

In designing the workshop, we were primarily inspired by approaches in designing within conflict areas [28], adversarial design [30], and participatory mapping [17]. Given that HRP frequently used maps to construct a scientific understanding of Mandal Valley, we chose mapping as a way to materialize conflict, express political conditions, anchor abstract disagreements and adversarial sentiments, revisit representations of more-than-humans, clarify understandings of claims to land, and rework spatial norms within the field site's physical geography. The goal here was to facilitate a space where tensions could be surfaced and collectively negotiated through the co-creation of artifacts. The first author designed and facilitated the workshop based on their ethnographic observations and field notes. During the workshop, the first author raised relevant questions to assist participants through the activities, supported the participants in their queries, and guided the group through difficult discussions about conflict. The workshop included five sessions. The workshop started by having the participants create a collage card that visually represented their positionality within Mandal Valley. Here, we were inspired by HCI research on the potential of supporting self-reflection, nurturing carework, and uncovering values in practice through the design of tarot cards [61]. In the subsequent four sessions, we conducted a series of collaborative mapping activities where the participants co-created maps over a base layer of Mandal Valley. Our decision to use maps was inspired by existing studies employing collaborative mapping as a commoning practice to articulate issues at stake [50]. These sessions aimed to 1) understand the participant's perceptions of their relationship with the social and environmental issues that persist in the local community; 2) elicit the ways by which the research group leveraged technologies and data towards their research goals; 3) assess the history and capabilities of HRP in terms of community engagement; and 4) speculate on strategies to mitigate and resolve conflicts faced by the research group.

The participants were divided into two groups, based on the ongoing initiatives at HRP, with each group co-creating its own map. Throughout this map-making process, we asked participants to use the map and poster as a medium to discuss topics related to their technology and data use, local community interactions with these technologies, their relationship with the community, and to envision ways in which the conflicts they experienced could be addressed. The four collaborative mapping sessions were conducted using printed maps, coloured markers, stickers, post-it notes, and posters. After each session, participants shared their maps to collectively discuss and reflect upon the process and themes of each mapping exercise. Each mapping prompt was followed by a reflective exercise in which participants were asked to sit in silence for a few moments before writing about how they felt. This deliberate deceleration in our approach was an effort to mimic the pauses of HRP's fieldwork practice and to cultivate the value of slow work, which is critical when staying attuned and accountable to the fluctuating conditions within community-based environmental research [43]. The aim was to facilitate a relational, historical, reflective, and situated understanding of the conflicts and to collectively probe beyond just identifying the explicit forms of conflict that participants encountered at the field site.

3.3 Data Interpretation

To analyze interview, field notes, and mapping workshop data, we used reflexive thematic analysis (RTA) as outlined by Braun and Clark [16]. Pseudonyms have been used in this paper to preserve the anonymity of the community members and the researchers of HRP (Table 1). Following the RTA procedure, the first author initially developed codes based on reflections on how conflicts at the field site emerged and how they were discussed, negotiated, and debated. During this process, it became clear that the emerging themes were not isolated; rather, they pointed to the deeply entangled nature of the conflicts that operated across different scales, from the institutional and political to the local, group, and personal. As such, after reflecting on our data analysis process and discussions among the authors, we decided to revisit the data and develop the codes and subsequently consolidated them into themes that were in accordance with the Ecologies of Contestation Framework [77].

Ecologies of Contestation Framework. Sawhney and Tran's Ecologies of Contestation Framework provides a multi-scalar approach to understanding how contestations are shaped by historical conditions, power relations, material artifacts, and stakeholder values [77]. Comprising four interrelated ecologies, the framework helps unknot interconnected social, political, and value-based considerations when analyzing studies in contested spaces. These include 1) "The Socio-Cultural Ecology," the broader social and political conditions of a design undertaking with which a practitioner must engage with; 2) "Ecologies of Power," the relations and social hierarchies between participants, designers, and stakeholders; 3) "Constructed Ecologies," the material and design constraints emerging during design interventions; and 4) "Values-based Ecologies," which focuses on the ethical considerations and values of designers.

Our findings (Section 4) are structured according to these four ecologies. Sawhney and Tran note these layers are not silos but permeable. We therefore present our findings by ecology for clarity, while demonstrating how they bleed into one another to produce the entangled conflicts we observed in the field. Importantly, this framing facilitated the incorporation of more-than-human and socio-ecological perspectives central to these conflicts. We also adapted specific aspects to fit our social contexts and methodological approach. For example, while the original framework centers the values-based ecologies on the practitioner, we extend it to include the values, ethical dilemmas, and reflexive insights of the research participants.

3.4 Positionality

The first author was born and raised in the neighboring Indian state of Himachal Pradesh and could be considered a "native" researcher insofar as his birth location, kin, and appearance align with the characteristics of an Indian-born, upper-caste, Hindu, cis-male-presenting, and abled adult. Notably, being male and having the last name *Chauhan*, signaling the upper-caste Rajput Hindu class, afforded him certain privileges when navigating local social structures. While completely divesting himself of these social attachments was impossible, he made a conscious effort to reject patriarchal or caste-based situations. His proficiency in Hindi and English allowed him to engage with both the local community and the visiting researchers. Despite these "insider" characteristics, his

Pseudonyms for HRP members	Role within HRP	Participated in the workshop
Rudraksha	Director / founder	No
Beej	PhD researcher / co-director	Yes
Cedar	PhD researcher / co-director	Yes
Chandan	PhD researcher	No
Neem	Local community member and research assistant	Yes
Peepal	Research associate	Yes
Banyan	Local community member and research assistant	Yes
Khazoor	Local community member and research assistant	Yes
Shami	Research assistant	Yes
Tulsi	Research assistant	Yes
Patra	Research assistant	Yes
Bans	Research assistant	Yes

Table 1: List of HRP members

weak grasp of the sub-regional Garhwali language and hyper-local customs often positioned him as an outsider. This otherness also manifested in subtle power relations during his interactions. Consequently, his analytical interpretation weaves through multiple social identities and incorporates various positions within the liminal spaces of being an outsider to a Garhwali community, a native of the broader Indian-Himalayan region, and a Western-educated HCI researcher. His positionality afforded access that others might not receive. The methods we describe may not be transferable without careful attention to how researcher identity shapes what can be surfaced and engaged with in fieldwork settings. These positions informed his analysis of the forest excursions and scientific practices.

The second author is an ecologist and anthropologist who has been conducting research in Mandal Valley with HRP for six years. He introduced the first author to the field site. He can speak Hindi and can proficiently understand the local dialect, Garhwali. He participated in the workshop and, in this paper, ensured that Mandal Valley is adequately represented as an ethnographic subject. The second author recognizes the subtle power dynamics that shape his identity and conduct in Mandal Valley by virtue of being a Western-educated researcher and having spent considerable time in this geography.

The third and fourth authors are affiliated with North American universities. The third author was born and raised in a region proximate to the study site, where state-initiated participatory rural appraisal [21] and community-forestry programs have led to both conflict and more inclusive decision-making processes. This experience has influenced his research, including his interpretation of observations and outcomes in this study. The fourth author brings extensive experience working in environmental data and mapping research across the Global South and the Global North, contributing insights from cross-institutional engagement.

4 Findings

4.1 Research practices can perpetuate conflict by intersecting with a legacy of contested land rights and contemporary economic pressures

Conflicts in Mandal Valley were found to be embedded within a complex socio-cultural ecology, defined by a legacy of contested land rights, social hierarchies, acute contemporary economic pressures, and competing imaginaries for the region. Interviews, observations, and group discussions with HRP members and the local community revealed that research practices, mediated by field technologies, and the movement of the alloprimates wove these conflicts into the broader socio-cultural fabric of the valley.

While HRP members operated with state-issued research permits, our fieldwork revealed that these documents often fueled conflict due to their jurisdictional ambiguity. For example, members of the HRP operated in Mandal Valley with research permits issued by the Forest Department. The permit process, rooted in the Wildlife (Protection) Act 1972, is plagued by bureaucratic delays and insufficient guidelines for research in protected forest areas. HRPs research permits covered state-controlled sanctuary areas but offered no clear instructions for the community forests where the researchers regularly experienced conflicts with locals. Protocol also required HRP members to register with the local police, which bypassed direct engagement with the Van Panchayat. The arduous nature of this process was highlighted when a non-Indian researcher was denied a permit during our study. In the workshop, the participants were initially asked to describe challenges in conducting research at the field site. They described how these top-down permits were not always viewed as legitimate by the local community. Workshop participants Peepal and Patra described conflicts where the locals disregarded the researchers' permit-based claims to access the community forest. Asserting control over the community forests, locals often demanded that HRP members shift their research away from community-forest areas, stating, *"Take their animals with them, so that they do not destroy the forest produce as well as the agricultural output in their [community-governed] area."* In these moments, what we observed during fieldwork excursions was not necessarily

an antagonistic position by the locals, but an assertion of their sovereignty over the land instead of acknowledging a distant government's power. Vagueness regarding the permits showcased how the legacy of colonial and post-colonial environmental policies continues to shape local agency and tensions.

In Mandal Valley, the historical tensions between state control and local autonomy over land use were layered with contemporary economic and political pressures. Banyan, a local research assistant for HRP, like most men in the valley, ploughed his family's agricultural fields. In an interview, he discussed the concerns of being dependent on crop yields. Banyan stated that the traditional subsistence livelihoods are under strain wherein agricultural yields of wheat and millet are often no longer sufficient to sustain families. As a result, this has led to an increased dependency on buying imported grains and rations from shops or nearby larger towns. Furthermore, Mandal Valley has been deeply impacted by the growing tourism-based economy, which has emerged as a significant, yet divisive, economic driver in the Indian-Himalayan region. This is because the benefits of tourism in Mandal Valley were not distributed evenly, primarily favoring properties with direct road access. Such differences fueled competition and a stark shift in land use, with some families converting their agricultural fields into tourist lodges, restaurants, and shops. Over time, this economic transition has materialized as a continuous process of environmental change, one that has unfolded over years and was actively observed during our ethnography. The environmental consequences of this transition are cumulative, manifesting both as an ongoing trend and an active reality during our fieldwork. We observed the steady encroachment of tourism infrastructure, such as local eateries (*dhabas*) and hotels, onto forest and agricultural land. This expansion is actively reshaping the valley's ecology by intensifying the demand for forest resources, such as firewood, and by displacing traditional grazing areas.

During our study, we observed that the Uttarakhand state's push for tourism revenue has transformed traditional pilgrimage routes into sites of administrative conflict. While Uttarakhand markets itself as a destination for religious tourism, the actual infrastructure supporting these remote pilgrimages is highly regulated by the FD. Pilgrimage sites around Mandal Valley are located inside the sanctuary boundaries, in climatically sensitive alpine meadows. HRP members have also conducted research on human-wildlife interactions in these meadows. While GPS mapping the Mandal-Rudranath route, we witnessed this tension firsthand when the FD raided and dismantled a seasonal shelter established annually by a local family for pilgrims. As such, local community members, who have accessed these meadows for centuries to worship deities like Rudranath, now face bureaucratic policing. Although locals view these services as an ancestral right and a necessity for pilgrim safety on tough trails, the state often classifies them as encroachments. Locals thus bear the brunt of strict enforcement. This creates an entangled landscape where formal policies intersect with economic precarity and the competing imaginaries of researchers, officials, pastoralists, and pilgrims vying for the valley's future.

The community makeup within Mandal Valley is not unified or homogeneous, and it is imperative to state that issues of casteism and patriarchy are tenets within the social and cultural fabric of the region. For HRP, these issues emerged through the employment of local community members as research assistants. Neem, a research assistant who had been working for HRP for three years, was from a 'lower' Hindu caste. His employment was not looked at favorably by several upper-caste sub-communities, who had stated their disapproval and had recommended other members from their sub-communities for employment. In such cases, HRP always declined these offers, but members had to navigate sensitive seams of caste discrimination in the socio-cultural dynamics of the region. In the examples of the research permits, tourism, and employment, it becomes evident that HRP was entangled in pre-existing social hierarchies and power relations. These entanglements complicated the positions of HRP's members, in particular for the local community members who were hired as research assistants. Their actions disrupted local customs, hierarchies, and politics, leading to conflict with the broader community.

These place-based conflicts that we describe above informed the design of the subsequent workshop. In the first mapping activity, the participants were asked to locate instances of conflict spatially, thereby connecting them to their research practice and lived experience. Participants articulated how resource competition extended beyond agricultural fields and into the community forests. After this mapping session, Cedar noted that, even in the forests, conflicts are primarily over resources such as grass and wood. Cedar, Peepal, and Patra further recounted a confrontation with a local shopkeeper who was frustrated by the destruction of trees by the langur troop. This led to a conversation about the interactions between locals and the langurs. Shami explained that a common bone of contention is *"the trees that both supply fodder for the livestock owned by the local community"* and *"are also a source of food (new and young leaves) for the langurs"*. The group discussed how langurs feed on and damage agroforestry trees planted within agricultural fields and near forest edges. This anecdote is one instance where, in the workshop, the nuanced and deeply personal nature of resource competition was connected with the broader socio-cultural landscape.

Much like other closed-knit communities in the Himalayan region, kinship in Mandal Valley extends to more-than-human life [45]. Here, more-than-humans are entangled within folklore, and the forest is an important aspect in the imaginaries of the communities. For instance, members of HRP were invited to a local *Jaagar* ceremony, where the serpent god (Naag Devta) was evoked. Notably, such moments that interwove more-than-human entities with local folklore often brought the community and HRP members together into a shared space. The cultural fabric of folklores within Mandal Valley was traditionally woven around seasonal rhythms that included the slow turn of agricultural cycles and the corresponding shifts in forest and land use. However, in our fieldwork study, we observed growing tensions between this historical pace and the pressures of a burgeoning growth-based tourism economy. Over time, this acceleration frayed the social and ecological balance and replaced periods of seasonal quiet with a continuous competition for resources and space, which formed the backdrop for the conflict. The conflicting imaginaries regarding the usage of the forest area in the Mandal Valley were a key reason for the disputes between the researchers at HRP and the local community members.

4.2 Data practices assert a worldview that overlooks more-than-human realities, local expertise, and situated forms of knowing

As noted in Section 4.1 above, the conflicts experienced by HRP members were entangled with historical, social, and political dynamics. We now unpack power relations between various actants to either explain or push the boundaries of the broader socio-cultural ecology [77] We describe how digital practices enacted within these relationships by actors such as the HRP members, the state, and non-profits within Mandal Valley created a very particular worldview that often neglected more-than-human realities and local expertise.

4.2.1 Power relations with the more-than-humans. The primary form of conflict faced by HRP was community opposition to research activities tracking langur behavior as they moved across the valley from one community forest to another. HRP's research involved daily trips throughout Mandal Valley to closely trace langur movements and behavior. Although several langur troops inhabit the region, the research group primarily focused on one troop whose movements frequently crisscrossed the valley, traversing community forests, the state sanctuary, agricultural fields, and villages (as seen in Figures 1 and 4). HRP members would follow the troop throughout the day, from their last recorded sleeping site each morning until they settled at their next. This nearly daily research practice required patience and often was a silent, constant, and focused activity. It involved dwelling in the stillness between events, waiting for specific behaviors, while actively tracking, following, collecting data, and discussing the troop's trajectory. Beyond langur behaviour, HRP also collected other ecological and environmental data. For example, HRP members had previously marked and numbered trees in the valley frequented by the troop to collect phenology data. One session involved following Beej and Khazoor as they walked between crop fields to examine the trees used by the langur troop for feeding, resting, and movement. Beej would approach each marked tree (Figure 3), observe it, and then dictate the phenology data to Khazoor, who would input the data onto a tablet:

> *"Okay next we have tree number 510. YL2ML2, and then, UR-RR-0-FL-FL Bud 0. Leaf Bud 4 Fern 0. Moss 30% Canopy medium Petiole green Dead Leaf 0 Lichen 0."*

During the workshop, after mapping HRP's research locations in the valley, the group discussed how this process of data collection for phenology appeared as a routine scientific procedure for them, necessary to understand the landscape relative to langur behavior. However, for locals, the trees enacted a different, vital role. The oak trees, meticulously catalogued by researchers, were the same ones lopped by villagers (usually women) to collect fodder and line cattle sheds. Simultaneously, they served as a critical food resource and traversal route for langurs. Trees within the crop fields thus became sites of convergence for multiple actors: the community members, the researchers, the langurs, the trees themselves, and other more-than-humans. Far from neutral objects, they were focal points of a multi-layered conflict rooted in competing claims over resources, scientific projects, and regional socio-economic pressures. Beej

Figure 3: An oak tree *(Quercus leucotricophora)* marked for phenology by HRP members

raised the issue during a moment of group reflection after mapping conflict zones on the map. They stated:

> *"It became clear to us that rising temperatures and the ongoing encroachment on the langurs' high-altitude habitat are driving a shift in their movement. That's why the troop has been forced into the [agricultural] fields and [community] forests to find food."*

These changes were resulting in tense human-wildlife interactions where the economic needs of the local community often clashed directly with the ecological needs of the langurs and the data requirements of the research group.

4.2.2 Institutional and State power. In the workshop, Banyan, also an experienced birder from the local community, shared his frustration regarding the FD's institutional power over the region's ecotourism initiatives. He described the FD department attempting to co-opt the local birding and tourism sector by hiring non-locals sympathetic to the FD for short-term projects instead of experienced community members. Banyan explained that the FD received a budget for these initiatives, but he suspected the funds were being misused by officials, with the actual costs being much lower than what was claimed. This top-down control of forest activities extended to land governance, where designations like National

Figure 4: The langur troop moving through from the community forests into the Kedarnath sanctuary. The stone wall demarcates the two forest designations.

Parks and Sanctuaries become political categories dictating access rules based on state or central authority. Consequently, local expertise, work, and livelihoods are sidelined in favor of state-controlled economic and conservation agendas.

The complex, opaque nature of this institutional influence emerged during a discussion with a member of a local environmental justice and women's welfare NGO (non-governmental organization). They explained that the FD often outsources community work by hiring organizations like their NGO to create five-year micro-plans for the villages. These micro-plans are part of the National Mission for a Green India under the National Action Plan on Climate Change, aimed at developing climate adaptation strategies for forest-dependent communities and vulnerable species/ecosystems. In Mandal Valley, enforcing these micro-plans required NGOs to survey villagers on metrics like household population and firewood usage, with the data then being passed back to the FD. In a way, the state authority operated through proxies, wherein the FD was tasking NGOs with the work of community data collection. By doing so, actions resembling grassroots community participation were ultimately co-opted into state-directed goals to serve the FD's agenda. This power dynamic is reinforced by the fact that the agency of the local Van Panchayat in Mandal Valley has been marginalized, with meetings usually happening only when the FD introduces a project to the community, thereby often making the FD the sole agenda-setter for community forest governance.

4.2.3 Power-relations and technology. Power relations were also expressed and contested through the research practices that were mediated by the technologies used in the field. The subsequent data practices originating from field technologies also speak to an institutional power that prioritizes a scientific worldview and, as a result, stripped the entangled landscape and livelihoods of the people and more-than-humans of their local meaning and context. Local community members contested this power by directly confronting the researchers. For instance, during one particular fieldwork excursion, members of HRP were conducting a langur troop scan. Scanning the troop meant keeping track of the activity of visible individual adult and juvenile langurs, as well as recording the average GPS location of the troop every 10 minutes over the course of the day. This meant using various field technologies such as GPS devices, range finders, tablets, binoculars, and temperature and moisture sensors.

A local woman, gathering wood and leaves, approached the HRP members and accused them of bringing the langurs into the village's agricultural fields.

> Villager: *"Languro ke saath kya kar rhe ho? Languro ko yahan kyun leke aa rhe ho?" (What are you doing with the langurs? Why are you bringing the langurs here [towards the fields])*

Neem, a local research assistant, had faced this situation before, and so, to de-escalate this confrontation, lied, claiming:

> *"Hum to bas chidiya dekh rhe hain, unke photo le rahe hain." (We are just observing and taking pictures of the birds.)*

This interaction was one of the many exemplifications of the ongoing and, nearly, daily negotiations of power, where researchers had to alter their behavior in response to the community's assertion of their right to the land. After moments like this, the research group would usually pause their data collection and research activities for the day. In the workshop, when discussing the consequences of the technologies that the HRP employed during fieldwork, Shami mentioned:

> *"... binoculars were said to be cameras, and they [locals] said that we use cameras, binoculars, and food, to attract the langurs, or that is how we bring them with us."*

At times, this relationship between certain local community members and the researchers rested on the perception that researchers have a form of agency or control over the movement of the langurs. These encounters revealed that in a fieldwork context where formal participatory channels for local communities are absent, conflict is not an obstacle to participation but rather is a form of political engagement through which the local community asserted its presence, knowledge, and issues into research practices that unintentionally operated in exclusionary ways.

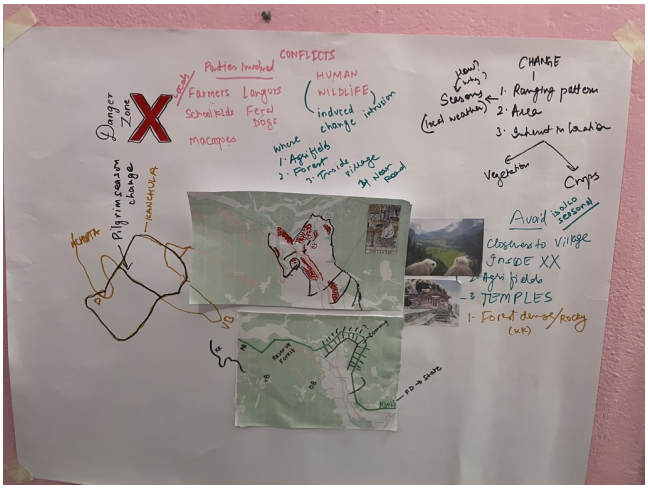

Figure 5: Artifact from the collaborative mapping exercise depicting areas where the researchers most often faced conflict. The group had started to mark out certain zones in the valley where they found it challenging to conduct research due to conflicts.

4.3 Collaborative mapping can surface latent conflicts by making research technologies and data practices an object of collective reflection

In the workshop, the collaborative maps became useful co-created artifacts that gave a relational form to the conflicts for the researchers and local research assistants. Although a reference base map layer of Mandal Valley was provided, the participants created their own maps to add details and contexts when discussing conflicts (Figure 6). These maps detailed conflict-related experiences, the connections between research and local community practices in the forest, locations avoided by HRP, and seasonal impacts upon their research activities.

In one mapping activity, participants were asked to locate areas where they found it challenging to conduct research because of strained relationships with the local community. The mapping process brought out rich descriptions of various kinds of conflicts in terms of the different actants, such as farmers, tourists, state officials, langurs, feral dogs, and other primate species (macaques) in the valley. The conflicts were also described in relation to broader sociopolitical and environmental patterns such as seasonal agricultural practices, tourism initiatives, and changing livelihoods and microeconomics of the community. In doing so, the participants were actively shaping the constructed ecology to better fit their lived experience by extending the pre-defined constraints of the map and creating their own representation of the valley.

While mapping, the group visualized and reflected upon how their data collection approach was highly dependent upon social, personal, and environmental factors such as incidents of community aggression against the researchers, harsh weather, health of the researchers, and community events/festivals. These factors eventually impacted the reliability of the quantifiable data that was being collected about the behavior of the langur troop. As participants marked *"danger zones"* on their maps (Figure 5), they explicitly linked moments of dispute to scientific failure, stating that when conflicts arise, *"We lose opportunity… I lose samples"* and *"We lose data"*. What this resulted in was that the researchers' motivations and their research were often devoid of and detached from interactions with the community. Therefore, any conflict of the researchers or the langurs with the community during their *fieldwork* practice was considered a loss of potential data that could be collected. For instance, Beej explained how they combined GPS data and observation of langur behavior in order to formulate an understanding of their environment and motivations.

> *"So we'll combine the [langur] activity with the GPS scan, and then we will combine this data with their vegetation data, and we will see that if there is any motivation available in their landscape for them to move from point A to point B or what are the characteristics of point B which may have attracted them to move towards point B."*

This process, while scientifically valid in its own frame, tended to strip the more-than-humans and the landscape of their local meaning and relational context. In doing so, the primatologists' practices render the more-than-human world legible as data. For the third mapping activity, the participants were asked to reflect on how their technology use and data practices were related to the conflicts that they experienced. The collaborative maps served to make the existing constructed ecology of their daily research practice an object of reflection. The research group created an inventory of the technologies and software that constituted their research practice. Here, the researchers reflected upon the impact and practices of the tools that they used daily. Shami brought up instances where locals had confronted them when the research group was collaborating with a documentary team in the valley:

> *"One way locals think about our technologies is that they sometimes think of these devices as like spy devices. What happened is that when the [documentary] team was here, the locals saw walkie-talkies and other gadgets, and they complained about us to the police that we are spying on them… The locals were also complaining that the cameras would trample their crops and were shouting, 'You go away, go away!'"*

In the process of reflecting upon their research technology practices during the mapping session, HRP members connected their activities in the agricultural fields and community forests to the emerging conflicts in the valley.

4.4 Confronting conflicts enables participants to grapple with their positionality and the ethical contradictions of their work

The persistent conflicts in Mandal Valley forced HRP members into a continuous and, often, uncomfortable process of internal reflection. This required navigating the friction between scientific and ethical objectives while confronting the messy realities of positionality and the unintended impacts of their research. These internal

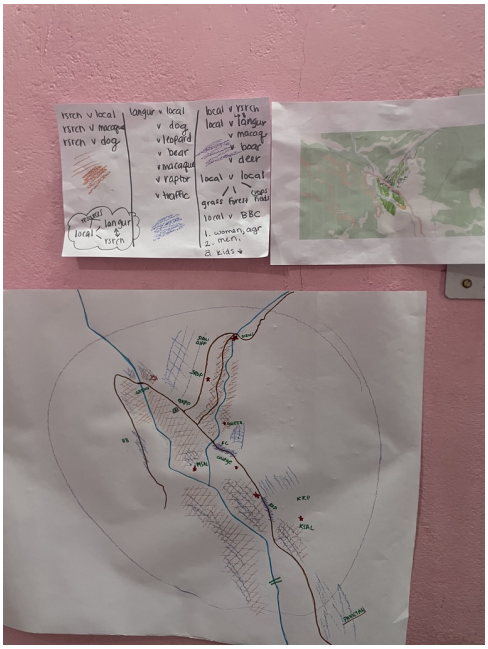

Figure 6: Map co-created after participants discussed the various actants of conflict in Mandal Valley.

conflicts were surfaced and untangled during the workshop. During the initial collage-making activity, both visiting researchers and local community research assistants articulated their values as residents of Mandal Valley. For instance, describing their collage, Beej stated that their primary motive was not research but *"understanding these mountains and experiencing a way of life"*. They further elaborated:

> *"I'm always thinking about what goes on in these deep forests or in this kind of landscape. So that's where I derive all my actions. Obviously, a sustainable life over here is important, but the life is impossible without the people who I meet."*

Meanwhile, Cedar, having navigated various thorny moments in Mandal Valley as an outsider and a woman, presented a candid expression of her struggle with positionality. She shared her self-doubt and the ways by which she had to consistently make a conscious effort in Mandal Valley *"not to be like a colonial white person just taking data out of the country and then leaving."* Cedar further explained why they had been conducting weekly nature and environment classes with children from the Mandal Valley for a couple of years. Cedar's goal here was that through these classes, the community could eventually understand the need for conservation and environmental research in the valley. Overall, starting the workshop with the collage-making activity created a reflexive environment that persisted throughout the subsequent collaborative mapping activities. Participants' reflections were indicative of the complexities in balancing the ethical integrity of their work and identity with community and place-based relationships.

HRP members constantly navigated ethical tensions, as their presence was both a source of conflict with the community and yet felt essential for langur conservation. In the fourth mapping activity, participants discussed HRP's impact on the community over its decade-long presence. Tensions over historical approaches emerged when Neem, a local research assistant, stated that the research activities of HRP had a *"negative effect on the [local] people,"* and had made them *"more agitated."*. Others immediately countered that without their presence and research activities, the langurs would be either dead or displaced. Here, they were referencing incidents where villagers had poisoned several langurs of a troop that were frequenting the agricultural fields. This heated exchange, among others, speaks to the core of their values and struggle in the ways that they grappled with the moral weight of a situation where their work simultaneously led to their antagonization with some members of the community while attempting to conserve the langurs.

Collaborative mapping activities and subsequent reflections sparked unexpected discussions about the conflicts experienced by the group. By mediating contestations, the activities prompted critical re-evaluation of the participants' agency and limitations, such as failed community-based initiatives. For instance, HRP members had planted kiwi trees with several families as a way to introduce a new form of income into the local community. In the workshop, HRP members argued that this project did not succeed as it felt like surface-level engagement with the community, wherein the research group had not adequately understood local motivations and issues. Neem voiced his concern:

> *"You distributed kiwi [plants], but there was no benefit in that. There was no [community] interest because it was free. Why would someone say no to a free thing? As a villager, suppose you guys [external researchers] come to me and say, we want to give you a kiwi. Sure. You give me a kiwi. But then planting it harvesting it is a totally different process. There's a lack of accountability in that, right?"*

Khazoor echoed similar sentiments: *"Research is only useful in the forests, not elsewhere. Research only benefits other research."*

Participants cited a lack of social sciences training and academic structural constraints as barriers to sustained community engagement. As one researcher admitted, *"We are first and foremost primatologists and environment researchers… we don't have the training specific for community-based conservation, how to think in that way, and how to approach and design for community relationships."* This self-assessment exemplifies how mapping exercises allowed the group to carefully nurture conflictual sentiments to support reflection. The session was useful in surfacing internal struggles, revealing that the team's values were actively being reshaped by their field experiences. Consequently, they questioned their efficacy and the ethical implications of conducting research without proper community partnership.

During the final mapping session, participants emphasized that building equitable relationships required deeper collaboration with the local community. Weeks later, HRP collaborated with a local NGO and high school to build reciprocity by leveraging their research skills, strengths, and practices. Beej and the first author joined a one-day seminar introducing students to environmental justice and climate change impacts in the Himalayas. We presented

a tutorial on field technologies such as using a rangefinder, GPS, and binoculars. Here, we shared our work with the community, describing the need for community-engaged conservation and the ways in which langurs help the environment.

5 Discussion

Through this study, we make two primary contributions to HCI. First, we build on our ethnographic study to demonstrate how digital practices within environmental research can constitute sites of conflict in community-governed commons. We show the value of these conflicts to gain insights into the complexities in the field site — it renders visible deep-seated social, historical, and political insights about the setting that would otherwise remain inaccessible. Second, building on this argument, we offer "staying with conflict" as a practical orientation for design research situated within contested and complex settings. To this end, we provide four strategies on designing and facilitating arrangements where the collective can stay and engage with the conflicts that arise rather than prematurely resolve them.

5.1 Digital practices as a source of conflict

Our study reveals that the datafication of environments is a site of conflict. Central to these tensions are the digital practices, like GPS tracking, primate behavior monitoring, and environmental sensing, that transform environments into sites of data production [36]. These practices prioritize a particular worldview operating through strategies that Westerlaken [83] define as digital logics, where capturing technologically convenient metrics marginalizes local significance. By limiting local participation to data gathering, these strategies overlook the site's socio-cultural fabric and produce conflict with situated practices of knowing. Practices of observation and capturing [36], for example, HRP's initiatives, FD surveys, and state-led environment initiatives, made Mandal Valley's socio-ecology visible in specific ways. However, this rendered other realities and concerns invisible, specifically the more-than-human relations and the socio-ecological practices that defined the local commons.

Our study demonstrates how conflict emerges when the digital logics of environmental research [83] are enacted in contested field sites, reflecting broader environmental governance concerns. In Mandal Valley, the oak trees enacted multiple identities, serving as integral components of the socio-ecology, commoning activities, and the subsistence economy. However, digital practices reduced them to abstract data points, stripping them of their relational meaning to phenology codes or demarcation markers [14]. These methods imply a consensus approach [26], assuming objective data forms a neutral ground for understanding the environment. Consequently, data-driven environmental initiatives reframe community confrontations as data loss. This reductionist logic [54] treats conflict as a technical problem, sidelining community concerns. In Mandal Valley, digital practices failed to adequately encompass local worldviews within their logics. By failing to incorporate local worldviews, digital practices fueled suspicion and resistance to what locals perceived as an intrusive challenge to their sovereignty and control over environmental narratives.

The findings lead us to argue that the design of environmental data initiatives cannot be separate from questions of control, governance, and sovereignty. As a field, we know that tools embed assumptions about who has the authority to define, measure, and interpret a space [10, 29, 85]. Design interventions must attend to data politics, exploring whose worldview is encoded, whose knowledge is marginalized, and, potentially, how design of data practices can promote equity. Our work extends growing HCI work on data justice [26, 35, 79, 82] by showing how even well-intentioned research approaches and data tools can become instruments of conflict when deployed without attention to enmeshed and complex community dynamics.

To that end, engaging with conflicts provides valuable insights into long term socio-political, historical, and ecological issues at the field site. Drawing on Agrawal's concept of the *making of environmental subjects*, we posit that digital practices are key actants constituting specific subjectivities for communities, researchers, more-than-humans, and institutions, that lead to conflict [2]. Therefore, surfacing latent conflicts is necessary to disrupt the reductions, digital logics, and binaries shaping these subjects. Moreover, acknowledging conflict, in contrast to co-existence, emphasizes the necessity of sustained engagement with incommensurable tensions and continuous negotiations. Indeed, langur movement through agricultural fields demands not simply tolerance but collective action to balance tensions arising from historic realities of colonial land demarcation, contemporary but persistent economic precarity, and competing imaginaries of environmental conservation. For HCI, we suggest designing approaches that disrupt hegemonic, anthropocentric values and foreground contested subjectivities and more-than-human perspectives at commonly governed sites [23, 84]. However, as Westerlaken et al. [84] cautions, digital practices and participatory interventions can risk exacerbating existing power dynamics. Our workshop attempted to mitigate this by materializing the conflict to support participant reflection on its entangled nature, their positionality, and ethical contradictions. To approach contested sites effectively, we argue that researchers must learn to stay with conflict, utilizing the strategies we detail in the following section.

5.2 The practice of staying with conflict

By "staying with conflict," we mean the active process of engaging with tensions to uncover their root causes without pushing to resolve them immediately. Inspired by Haraway's arguments on the need to engage with the *thick present*, we posit that a rush to resolve complex disagreements risks erasing the messiness and entangled nature of the social, historical, and political issues at play. A more generative approach, informed by the agonistic turn in PD, is to create temporary arenas where conflicting perspectives can be productively articulated [11]. We contribute the following strategies for facilitating arenas of staying with the conflict so that differences can be productively articulated, debated, and re-imagined.

5.2.1 Articulating matters of concern via contestational objects. The mapping sessions supported inquiry through adversarial design [30, Ch. 5], where co-created maps clarified situations that were otherwise invisible. Functioning as contestational objects, these

maps linked adversarial sentiments, digital practices, and community relations to broader environmental politics. This process reconceptualized seemingly simplistic researcher-local community conflict into ongoing and entangled tensions. The co-created maps aided in linking field technologies and work practices to the broader environmental politics [30]. The participants' willingness to untangle the conflict reflected their stake as outsider researchers or, in the case of the local research assistants, members of the community. As such, approaching conflict from various perspectives through mapping and reflection was crucial for participants to understand local contestations and foster attachments to these issues. This was particularly vital for HRP researchers struggling to nurture reciprocal relationships with the community. By co-creating contestational objects, the group devised strategies to support the community as active partners instead of just "friendly outsiders" [39], given their unique skills, resources, and experiences. Facilitating the co-creation of contestational objects requires promoting a space that connects local grievances to the broader political discourse. This can go beyond the more immediate, localized problems to draw out historic issues and concerns. Workshop organizers might ask questions that tie people's everyday experiences to larger structures, such as "Where do you encounter regulations that feel like an imposition" or "What places mean something different to you than to the authorities?" Such inquiries are invitations to create contestational objects.

Through this process, the workshop evolved in unexpected and productive directions regarding HRP's relationship with the geography, ecology, and communities of Mandal Valley. Consequently, new conflicts surfaced, notably the double binds researchers face balancing long-term community relationship-building against institutional demands of condensed research timelines. Our work advocates for designing spaces that introduce conflict to align perspectives and envision a shared future between multiple actors. This entails prefiguring spaces for the other, enabling sensitivities and sensibility, and co-envisioning futures grounded in shared understanding between conflicting actors [62, 70]. We facilitated this by designing multiple, flexible pathways in the mapping sessions that allowed participants to stay with and steadily approach conflict. This enabled new, generative understandings to emerge from the contingency of the moment rather than a strictly predefined agenda [4]. By surfacing and sustaining differences, we rendered varied, nuanced, and difficult-to-articulate matters of concern visible to all.

5.2.2 Designing for the micro-politics of relations, pauses and between-ness. Our work engages with scholarship arguing that design approaches should matter and address 'big issues' by re-politicizing design for future engagements [12]. However, we highlight the importance of designing environments where contested issues are given form rather than resolved. This allows them to evolve into unexpected directions and imaginaries for alternative futures, and reveal deeper understandings of breakdowns [48]. We liken this to Akama's concept of 'Ma' or 'between-ness' [4], which focuses on the micro-politics of relations and the generative potential in pauses and relations between entities rather than in the entities themselves. Our study drew on the more-than-human rhythms of the valley, specifically the first author's experiences observing HRP members and langurs in the community forests. These nearly daily trips to the forests, following the langurs, were filled with moments of silence, reflection, and pause, and the "un-named tones and expressions" [4].

By arguing for 'Ma,' we challenge dominant collaborative and participatory practices built on tight agendas, action-oriented facilitation, and pressures to resolve disagreements into actionable outcomes. Staying with conflict requires designing against these pressures. To translate this into the workshop, we utilized reflective prompts and pauses following each mapping exercise. These moments allowed participants to step back from the immediate tensions and question their roles and obligations toward the valley. In doing so, our collective space reimagined the valley and its inhabitants as *oddkin* [48] that demand reciprocal attention and care. This aligns with post-human design approaches that argue for *decentering* by slowing down and turning towards the self to problematize established centers [66]. Because conflicts evoke strong embodied feelings that unfold gradually, engaging with them requires commensurate time. We learned that designing for between-ness can be a generative motivation for designers to create that time. Ultimately, supporting the practice of staying with and unfolding the nuances of conflict requires patience and careful deliberation so that participants can understand themselves and their relations to others.

5.2.3 Supporting the narrative dimensions of data. While Section 5.1 detailed how digital practices generate conflict, here, we argue re-imagining data and digital artifacts as narrative tools can alleviate harms emerging from conflict. Following Crooks and Currie [26], adopting agonistic data practices that utilize affective and narrative dimensions of data can support productive pathways of staying with conflict. The workshop's co-created maps exemplified this: researchers revisited geospatial maps that were typically treated as scientific instruments as narrative artifacts. This re-visitation of maps as narrative tools for worlding [48] enabled a relational exploration of *becoming with* the socio-cultural, political, and historical entanglements in the valley. We advocate for incorporating multiple narrative layers into environmental data [79], for instance, by supporting communities to annotate GPS data with stories, augment sensor readings with local meanings, or create counter maps reflecting local ontologies [17]. When geospatial representations become anchors for memory and meaning, they lose their pretense of objective authority and thus become available for contestation.

Practically, this also materialized post-workshop when HRP members shared environmental narratives with local schools and environmental-justice NGOs. In inculcating a narrative dimension from their prior data practices, the group sought to move away from the role of "friendly outsiders" and toward active partnership and convivial forms of environmental work [18]. We posit that staying with the conflict, particularly in situations where technologies and data have done harm, requires their careful re-visitation with affect and storytelling to inspire generative outcomes between common adversaries.

5.2.4 Reflecting upon subjectivities. In sites facing environmental governance issues, the value of staying with the conflict lies in its ability to intervene in the making of environmental subjects [2]. Because the conflicts we encountered stemmed from a long and

fraught history of contested *technologies of government*, it was essential that we enable a reflexive space to examine and reinterpret subjectivities arising from colonialism, patriarchy, and caste-ism, alongside ongoing technologies of government like research permits, digital practices, and property reforms. Our study challenged researchers to confront the political implications of their presence while providing local assistants space to articulate local knowledge. Staying with the conflict thus creates the reflexive space necessary for subjectivities to be examined, contested, and potentially transformed [70]. While research often treats positionality as a fixed disclosure where one's self precedes the engagement, we found that positions are actively negotiated and in a continuous state of *becoming* [4], leading to alternative possibilities. For instance, Cedar's reflexive struggle of being a "colonial white person taking data" was not resolved. Indeed, given their position, it cannot be. Yet, it was made workable through sustained local engagements. We therefore contribute to agonistic and adversarial design practice by arguing for creating conditions where participants can renegotiate their identities in relation to each other and the matters of concern that bind them as engagements evolve.

6 Limitations and Future Work

This study has several limitations that bound our claims. First, our mapping workshop involved only HRP members, not the broader community members with whom conflicts occurred. While we justified this choice (Section 3.2), it means our findings reflect one perspective on a multi-sided and entangled conflict. Future work should explore safely including antagonistic parties in a participatory process without exacerbating harm. Second, although grounded in long-term ethnography, this paper includes a single workshop that represents a moment in an ongoing negotiation. We acknowledge that we cannot claim that "staying with conflict" produces durable change; longitudinal research is required to understand if observed reflexive shifts persist and translate into relational practices. Third, our findings are rooted in a specific history of land governance. While we believe the strategies we articulate have broader relevance, applying them to other contested settings like urban commons or digital platforms requires careful adaptation.

7 Conclusion

This study has detailed an ethnographic and mapping intervention within a contested environmental research site in the Indian Himalayas. Through an adversarial design approach, we sidelined the immediate need to resolve conflict and instead diverted our attention to surfacing and giving form to the deep-seated frictions between a scientific research group and a local community. In doing so, we explain how conflicts have political roots tied to a history of land reforms and management policies. In response, we support the need for a design approach that embraces conflict, disputes, and agonism as a fundamental aspect of democratic life [11]. The history of environmentalism in the Himalayas is present with acts of agonism wherein collective movements like the Chipko movement, which started from the Dasholi block of Mandal Valley, were powerful, embodied assertions of local rights against the claims of external state and commercial powers [46, 69]. This history of resistance and advocacy are exemplars of how productive conflict-filled struggle has long been a core response to power in the region. For design, in particular for studies that operate within contested and environmentally vulnerable regions, this necessitates staying with the trouble [48] and giving form [4] to the conflict.

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