

Can Phones Build Relationships? A Case Study of a Kenyan Wildlife Conservancy's Community Development

Matt Ziegler
mattzig@cs.washington.edu
University of Washington

Morgan Wack
University of Washington

Nancy Ingutia
nancy.ingutia@olpejetaconservancy.org
Ol Pejeta Conservancy

Ian Muiruri
Ol Pejeta Conservancy

Nicholas Njogu
Ol Pejeta Conservancy

Kennedy Muriithi
Ol Pejeta Conservancy

William Njoroge
Ol Pejeta Conservancy

James Long
University of Washington

Kurtis Heimerl
University of Washington

ABSTRACT

Wildlife conservancies across the globe are increasingly recognizing their need to support their surrounding communities to sustainably operate. Rapidly shifting environmental and sociopolitical climates increasingly stress existing resource and service provisions, forcing wildlife conservancies to co-manage with local communities shared resources like water, wildlife, soil, pollinators, and security. This work presents a case study in Laikipia, Kenya on Ol Pejeta Conservancy's use of text-based technologies to provide services and build relationships with the many widely-dispersed communities on its borders. Through technology deployments, staff interviews, and community focus groups, we investigate a potential role for basic mobile phone services, like SMS and USSD, to help conservancy personnel disseminate accurate and timely information, gather community feedback, address grievances, and improve accountability. Our findings show that communication with locals requires intense and ongoing effort from conservancy staff. Partially successful deployments of phone services provide a proof-of-concept for their utility in community relations but highlight particular design challenges for wildlife conservancies; having critical needs for broad inclusive engagement; clear, deliberate communication; and careful trust-building.

KEYWORDS

environmental governance, wildlife conservation, ICT4D, Kenya

ACM Reference Format:

Matt Ziegler, Morgan Wack, Nancy Ingutia, Ian Muiruri, Nicholas Njogu, Kennedy Muriithi, William Njoroge, James Long, and Kurtis Heimerl. 2020. Can Phones Build Relationships? A Case Study of a Kenyan Wildlife Conservancy's Community Development. In *ACM SIGCAS Conference on Computing and Sustainable Societies (COMPASS '20)*, June 15–17, 2020, Ecuador. ACM, New York, NY, USA, 12 pages. <https://doi.org/10.1145/3378393.3402279>

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.

COMPASS '20, June 15–17, 2020, Ecuador

© 2020 Association for Computing Machinery.

ACM ISBN 978-1-4503-7129-2/20/06...\$15.00

<https://doi.org/10.1145/3378393.3402279>



Figure 1: USSD screen about Ol Pejeta's community cookstove-building program

1 INTRODUCTION

Wildlife conservancies around the world—traditionally tasked with protecting flora and fauna—are expanding their mandates to address broader environmental and social problems affecting local people [6, 16, 49]. Heightening environmental stresses require co-management of shared natural resources with communities, like water, soil, pollinators, and wildlife; especially in developing countries where more people depend directly on the land for their livelihoods [34]. Additionally, many conservancies take on responsibilities of providing parallel amenities that under-resourced governments lack the capacity to manage or provide, such as sanitation and agriculture extension [19, 48, 56]. Historically, conservancies' relationships with local people have suffered conflicts over resources, and mistrust over whether and which communities received economic benefits from tourism revenues and research activities [56, 69]. Environmental institutions in many parts of the world have underlying, complicated colonial histories, which amplify these surface tensions; for example, many of the national parks in the USA were created by violent expulsion of Indigenous people from their homes [43]. In light of their new mandates, however, conservancies must find ways to overcome past challenges and forge productive new relationships with local communities.

Ol Pejeta Conservancy (OPC) in Laikipia, Kenya, shares the broader mandate of addressing local environmental and service needs. Known globally as the refuge for the last two Northern White Rhinos, OPC is a recognized regional leader for its Community Development Program (CDP). The CDP engages with the 20 communities and 35,000+ people who live within 5km of the protected area's borders to co-manage shared rivers that flow in and

out of conservancy boundaries, mitigate disease transmission between wildlife and livestock, support beekeeping and conservation agriculture, encourage reports on poaching, and reduce human-wildlife conflict with elephants, lions, and baboons; among other varied projects. OPC initiatives have shown a demonstrably positive impact. However, their reach and engagement with partner communities face ongoing challenges. With their limited staff they must address widespread community poverty, and the history of mistrust and disagreements that characterize former relationships.

Robust communication and relationship building are therefore seen as crucial factors in ensuring the conservancy's long-term operational sustainability. Decades of research on community environmental governance stress the importance of developing relationships based on trust and credibility so partnering groups can work together harmoniously and resolve grievances promptly when issues arise [8, 9]. OPC now makes significant resource-intensive communication efforts. They hold regular and open community meetings, make frequent field visits, communicate daily with local officials, and issue printed community newsletters [21]. But their 'local' communities are widely dispersed, and travel among them is difficult. Information penetrates these areas slowly and in fragments, and misinformation is prone to spread.

This paper explores the potential for conservancies to more meaningfully engage with their neighboring communities using ICTs (information and communication technologies). Because most households surrounding OPC have basic mobile phones but lack internet access, we focus on simple phone services like SMS, automated voice menus (IVR), and text-based menu applications (USSD). We evaluate pilot installations and examine broader questions: Can we improve community relations using basic phone services to open communication channels, improve community service provisions, and strengthen OPC's ability to work with communities when issues arise? Potential applications of these mobile phone platforms include widely circulating information about OPC's activities (e.g., health outreach dates, community meetings, agriculture and cattle tips, job postings, program announcements, and conservancy news), improving program impact (through accountability mechanisms such as widely announcing prices to ensure no extra fees for subsidised cookstoves, and monitoring irrigation projects with surveys), speeding up communication about human-wildlife conflict for faster responses, and gathering grievances and feedback.

Using OPC as a case study, we review existing scholarship on mobile phone-based engagement and community-oriented conservation (Section 2). Since any successful introduction of new technology depends heavily on cultural and socio-political context, we describe the theory and culture of community resource stewardship as it pertains to OPC (Section 3). We then shift focus to explore this area's technology infrastructure and strategies for mobile phones in community development. We review usage data, anecdotal evidence, survey results, and opinions regarding (1) a bulk SMS service for sending announcements to communities, with limited reach but demonstrable positive impacts on community engagement; (2) a partially-successful two-way SMS hotline for gathering community input, which was hindered by usability challenges for some demographics but still used by community members to communicate about pressing needs; and (3) an early-stage pilot of a browsable

text-based USSD application, which had promising uptake but also suffered from usability problems (Section 4).

To deepen our understanding of staff and community members' experiences with communication, general phone usage, and the pilot technology deployments, our research then shifts to a more structured qualitative approach via staff interviews and community focus groups (Section 5). We find that OPC staff regard communication as a crucial challenge, and community members get incomplete information through a patchwork of sources despite OPC staffs' intensive efforts. The needs for trust-building, potential for miscommunication, and security emerged as important challenges. ICTs could be a key for engaging tech-savvy young people who OPC has thus far struggled to reach, but many elder community members faced particular difficulty and frustration with text-based interfaces. We conclude by discussing the extent that basic mobile technology could better connect and support relationships between conservancy staff and community members, and the need for further design work and evaluation to better understand how to adapt these approaches for other environmental institutions (Section 6).

2 RELATED WORK

2.1 Mobile Phone-Based Engagement in Development

We explore how ICT could activate environmental initiatives and what channels and messaging are most effective for meaningful communication between conservancies and the communities they serve. Although donors and non-governmental organizations increasingly view mobile phone engagement as a core component of development programming and impact, research across sectors highlights problems in recruitment [26, 45, 53], uptake [15, 27, 62, 71], usage [40, 59, 65, 70], and cross-channel compatibility [26, 28]. Thus far, ICT solutions have primarily been evaluated in sectors like health [11, 22, 30, 46, 50, 52, 54], agriculture [12, 15, 27, 38, 58, 70], and education [25, 60, 63] rather than conservation. Although ICTs can improve coordination among participants across varied development sectors [17, 36], results on conservation and local resource management have emphasized challenges in these realms that are distinct from other sectors [4, 44, 67, 72]. Appropriate design, recruitment, and overall effectiveness of ICT interventions in conservation thus remain poorly understood in theory and practice.

2.2 Communities and Conservation

Growing concerns about environmental degradation and resource-based conflict have led stakeholders from wildlife conservancies, local communities, and governments to search for novel solutions to address these mounting challenges. Recent decades have seen the rise of integrated conservation and economic development initiatives with mixed success [7, 10]. Many previous efforts to address local development issues have been complicated by institutional deficiencies in service provision and protection [13, 31, 42, 57]. Pervasive throughout much of the developing world, these deficiencies often obfuscate the development of simple solutions to dispute management involving human, flora, and wildlife populations.

One identified challenge for maintaining local environmental resources in low-income countries involves incomplete property rights, which delineate ownership and management responsibilities

of each community's common-pool resources (CPRs) [4]. Unlike traditional public goods, which are open to everyone (non-excludable) and infinite in supply (nonrival), CPRs are limited in supply and accessibility [48, 49]. Without formal property rights, such as land titles, the boundaries between individual and group assets are blurred with CPRs, creating space for conflict [35]. Accordingly, standard political economy scholarship stresses the deficiency of conventional solutions to CPR management given the incentives to free-ride in their use [35, 47], yet real-world examples of self-governance demonstrate that local communities frequently overcome barriers to collectively mobilize to manage CPRs [35]. These actions are typically facilitated not only through adequate resources, but also through strengthening communication among stakeholders, and from monitoring strategies that build trust and limit free-riding [48].

Positive demonstrations of community actions have encouraged governments, civil society, and conservancies to become more active in CPR management [5, 49], but conflicts among stakeholders are intensifying as climate conditions worsen. As a result, external actors often leverage influence to reap the positive returns from collective community actions while sacrificing local welfare [32, 49]. Power asymmetries between local communities and both governments and private conservancies have enabled the historical exploitation of marginalized populations' natural resources [18, 32].¹ With expected spikes in regional temperatures and increased water scarcity for local populations [61], the frequency and intensity of these disputes will likely result in further conflict and human encroachment on protected conservation areas [49]. In response to these historical wrongs and mounting climate challenges, contemporary environmental stakeholders are prioritizing engagement with local communities to promote collaborations for protecting the shared environment.

3 CONTEXT

Our study occurs in Kenya, a country facing a variety of historical and contemporary challenges to sustaining environmental resources that are threatened by a dearth in arable land, sedentarization, the illegal razing of protected forests, frequent droughts, and extensive poaching [14]. Obstacles to successful common-pool resource (CPR) management have increased inter-community conflict; contestation has burgeoned where local communities have struggled to adjudicate distributional claims over shared economic and environmental resources [14, 41]. Foreign settlements and land grabs in the Rift Valley "White Highlands" (that overlap some of OPC's project area) have continually driven ethnic Kikuyus (primarily agriculturalists) and Maasai (primarily pastoralists) from their ancestral land [14], an issue that successive governments have failed to adequately address [41]. Instead, local and national politicians frequently opt to leverage the scarcity of tenable land for political gain [14, 18] by limiting land rights and service provision. These adversarial forms of patronage politics exacerbate resource-based contestation and electoral violence [18]. Weather shocks associated with climate shifts have further induced droughts and patterns of abnormal rain, worsening local resource-based conflict between groups, especially Kikuyus and Maasais.

¹Profiteering has been most evident where tourism has been greatest, because gains are often disproportionately shared with local communities, if shared at all [14, 49, 66].

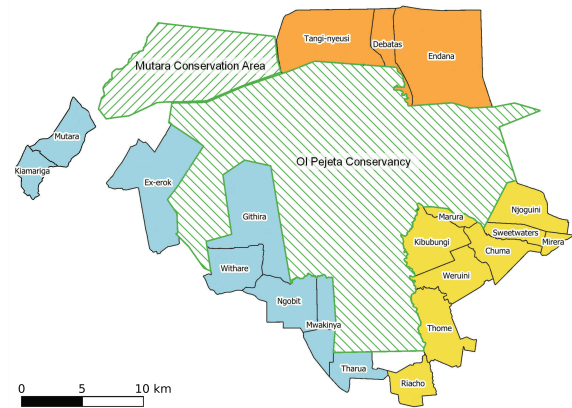


Figure 2: Ol Pejeta's communities. Northern communities (orange) are mostly pastoral with less-developed infrastructure. Southeastern communities (yellow) are agro-pastoral, and closer to a major town with better accesses to services. Southwestern communities (blue) are agro-pastoral and have significantly more human-wildlife conflict.

The government attempted to address CPR issues following the adoption of a new constitution in 2010, which promotes devolved governance to manage land scarcity and marginalization [41]. These reforms place a greater onus on local governance of service provision and empower communities to place a larger participatory role in devolved structures. Unfortunately, these reforms, which extend significant authority to newly created local county councils, sometimes have created new platforms for corruption rather than refocusing resources on local inequalities in the distribution and use of tenable land [18]; they have also increased the frequency human-wildlife conflict [1, 66], with numerous reports detailing illegal hunting, poaching, and violence against wildlife [32, 66].

3.1 Ol Pejeta Conservancy

Ol Pejeta Conservancy (OPC), a private Kenyan-run not-for-profit organization, was created to fill this void in service provision and institutional capacity to improve wildlife and land protection for local communities [20]. OPC protects 140 critically endangered Black Rhinos and over 13,000 individual species, including the endangered African Wild Dog and Grevy's Zebra. These attractions helped OPC host 104,354 tourists in 2018, (over 50% were Kenyan), enabling OPC to use their conservation work as a platform to engage with local communities. However, deficiencies in public investment have saddled OPC with a host of new and non-traditional responsibilities, ranging from irrigation to improvements in systems as disparate as agriculture and education [20], efforts that have been complicated by rising urbanization in the villages surrounding OPC and changes in seasonal weather patterns.

OPC also faces tensions with local people. The conservancy is located on the former colonial ranches created by the violent eviction of the Maasai people during foreign settlement in the colonial period [37]. Injustices of these re-settlements are still felt today, many locals arguing that their communities are still excluded from land, economic development, and decision-making. In the 2017 elections, local politicians took advantage of these tensions to

promise conservancy land to locals in exchange for votes, inciting violence against area conservancies [2]. While OPC was fortunately spared in this area—a result its leaders attribute to their relationship-building efforts with locals—communities complain that OPC has different development goals than they do, and that they do not receive promised economic benefits from tourism [39].

OPC's Community Development Program (CDP) began in 2004 during the transition from ranch to conservancy, with only one employee focused on agriculture. It has steadily grown to a team of 12. CDP initiatives include school technology and infrastructure support, conservation education, school bursaries, community visits to the conservancy, solar installations, rainwater retention, river management, well drilling, cattle extension and breeding, agriculture extension, beekeeping, support of government clinics, mobile health outreach, and fuel-efficient cookstove building. In 2018, OPC spent \$600,234 USD on community projects [20]. It engages daily with 18 community representatives and 6 local chiefs, who are the primary liaisons with communities. Community representatives began in 2007, originally by approaching chiefs to find influential people to serve as links to the communities. Community boundaries were formalized in 2014 (Figure 2), and the unpaid community representatives became democratically elected. OPC holds meetings every 1-3 months in each community to receive feedback and plan programming. Community representatives organize the meetings, which are always attended by CDP staff. Additionally, OPC prioritizes local hiring for their approximately 850-person staff.

In recent years, CDP has begun using the Social Assessment of Protected Areas (SAPA) method [29] to assess its impacts on communities' livelihoods. The 2019 SAPA found the most-valued benefits to include OPC's fence that protects from cattle rustling and incursions by wildlife, security assistance, education support, and health facilities. Areas most critically in need of improvement include the perception that OPC cares more about wildlife than local people, reports and fears of human-wildlife-conflict, exclusion from job opportunities (particularly for women), and uneven distribution of CDP projects across communities [39]. While scaling these efforts would enable OPC to engage more fruitfully with local communities to improve service provision, outreach, feedback, and accountability, OPC currently lacks the technical and programmatic capabilities to meet these communities' diverse sets of needs.

4 TECHNOLOGY ECOSYSTEM

Since 2014, OPC has experimented with mobile phone technologies to address challenges of community engagement, with mixed outcomes. A bulk SMS service for broadcasting announcements has successfully increased communication and further pilots with interactive two-way SMS and browsable USSD services have also proven useful for a limited set of community members. Thus far, however, the systems have struggled to gain widespread adoption, in part because of usability challenges. We next describe the successes and limitations of these systems, and design considerations for future work and broader engagement.

4.1 Bulk SMS

OPC began deploying a bulk SMS service in 2014 to broadcast organizational announcements to community members. The idea

Dear ol pejeta consaverncy am a community member but ai whant inform you if it is an any varncy just inform ifen a fance ripear and security patrol thanks

10 Erephants ware patrolling kijabe thd whole night pls.

Hi!my name is [redacted] from [redacted] naomba kazi nimesikia you are searching for a storekeeper but naomba kazi yeyote ile please

Goodafternoon am a resindent of [redacted] and am borthed by a sheep diseases that afect lamps coursing small woulds aroud mouth

My Name is [redacted] am farming nearest to u here on the river whow can u helpers from these monkey theru inaharimbu everything in the shamba

Am a guardian from [redacted] and my sister achieved 332 marks how can I get a scholarship form?

Figure 3: Selected messages from the two-way SMS hotline. Community members tend to send messages only for urgent issues like unemployment and human-wildlife conflict.

emerged from OPC's 2014 SAPA study, when community members reported a deficit in communication and OPC held follow-up meetings to discuss improvement strategies. Since then, OPC has gradually collected the phone numbers of 3,100 residents, mostly through community meetings and aggregating contacts from staffs' individual phones. Each month, they send out several messages most often related to job vacancies at OPC, community meetings, and health outreach dates. Sporadically, they also send messages about urgent issues as they arise (e.g., elephant breaches). OPC can issue system-wide messages or target individual subgroups; however, community members cannot directly reply to these messages.

Anecdotal evidence suggests that this SMS program has had a positive impact. Since its introduction, the average numbers of health outreach attendees and job applicants have more than doubled, and community meeting attendance has increased. Residents also report knowledge of this system: in OPC's 2019 SAPA survey, 68% of respondents "agree that OPC's text messages have been effective for sharing information" (9% disagreed, 21% didn't know, 2% no comment) [39]. Additionally, various government agencies have asked OPC to send messages on their behalf, utilizing OPC's community contacts.

4.2 Two-way SMS

Because the bulk SMS system enabled only one-way communication, a second SMS prototype was developed in 2019 that allows users to reply. The new prototype, designed to be more interactive, let OPC quickly find out about issues in the communities and gather feedback. Since community members commonly call OPC staff on their personal phones with questions and issues, the two-way SMS system also intended to centralize these communications to increase accountability and responsiveness.

Since its deployment, the two-way SMS service has been a partial success. OPC began advertising the number to communities in February 2019 by explaining it in community meetings and sending regular bulk messages saying: "To contact Ol Pejeta about anything important, send a short message to 0712 345 678" (translated). In the 1-year period after its initial launch, this number received 344 messages from 170 users, in both English and Swahili (Figures 3

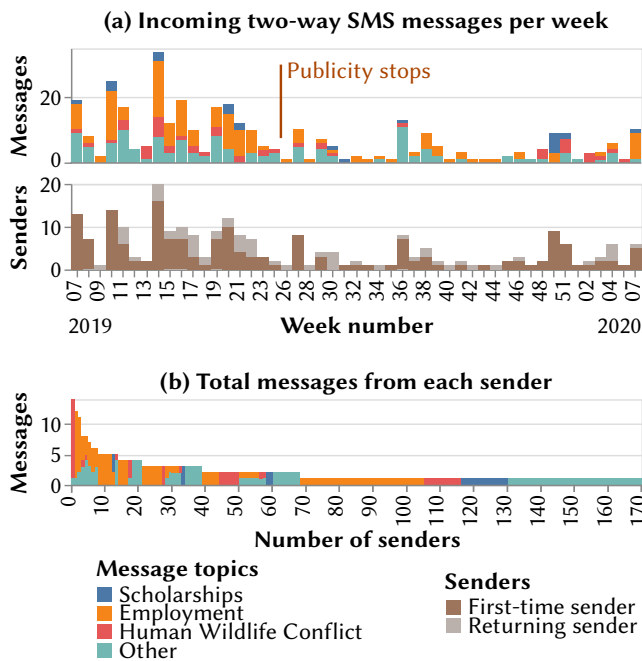


Figure 4: Incoming messages on the two-way SMS service. (a) Incoming messages over time: the service was first publicized to OPC's communities on February 14, 2019, and reminder messages were periodically sent until June. Usage tapered off after publicity ended, but new users still continue to send messages. (b) Incoming messages per user: over half of users sent only one message, but a subset were very active.

and 4). The most common messages enquired about job opportunities ($n=148$), human-wildlife conflict ($n=48$), and scholarships ($n=24$); others related to water management, security, livestock, health outreach, and a variety of other topics. Some issues, like human-wildlife conflict, require extensive back and forth (and SMS messages often led to follow-up phone calls with OPC staff). Other messages asked for simple factual information (e.g., if there are any job vacancies) and required only one quick SMS reply from CDP.

This second prototype presented more complex technical challenges than the bulk SMS service. Since there was no suitable off-the-shelf software, new software was developed by a contractor. Usability challenges hindered adoption, since OPC's database of community contacts is heavily skewed towards elderly residents who often have trouble sending text messages. Technical problems with the system's implementation made it impossible for OPC to send large volumes of messages over the two-way SMS number—users regularly received messages from the bulk SMS number that they could not reply to directly and were asked to reply to a second number.² Users must also pay normal SMS rates, which may prohibit people from participating and act as a demand filter [55].

Although a main goal of the two-way SMS service was to establish sustained bidirectional communications, OPC found that usage was typically limited to urgent messaging (like unemployment

²Initially the contractor tried implementing the system with three successive short codes that could both send and receive bulk messages, but each of the short codes received thousands of spam messages that became too expensive to maintain.

and human-wildlife conflict). The SMS service has not effectively maintained comprehensive or consistent feedback about its broader range of issues and services. After OPC stopped actively advertising the two-way SMS number in June 2019, incoming messages gradually decreased, although OPC still receives several messages each week from new phone numbers (Figure 4), likely due to community members sharing the number peer-to-peer.

4.3 USSD

Building from OPC's partial success and remaining challenges with the two-way SMS service, our research team partnered with OPC to develop a new prototype USSD service. USSD is a protocol that universally works on every mobile phone, including basic (non-internet capable) devices. With USSD, users dial a phone number and are presented with an interactive text-based menu that allows numeric responses from a standard keypad. It is a popular interface in Kenya and other developing countries to load pre-paid airtime; obtain information on users' telecom, banking, and electricity accounts; and send/receive money with mobile banking [51]. But unlike SMS, USSD responds instantly to a user's queries and can display browsable information, collect structured input, and show menu options to communicate possible interactions. It cannot directly "push" a session start for users (users must proactively dial the number to begin a session); and USSD codes are commonly advertised via SMS and other media. USSD cannot accept long user inputs because of a 30-second time limit on each screen, and it leaves no evidence of the interaction on a user's phone [51].

Our USSD prototype connects users to OPC's community projects (Figure 5), including browsable information about stove building (Fig 1), school scholarships, cattle, job postings, health outreach dates, and contacts of community representatives. It offers interactions for requesting services, such as ordering cattle supplies, registering a submitted scholarship application (Fig 5), and requesting a complimentary community visit to OPC.

Our initial feasibility study for USSD deployment focused on OPC's annual bursary (scholarship) application process. OPC distributes paper scholarship forms that applicants fill out and return to their community representative. The USSD application had two features (Fig 5 right): users could browse information about the scholarship program, and were asked to register their submitted applications via USSD by entering their name, phone number, and the recipient of their form (to ensure that no paper applications were lost or maliciously withheld); instructions were printed on the scholarship forms to dial the USSD shortcode upon submission. Community representatives were shown the USSD number in a meeting, and one bulk SMS was sent to all 3101 registered users advertising the USSD number for information on scholarships.

Over the next month, the USSD number received 805 connections from 256 unique phone numbers (Figure 6). Initial sessions reflect users mostly browsing information, while subsequent sessions mostly attempted to register applications. Many users successfully browsed several screens of information with each session, whereas others appeared unable to use the service because of unanticipated usability problems. For example, because users were asked to select their community from a two-page list, many were confused about

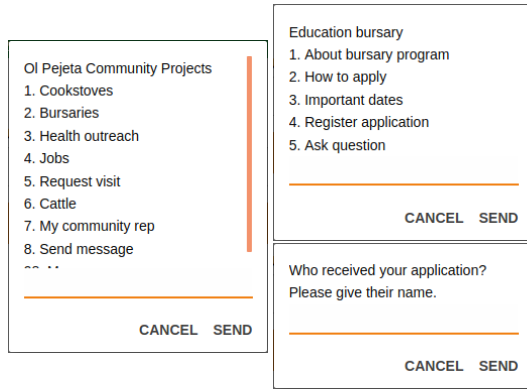


Figure 5: Prototype USSD screens. Left: a screen listing CDP projects. Right: scholarship information and registration.

selecting “10: NEXT” to go to the second page, a problem that has been documented with other USSD services [46].

Though many users successfully browsed scholarship application information on the USSD service, the pilot for registering applications was largely unsuccessful: OPC received 293 paper scholarship applications, of which only 44 registered via USSD. Many instead preferred to call OPC staff to confirm their applications (a phone number was published on the form for questions) or had community representatives to register on their behalves. Seventeen of the 61 USSD registrations came from one phone number, who was a community representative; eleven applicants registered more than once, mostly due to mistakes in data entry.

5 FORMATIVE QUALITATIVE RESULTS

To better understand the efficacy and impact of the existing SMS systems and our USSD prototype, and to inform future ICT design efforts, we conducted formative qualitative and user-based research with OPC and its surrounding communities. First, we discuss interviews with OPC staff about their experiences using the mobile systems, as well as challenges of communication and community engagement. We then report focus group results with local community members about their interactions, sources of information, and existing communication channels with OPC.

5.1 Staff Interviews

We conducted 11 semi-structured interviews with OPC staff (9 members of OPC’s 12-person community development (CDP) team and the deputy managers of security and wildlife). After each interview, we sent typed notes back to each participant for their review. Interview topics included participants’ day-to-day tasks, communication with communities, phone usage for their jobs, and experiences with the SMS and USSD prototypes.

OPC’s community-facing staff reported spending their days interacting with community members in a variety of ways: holding meetings and trainings, coordinating projects, visiting schools, fact-finding, responding to urgent security and wildlife issues, and taking frequent calls from various local leaders and community members. CDP devotes significant time toward communication, but with only 12 CDP staff for roughly 35,000 community members,

maintaining robust communication is a challenge. While some community members are highly engaged, others are difficult to reach, never come to community meetings, and lack social connections to OPC programs. Obtaining nuanced and honest feedback is difficult.

Phone communication. Every staff participant reported that calls are a main way to interact with community members, especially because large distances make it difficult to be physically present in all 20 communities. The widespread availability of basic phones lets many community members reach OPC staff, but staff felt burdened by the sheer volume of calls: “I get calls from communities every day, every night, even on weekends.” “Sometimes I don’t want to pick up the phone on my days off, but this is maybe urgent for them.” One participant reported an average of 6 hours per day on the phone, and most reported fielding many short calls frequently throughout the day (except for a couple staff in administrative roles). In fact, the majority of interviews for this paper were interrupted by phone calls, including one from an anxious parent of a scholarship recipient, a teacher asking for computer upgrades, and a community representative worrying about locusts, by way of example.

Many calls are repetitive and ask for only basic information that could theoretically be distributed in other ways: “People call us asking the same questions over and over again; we answer a thousand calls about the simplest thing.” “I wish everybody could automatically know the projects we are doing in their area. At community meetings, we get a lot of questions about things we are already doing.” Many community members have the contact of only one OPC staff person,

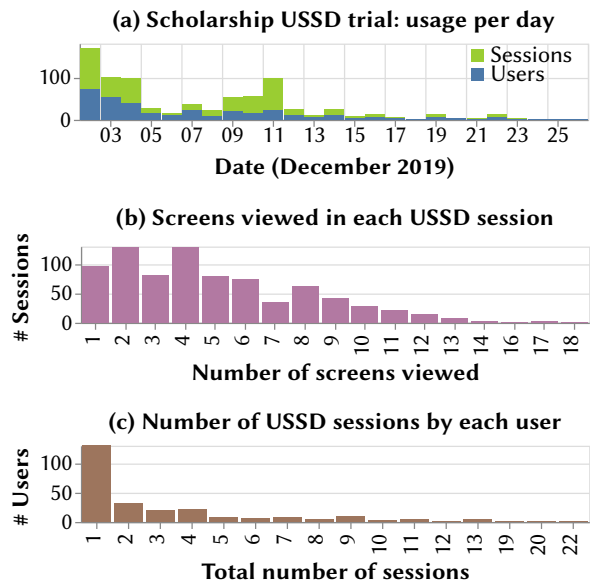


Figure 6: USSD usage during a 1-month trial for OPC’s scholarship application process, with 805 connections from 256 users. (a) Traffic peaked on Dec 2 after an SMS announcement about the USSD code for scholarship information; with a second peak around the Dec 11 due date. (b) Many sessions ended on the 1st or 2nd screens due to usability problems, but most browsed several screens of information. (c) 130 users connected only once; some connected repeatedly.

who often becomes a general purpose point-of-contact for everything related to OPC. *"They call me simply because they have my contact and nobody else."* *"People call me about all kinds of random stuff. Human-wildlife conflict, water issues, conservation education..."* *"Everybody calls me about everything."*

For specific community programs, CDP staff take calls for a variety of reasons. For example, cattle and agriculture extension officers frequently give advice over the phone, parents call to ask questions about the scholarship program, the supply chain for stove-building is coordinated over the phone, and locals call to report problems with wildlife. Organizing a meeting typically requires many phone calls with the community representative and attendees to confirm their attendance and share details. Even after a meeting is announced over a bulk SMS, CDP staff typically get phone calls asking for more information. Several staff members expressed a need for contacts of more community members, such as a database of teachers. Weak network coverage presents a challenge especially in the less-developed northern region: *"You find people that have 3 numbers that work best in different places."*

CDP staff occasionally reported using Whatsapp and SMS. Whatsapp helps them to send pictures with community members, like receipts for school fees and photos of livestock diseases. OPC has two communities where farming is very profitable and farmers are young, and the extension officer has been able to start Whatsapp groups for interacting with those farmers collectively. Depending on the demographics of each projects' participants, though, many staff members reported that they never use SMS because their contacts have neither smartphones or internet.

Community engagement. OPC's community engagement and outreach reveals important considerations that are potentially both aided and complicated by upgrades to extant mobile channels. OPC believes that direct contact with communities is a critical aspect of their work for building relationships and trust: *"If people don't see us regularly, they will think we have abandoned them. People need to see that we are concerned with their welfare, not that we just come when we want something."* CDP staff report spending around 1-3 days each week doing field work in the communities. Staff visit schools for conservation education programs, run health outreach clinics, give trainings on agriculture and cattle issues, perform maintenance on school computers, and organize and attend various types of meetings. Sometimes urgent issues arise that need to be addressed immediately in the field, such as disputes between community stakeholders; transportation is a main challenge and expense since OPC's area is 360km² and communities are spread apart. This limitation often forces OPC staff to rely on phones instead of being in the field, which can depersonalize the interactions and constrain information flows.

OPC staff attend and organize in-person meetings for various purposes when phone communication is not sufficient. These include negotiating issues with all stakeholders, complex demonstrations and presentations, and seeking nuanced, in-depth feedback about CDP's programs. Every 1-3 months, OPC also holds community meetings at each site that are organized by community representatives. Attendance varies widely, from 10 people to hundreds, and OPC staff are always present. Community meetings are an opportunity to give updates on programs, build relationships

and collect feedback. CDP staff repeatedly stressed the importance of these meetings: *"Programming decisions get made from the issues that come up at community meetings. People argue, raise grievances, explain what they don't know, and negotiate about programming decisions."* Further, OPC is frequently invited to large meetings organized by local chiefs as well as small 10-15 person meetings held by community groups (e.g., savings associations). OPC invites community groups for guided tours of the conservancy that emphasize their roles in conservation as community members, and champions issues on human-wildlife conflict and the need to report suspicious activities. Cattle grazing committees and farming groups are put together to share knowledge and discuss issues. To address water issues, OPC holds stakeholder meetings that bring together resource users with government officials and local leaders to negotiate rules and obtain *Water Resource User Association* permits, in compliance with the law. Recent surveys indicate that most people feel the water situation has improved; the project coordinator stated that *"after the meetings, people were more likely to call us to report problems and violations... We found that it's been important to bring all stakeholders together, like every 3 months. It's been very effective."*

CDP staff repeatedly stressed that managing expectations was one of the most important and challenging parts of their jobs. Misinformation and rumors easily spread through communities, messages can be misunderstood, and people feel that OPC's resources are not distributed fairly. *"People always see you as a donor. If you speak the wrong way, people think you can get them a job tomorrow... for example, if you gave somebody a dam liner before, they will expect another one the next time they see you, and you need to tell them the funding has run out and the project is over."* The scope of a project is therefore one of the hardest things to communicate. There are also fears of bias in reporting: *"I wish we could know people's real attitudes, what they really think, what they say to their neighbors."* There are some concerns that OPC is losing important information because users cannot reply to the bulk SMS messages, e.g., *"We don't know how our text messages are perceived by our communities."* It is hard to ask community members about some past events because there is no culture of recordkeeping, e.g., to know whether farmers' harvests have improved over time. Several OPC staff expressed desires for faster feedback to be able to react more quickly when faced with emergencies or floods.

CDP staff apply multiple strategies to improve communication and facilitate community engagement; their language must be timely and precise. As one staff member reported, *"Any opportunity that needs clarity must be dealt with immediately. Many people will pretend they don't know, but they will play you. Communication needs to be central. It can be dangerous to beat around the bush. We need to be honest and fair in all issues, and we need to hear both sides of all grievances. For example, I got a call from a women's group asking to buy tents and chairs. I explained that we don't do that. Not that maybe we will someday... Things that we don't do, we just say we don't do them. Relationships, clear communication, and appropriate communication carry the day."*

Security and poaching. One critical area for OPC community engagement and government liaising involves reporting on poaching and suspicious activities by residents to OPC: *"Security is information. Without information we cannot do anything."* CDP outreach

emphasizes to communities that they can send tips on threats to wildlife due to illegal activities, which OPC is chartered to report to the government. But here again, relationship building is critical. OPC wants to solicit information from key trusted informants, and community members are likely to report to OPC only if they believe the organization will properly respond and the government will not exact unfair retribution. Information of this sort tends to come through face-to-face interactions with trusted intermediaries because informants do not want to create phone records that could compromise their security: *“An informer should be treated with the most integrity and confidentiality... the two-way SMS system compromises the security of an informer.”*

Summary and ICT design implications. Our interviews with OPC staff repeatedly stressed the criticality of communication to conservancy operations and community development work. Although ICTs clearly cannot replace face-to-face communication in many cases, they could be helpful for some. The distribution of OPC staff’s phone numbers and the volume of calls to staff, while showing the importance of two-way communication, have also become burdensome. Some of this burden could theoretically be relieved by partially-automated ICT services (especially for the many repetitive calls seeking only basic information), and improve information access throughout the communities. However, the limitations of simple SMS and USSD interfaces create challenges for the careful, nuanced, and diplomatic communications that OPC requires; like negotiations among many stakeholders or complex agriculture demonstrations. For sensitive topics like poaching, senders and receivers of information must trust one another and the system itself. Additionally, staff stressed the importance of their continuous presence in communities to build familiarity and trust. Regular community engagement over ICTs could conceivably help build credibility, but could also harm relationships if over-reliance on ICTs led to fewer face-to-face interactions.

5.2 Community Focus Groups

Our second formative research activity aimed to better understand community experiences with OPC, usage of existing SMS communications systems, and feedback on the USSD pilot. We conducted three community focus groups, one from each of OPC’s major regions (Figure 2). Recruitment occurred via OPC’s community representatives, who each were asked to find ten participants having an even mix of age, gender, and engagement levels with OPC, (about five individuals who regularly attend community meetings and participate in programs, and five who never attend). The focus groups took about three hours each; participants were compensated 1,000 Kenyan shillings (about \$10 USD) to cover their time and transportation.³ In each focus group, we alternated between breakout sessions and group discussions. For breakout sessions we divided participants into subgroups of elders (>55) and youths (mostly 20-35), gave a prompt (e.g., *“What are the positives and negatives of your communication with Ol Pejeta?”*) and asked participants to list answers on posters. Each group presented their answers in moderated plenary discussions. We varied the prompts for each session, trying to suit the discussion’s flow. Topics included OPC’s impact on their

³Most people in the area are farmers and casual laborers, earning ksh 300-500 per day. We expected some participants to travel up to 5km to attend the sessions.

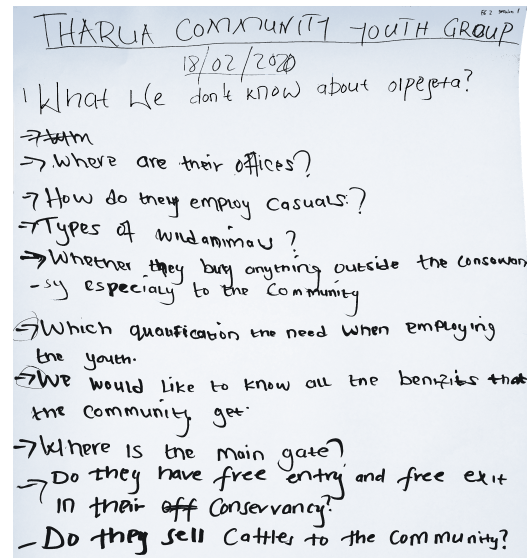


Figure 7: Example poster from focus group.

lives, interactions with OPC staff, information sources on OPC and community programs, and phone and technology usage. At the end of each session, we solicited feedback on OPC’s existing SMS services and the USSD prototype. To motivate participant engagement and honest criticism [23, 64], we stressed that the services were still works-in-progress that their opinions could have influence.

Interactions and impact of OPC. There were varying levels of knowledge about OPC’s programs in participants’ communities. Participants generally knew about conservancy operations:⁴ that it protected animals and brought in revenue from tourists. Specifically, we asked each group if they knew why OPC was famous for rhinos (having the last two Northern Whites); the groups agreed that they knew OPC had *“unique rhinos”* or had heard about Sudan’s death (the last male) on the radio and social media, but each group seemed confused about the international significance of this information. Beyond this, a few individuals had in-depth knowledge of OPC’s community programs and could list most of them, and most participants reported that they had benefited from at least one program (e.g., having visited a health outreach clinic or received a dam liner). However, some participants said they never used any OPC programs, and each focus group responded differently when asked which CDP programs had the most impact on their lives: health outreach and security were most important for the first group, water capture and scholarships for the second, and health and employment for the third.

The sessions frequently digressed to discussions about new services that communities wanted—requiring careful facilitation from the moderators and highlighting locals’ dependence on OPC for services. For example, one breakout group made an unsolicited sheet of project proposals, and another became a half-hour emotional discussion about fair resource distribution among communities.

During the sessions, clear differences in responses emerged between elder and youth subgroups. Elders (>55) were more engaged

⁴Importantly, we note that recruiting through community representatives probably led to participants who were more engaged with OPC than average.

with CDP programs, and many had direct phone numbers of OPC staff. They were mostly farmers, were more likely to own land, and were thus more concerned with issues like water, human-wildlife conflict, and agriculture extension. Conversely, youths (approx 20-35) mostly worked as laborers and were much more interested in securing jobs and furthering their education. Therefore, they were less engaged with OPC's environmental programs, and the topic of jobs frequently arose in focus groups: *"You should be fighting for more jobs to come to our community!"*

General OPC communication channels. Communities members reported receiving information about OPC from a patchwork of sources including community meetings, SMS alerts, OPC's community newsletters, park visits, posters, and community representatives; but no single authoritative source reached the majority of community members. Some had found information through mass media, (e.g., seeing OPC's cattle operation on a local TV show for farmers), and a few younger participants had accessed OPC's website and Facebook page. Roughly half of the participants had phone numbers of CDP staff, whom they sometimes called with questions and issues, e.g., *"We call the veterinarian who does artificial insemination, and he gives us the updates"*; others said they had staff contacts but never called. Participants chiefly obtained numbers from previous CDP interactions like scholarship meetings and human-wildlife conflict incidents, or from community representatives. Many also had friends and relatives who had gotten jobs at OPC; e.g., one participant knew a security guard: *"He's a relative, so we chat often but not really about OPC."* Information also spread via word-of-mouth. Some learned about OPC's scholarships by knowing families of beneficiaries or saw that neighbors had installed plastic dam liners. A couple got news from relatives who received OPC's SMS messages. Some reported getting information from their children, who had learned about OPC at school.

Each information source, however, had limited and uneven reach. Only elder participants said they attend community meetings; youth almost never attend. One said she came to community meetings because *"we are dedicated, and we know we could benefit from them."* Asked why youths do not attend, participants consistently agreed that the youths were too busy working during the days, and that they felt that the meetings were more for elders: *"If you want youths to come, you should tailor the meetings for youths."*

General phone access and usage. The focus groups reported that most people have mobile phones and use them heavily. Everybody agreed that most locals have a basic mobile phone, but participants disagreed about how many had smartphones and internet access. Of our participants, nearly every one had his or her own mobile phone, and many youths had smartphones. Participants agreed that they experienced network issues and spotty connectivity (particularly in the less-developed northern region). Indeed, we sometimes had network problems during our USSD prototype demonstrations.

Even though participants owned phones, they enumerated challenges and user burdens that limit their abilities to use them. Participants agreed that they can go a long time without any credit on their phone. In one instance, someone said: *"Most of the time we don't have any balance."* (Everyone laughs.) *"We can go a long time without making any calls or messages."* Sometimes, charging phones is difficult, and they used a mix of ways to do so: a few had

their homes connected to the power grid, many had solar panels at their houses, and some charged phones at a friend's house or a business. During the rainy season, there is often not enough sunlight to charge phones for days or weeks, presenting a particular problem for smartphones (having lower battery life). One person said: *"Lots of people have both a smartphone and a basic phone. The basic phone is a backup for when the battery dies."*

Participants' usage of phone features varied between demographics. Many elders disliked SMS and had trouble using it: *"It gives a headache."* They unanimously agreed that they preferred voice calls for a variety of reasons: some were illiterate and said they could not read SMS messages themselves, and they asked their children or neighbors for help. Many simply do not access SMS messages at all, as one youth reported: *"A lot of people don't have anyone to read messages for them. Sometimes an old person comes to me because their phone's memory is full of messages, and they don't know what to do... they haven't opened any of them."* Other SMS frustrations included difficulty typing with small buttons, reading from small phone screens, language barriers, and a general lack of interest. Younger participants, on the other hand, unanimously preferred SMS because it was cheaper and more private than voice calls.

We asked specifically how participants viewed USSD and about experience with other USSD codes. Both age groups noted a variety of services they use that feature USSD, including mobile banking, sports betting, selling milk through a dairy collective, and ordering goods for delivery to their houses (a service called Copia) [3]. Some elders said they still used text-based services even though they disliked them. (*"I only text on a need basis;"*) they would put up with the hassle of SMS and USSD if there were enough benefit for them.

OPC-specific SMS and USSD feedback. We asked the groups for feedback on OPC's existing SMS services and the USSD prototype. Even though older participants were generally reluctant to use SMS, nearly everyone who received OPC's bulk SMS messages were in the older group. We asked how to better recruit youths to use OPC's SMS messages since they usually do not attend community meetings where numbers are collected. We got varied suggestions, like advertising through churches, WhatsApp groups, and on vests of motorcycle taxi drivers; asking elders for phone numbers of their friends and relatives; and distributing printed T-shirts.

Participants generally indicated that they paid attention to OPC's text messages because they conveyed information of direct benefit, like job postings and health outreach dates: *"I can see when the message is from Ol Pejeta, so I give it to my son to tell me what it says."* Short SMS messages have the potential to be misinterpreted, though: we heard of one incident when OPC issued a bulk SMS announcing that it provided dam liners to certain community groups. Some people misunderstood the message to mean that OPC was offering dam liners to their own communities, causing confusion and frustration when they found out that this was not the case. Regarding the two-way SMS service, no participant knew the number for sending SMS texts to OPC headquarters. A few said that they had seen it once in a message long ago, but they no longer had it. This confirms that having two separate SMS numbers is a usability problem, but some participants said that they would not send SMS to OPC in any case because it was easier to make voice calls.

Finally, we demonstrated the USSD prototype and asked participants to try it on their own phones. All of the youth navigated the USSD screens with ease, reading and understanding most of the information. However, we watched the elder group struggle with the prototype, encountering several usability problems. For example, many grew frustrated when the application timed out after 30 seconds of inactivity, misattributing it to network issues. Participants were generally unable to venture many suggestions to simplify the USSD application for older users, and instead every group suggested that OPC should offer training: *“They just have to get used to it, and they will learn.”* People in every group also suggested that we should add more topics, including the types of animals on OPC lands, seeds and crops, livestock, tourism, and tree planting. They also wanted more comprehensive and detailed information, e.g., for screens on improved cookstoves to explain their disadvantages, *“since everything we use has disadvantages.”*

Summary and ICT design implications. Our focus group discussions showed a diversity of ways that community members engage and do not engage with OPC, experiencing different benefits and problems. Participants got information about OPC from a heterogeneous patchwork of sources—information reaches the communities in fragments and there is no central, authoritative source. The ubiquity of mobile phones suggests that ICT services could potentially have a wide reach, but certain demographics are marginalized by accessibility barriers like low literacy, unfamiliarity with SMS and USSD, network connectivity, and the cost of sending messages. Some of these barriers could be addressed by incorporating other technologies like voice-based IVR. Additionally, the nature of short SMS and USSD communications creates a liability for misunderstanding, and extra care must be taken for clarity, especially in the sensitive contexts of these community relations. Though elder community members are probably less likely to use text-based applications, they could be a key for reaching youth, who OPC has thus far struggled to engage.

6 DISCUSSION AND CONCLUSION

The charter of wildlife conservancies is expanding beyond their traditional focus on animals and ecosystems, elevating the need to work jointly and productively with communities outside their formal protected areas. We investigated text-based tools to support Ol Pejeta Conservancy’s outreach and engagement efforts. Through pilot technology deployments, interviews with OPC staff, and community focus groups, our formative research demonstrates potential for ICT services to improve conservancies’ community engagement, build sustainable relationships, and deliver effective programs. It also highlights important design and implementation challenges. While phone interactions are clearly no substitute for community meetings and face-to-face interactions, ICT’s could still be integrated with existing communication processes to improve communities’ access to critical information and services.

Our preliminary study sheds some light on the problem of community engagement for environmental institutions. Mobile phone services are already common across development sectors like health and agriculture, but deploying these services in wildlife conservancies requires a new consideration of their impact on the crucial relationships with the communities they depend on, and the mutual

trust needed for conservancies and communities to work together. Although basic phone technologies are available in low-income communities surrounding many conservancies, their limited affordances create challenges for careful communication, negotiation, and relationship building that environmental governance requires.

Our preliminary work does not address cost-effectiveness. Phone-based services are expensive at scale: organizations and users typically pay for each SMS message, USSD session, or each minute of a voice call; costs add up fast with large deployments. Institutions running large-scale ICT services must think strategically about the cost effectiveness of each interaction, and how best to register and engage the most users within budgetary constraints.

In OPC’s case, because SMS and USSD present accessibility challenges for elder demographics and those with less formal education, exploring voice-based phone technologies (IVR) could extend access to these groups and help to scale. Elder community members, currently the most engaged with OPC activities, are unlikely to adopt a system that is burdensome even if it reduces the burden on OPC staff [33]. However, our early work suggests that ICTs could potentially be a key for engaging young people—who OPC has long struggled to engage—via their affinity for technology. This will require creative program development for issues important to young people, such as employment, micro-enterprise, and entrepreneurship. (For example, some projects have deployed USSD “yellow pages” to advertise local businesses [24, 68].)

Further work is required to understand the generalizability of our findings to other conservancies that have different models of community engagement. Designing effective and accessible ICT services takes time and investment, as evidenced by our partial success, and many conservancies lack the technical capacity for this process. However, many local and international conservancies look to OPC as a model for community relations: OPC provides consulting on community development to other organizations, and the Laikipia Conservancy Association is actively adopting OPC’s model. Therefore, as OPC scales its development activities and outreach, it could provide evidence to action for policy, recognizing that ICT projects require some degree of customization for individual contexts: different settings can vary widely in technology access, literacy, infrastructure, culture, institutions, and environment.

After further work to design better systems for OPC and the communities it serves, more rigorous evaluation will be needed to know whether we can confidently recommend these ICT approaches for other environmental institutions, and to what extent they can help conservancies and their interlinked communities live and work together.

7 ACKNOWLEDGEMENTS

We are especially grateful to Ol Pejeta’s community members and staff who have contributed to this work: Eva Kimani, Mercy Waithira, Stephen Gachagua, Ann Komen, Stephen Elimlim, Paul Waweru, Hillary Mutuma, Daniel Mwaniki, and Moses Muthoki; and to Richard Anderson, Neil Kagalwala, and Sandy Kaplan at the University of Washington. This material is based upon work supported by the National Science Foundation Graduate Research Fellowship under Grant No. DGE-1762114.

REFERENCES

- [1] 2017. The Untold Story of the Conflict in Laikipia, Kenya. <https://www.animals24-7.org/2017/03/17/the-untold-story-of-the-conflict-in-laikipia-kenya/>.
- [2] 2017. Violence, Land, and the Upcoming Vote in Kenya's Laikipia Region. <https://www.crisisgroup.org/africa/horn-africa/kenya/violence-land-and-upcoming-vote-kenyas-laikipia-region>.
- [3] 2020. Copia Kenya - Send Goods Upcountry Affordably and Conveniently. <https://copia.co.ke/>
- [4] Arun Agrawal. 2003. Sustainable Governance of Common-Pool Resources: Context, Methods, and Politics. *Annual Review of Anthropology* 32, 1 (Oct. 2003), 243–262. <https://doi.org/10.1146/annurev.anthro.32.061002.093112>
- [5] Arun Agrawal and Clark C Gibson. 1999. Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation. *World Development* 27, 4 (April 1999), 629–649. [https://doi.org/10.1016/S0305-750X\(98\)00161-2](https://doi.org/10.1016/S0305-750X(98)00161-2)
- [6] Arun Agrawal and Nicolas Perrin. 2003. Climate Adaptation, Local Institutions and Rural Livelihoods. In *Annual Review of Anthropology*. Vol. 32. 243–262. <https://doi.org/10.1016/j.gloenvcha.2013.08.014>
- [7] Peter Alpert. 1996. Integrated Conservation and Development Projects. *BioScience* 46, 11 (Dec 1996), 845–855. <https://doi.org/10.2307/1312970>
- [8] Chris Ansell and Alison Gash. 2008. Collaborative Governance in Theory and Practice. *Journal of Public Administration Research and Theory* 18, 4 (Oct 2008), 543–571. <https://doi.org/10.1093/jopart/mum032>
- [9] Chris Ansell and A. Gash. 2012. Stewards, mediators, and catalysts: Toward a model of collaborative leadership. *Innovation Journal* 17 (Jan 2012).
- [10] Christopher B. Barrett and Peter Arcese. 1995. Are Integrated Conservation-Development Projects (ICDPs) Sustainable? On the conservation of large mammals in sub-Saharan Africa. *World Development* 23, 7 (Jul 1995), 1073–1084. [https://doi.org/10.1016/0305-750X\(95\)00031-7](https://doi.org/10.1016/0305-750X(95)00031-7)
- [11] Anna Batool, Samia Razaq, Maham Javaid, Beenish Fatima, and Kentaro Toyama. 2017. Maternal Complications: Nuances in Mobile Interventions for Maternal Health in Urban Pakistan. In *Proceedings of the Ninth International Conference on Information and Communication Technologies and Development (ICTD '17)*. Association for Computing Machinery, 1–12. <https://doi.org/10.1145/3136560.3136573>
- [12] Heike Baumüller. 2018. The Little We Know: An Exploratory Literature Review on the Utility of Mobile Phone-Enabled Services for Smallholder Farmers. *Journal of International Development* 30, 1 (2018), 134–154. <https://doi.org/10.1002/jid.3314>
- [13] Tessa Bold, Mwangi Kimenyi, Germano Mwabw, Alice Ng'ang'a, and Justin Sandefur. 2018. Experimental Evidence on Scaling up Education Reforms in Kenya. *Journal of Public Economics* 168 (Dec. 2018), 1–20. <https://doi.org/10.1016/j.jpubeco.2018.08.007>
- [14] Catherine Boone. 2012. Land Conflict and Distributive Politics in Kenya. *African Studies Review* 55, 1 (2012), 75–103. <https://doi.org/10.1353/arw.2012.0010>
- [15] Adriana Camacho and Emily Conover. 2010. *The Impact of Receiving Price and Climate Information in the Agricultural Sector*. SSRN Scholarly Paper. Social Science Research Network, Rochester, NY. <https://doi.org/10.2139/ssrn.1858036>
- [16] Benjamin Cashore. 2002. Legitimacy and the Privatization of Environmental Governance: How Non-State Market-Driven (NSMD) Governance Systems Gain Rule-Making Authority. *Governance* 15, 4 (2002), 503–529. <https://doi.org/10.1111/1468-0491.00199>
- [17] Dipanjan Chakraborty, Mohd Sultan Ahmad, and Aaditeshwar Seth. 2017. Findings from a Civil Society Mediated and Technology Assisted Grievance Redressal Model in Rural India. In *Proceedings of the Ninth International Conference on Information and Communication Technologies and Development (Lahore, Pakistan) (ICTD '17)*. Association for Computing Machinery, New York, NY, USA, Article 2, 12 pages. <https://doi.org/10.1145/3136560.3136574>
- [18] Nic Cheeseman, Gabrielle Lynch, and Justin Willis. 2016. Decentralisation in Kenya: The Governance of Governors*. *The Journal of Modern African Studies* 54, 1 (March 2016), 1–35. <https://doi.org/10.1017/S0022278X1500097X>
- [19] Brian Child, Helen Suich, Spenceley Anna, Helen Suich, and Spenceley Anna. 2012. Conservation in Transition. In *Evolution and Innovation in Wildlife Conservation*. <https://doi.org/10.4324/9781849771283-8>
- [20] Ol Pejeta Conservancy. 2018. 2018 Annual Report. <https://www.olpejetaconservancy.org/about-us/our-story/annual-report/>
- [21] Ol Pejeta Conservancy. 2019. Community Newsletters. <https://www.olpejetaconservancy.org/community/community-newsletters/>
- [22] Catalina M. Danis, Jason B. Ellis, Wendy A. Kellogg, Hajo van Beijma, Bas Hoefman, Steven D. Daniels, and Jan-Willem Loggers. 2010. Mobile Phones for Health Education in the Developing World: SMS as a User Interface. In *Proceedings of the First ACM Symposium on Computing for Development (London, United Kingdom) (ACM DEV '10)*. Association for Computing Machinery, New York, NY, USA, Article 13, 9 pages. <https://doi.org/10.1145/1926180.1926197>
- [23] Nicola Dell, Vidya Vaidyanathan, Indrani Medhi, Edward Cutrell, and William Thies. 2012. "Yours is Better!": Participant Response Bias in HCI. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (Austin, Texas, USA) (CHI '12)*. Association for Computing Machinery, New York, NY, USA, 1321–1330. <https://doi.org/10.1145/2207676.2208589>
- [24] Brian Dillon, Jenny C Aker, and Joshua E Blumenstock. 2020. How Important is the Yellow Pages? Experimental Evidence from Tanzania. DP14489 (2020), 60. http://dillon.dyson.cornell.edu/CV_papers/DillonAkerBlumenstock-YellowPages.pdf
- [25] Karn Dubey, Palash Gupta, Rachna Shriwas, Gayatri Gulvady, and Amit Sharma. 2019. Learnings from deploying a voice-based social platform for people with disability. In *Proceedings of the 2nd ACM SIGCAS Conference on Computing and Sustainable Societies (COMPASS '19)*. Association for Computing Machinery, 111–121. <https://doi.org/10.1145/3314344.3332503>
- [26] Aaron Erlich, Danielle F. Jung, James D. Long, and Craig McIntosh. 2018. The Double-Edged Sword of Mobilizing Citizens via Mobile Phone in Developing Countries. *Development Engineering* 3 (Jan. 2018), 34–46. <https://doi.org/10.1016/j.deveng.2017.11.001>
- [27] Marcel Fafchamps and Bart Minten. 2012. Impact of SMS-Based Agricultural Information on Indian Farmers. *The World Bank Economic Review* 26, 3 (Jan. 2012), 383–414. <https://doi.org/10.1093/wber/lhr056>
- [28] Karen E. Ferree, Clark C. Gibson, Danielle F. Jung, James D. Long, and Craig McIntosh. 2017. How Technology Shapes the Crowd: Participation in the 2014 South African Election. (Dec. 2017). <https://escholarship.org/uc/item/5pd6k715>
- [29] Phil Franks, Rob Small, and Francesca Booker. 2018. Social Assessment for Protected and Conserved Areas (SAPA) Methodology manual for SAPA facilitators. (Nov 2018). <https://pubs.iied.org/14659IIED/>
- [30] Caroline Free, Gemma Phillips, Louise Watson, Leandro Galli, Lambert Felix, Phil Edwards, Vikram Patel, and Andy Haines. 2013. The Effectiveness of Mobile-Health Technologies to Improve Health Care Service Delivery Processes: A Systematic Review and Meta-Analysis. *PLOS Medicine* 10, 1 (Jan. 2013), e1001363. <https://doi.org/10.1371/journal.pmed.1001363>
- [31] Alejandro J Ganimian and Richard J Murnane. 2014. *Improving Educational Outcomes in Developing Countries: Lessons from Rigorous Impact Evaluations*. Working Paper 20284. National Bureau of Economic Research. <https://doi.org/10.3386/w20284>
- [32] Clark C. Gibson. 1999. *Politicians and Poachers: The Political Economy of Wildlife Policy in Africa*. <https://doi.org/10.1017/CBO9780511625640>
- [33] Jonathan Grudin. 1994. Groupware and Social Dynamics: Eight Challenges for Developers. *Commun. ACM* 37, 1 (Jan. 1994), 92–105. <https://doi.org/10.1145/175222.175230>
- [34] Lynne Zeitlin Hale and Stephen Bloye Olsen. 2003. Coastal Governance in Donor-Assisted Countries. *Crafting Coastal Governance in a Changing World Coastal Management Report #2241* (Dec 2003), 36.
- [35] Garrett Hardin. 1968. The Tragedy of the Commons. *Science* 162, 3859 (1968), 1243–1248. <https://doi.org/10.1126/science.162.3859.1243> arXiv:<https://science.sciencemag.org/content/162/3859/1243.full.pdf>
- [36] Richard Heeks. 2010. Do Information and Communication Technologies (ICTs) Contribute to Development? *Journal of International Development* 22, 5 (2010), 625–640. <https://doi.org/10.1002/jid.1716>
- [37] Lotte Hughes. 2006. Moving the Maasai: A Colonial Misadventure. (Jan. 2006). <https://doi.org/10.1057/9780230246638>
- [38] Fahad Idrees, Anna Batool, and Junaid Qadir. 2017. Weather Forecast Information Dissemination Design For Low-Literate Farmers: An Exploratory Study. In *Proceedings of the Ninth International Conference on Information and Communication Technologies and Development (ICTD '17)*. Association for Computing Machinery, 1–5. <https://doi.org/10.1145/3136560.3136596>
- [39] Nancy Ingutia, Bernard Mwangi, Nicholas Njogu, Rob Small, and Ann Komen. Forthcoming. SAPA Case Study: Preliminary Results and Actions for Ol Pejeta Conservancy. (Forthcoming).
- [40] M. Sirajul Islam and Ake Grönlund. 2010. An Agricultural Market Information Service (AMIS) in Bangladesh: Evaluating a Mobile Phone Based e-Service in a Rural Context. *Information Development* (Nov. 2010). <https://doi.org/10.1177/026666910385556>
- [41] Karuti Kanyinga and James D. Long. 2012. The Political Economy of Reforms in Kenya: The Post-2007 Election Violence and a New Constitution. *African Studies Review* 55, 1 (2012), 31–51. <https://doi.org/10.1353/arw.2012.0002>
- [42] Michael Kremer, Conner Brannen, and Rachel Glennerster. 2013. The Challenge of Education and Learning in the Developing World. *Science* 340, 6130 (April 2013), 297–300. <https://doi.org/10.1126/science.1235350>
- [43] Michael Marchand, Kristiina Vogt, Asep Suntuana, Rodney Cawston, John Gordon, Mia Siscawati, Daniel Vogt, John Tovey, Ragnhildur Sigurdardottir, and Patricia Roads. 2013. *The River of Life: Sustainable Practices of Native Americans and Indigenous Peoples*. DE GRUYTER, Berlin, Boston. <https://doi.org/10.1515/9783110275889>
- [44] Chris Muashekele, Heike Winschiers-Theophilus, and Gereon Koch Kapuire. 2019. Co-Design as a Means of Fostering Appropriation of Conservation Monitoring Technology by Indigenous Communities. In *Proceedings of the 9th International Conference on Communities & Technologies - Transforming Communities (Vienna, Austria) (C&T '19)*. Association for Computing Machinery, New York, NY, USA, 126–130. <https://doi.org/10.1145/3328320.3328383>
- [45] Mustafa Naseem, Bilal Saleem, Sacha St-Onge Ahmad, Jay Chen, and Agha Ali Raza. 2020. An Empirical Comparison of Technologically Mediated Advertising

- in Under-Connected Populations. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) (CHI '20). Association for Computing Machinery, New York, NY, USA, 1–13. <https://doi.org/10.1145/3313831.3376683>
- [46] Fabian Okeke, Beatrice Wasunna, Mercy Amulele, Isaac Holeman, and Nicola Dell. 2019. Including the Voice of Care Recipients in Community Health Feedback Loops in Rural Kenya. *Proc. ACM Hum.-Comput. Interact.* 3, CSCW, Article 71 (Nov. 2019), 20 pages. <https://doi.org/10.1145/3359173>
- [47] Mancur Olson. 1965. *Logic of Collective Action: Public Goods and the Theory of Groups*. Harvard University Press, Cambridge ; Massachusetts. <https://doi.org/10.2307/j.ctvjsf3ts>
- [48] Elinor Ostrom. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press, Cambridge ; New York. <https://doi.org/10.1017/CBO9781316423936>
- [49] Elinor Ostrom. 2008. The Challenge of Common-Pool Resources. *Environment: Science and Policy for Sustainable Development* 50, 4 (July 2008), 8–21. <https://doi.org/10.3200/ENVT.50.4.8-21>
- [50] Trevor Perrier, Nicola Dell, Brian DeRenzi, Richard Anderson, John Kinuthia, Jennifer Unger, and Grace John-Stewart. 2015. Engaging Pregnant Women in Kenya with a Hybrid Computer-Human SMS Communication System. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems - CHI '15*. ACM Press, Seoul, Republic of Korea, 1429–1438. <https://doi.org/10.1145/2702123.2702124>
- [51] Trevor Perrier, Brian DeRenzi, and Richard Anderson. 2015. USSD: The Third Universal App. In *Proceedings of the 2015 Annual Symposium on Computing for Development - DEV '15*. ACM Press, London, United Kingdom, 13–21. <https://doi.org/10.1145/2830629.2830645>
- [52] Trevor Perrier, Elizabeth K. Harrington, Keshet Ronen, Daniel Matemo, John Kinuthia, Grace John-Stewart, Richard Anderson, and Jennifer A. Unger. 2018. Male Partner Engagement in Family Planning SMS Conversations at Kenyan Health Clinics. In *Proceedings of the 1st ACM SIGCAS Conference on Computing and Sustainable Societies (COMPASS '18)*. Association for Computing Machinery, 1–11. <https://doi.org/10.1145/3209811.3209857>
- [53] Anthony Poon, Sarah Giroux, Parfait Eloundou-Enyegue, François Guimbretiere, and Nicola Dell. 2019. Engaging High School Students in Cameroon with Exam Practice Quizzes via SMS and WhatsApp. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (Glasgow, Scotland UK) (CHI '19). Association for Computing Machinery, New York, NY, USA, 1–13. <https://doi.org/10.1145/3290605.3300712>
- [54] Meenal Pore, Nuri Purswani, Reginald E. Bryant, Purity Mugambi, and Osamu-yimen Stewart. 2015. Towards a 2-Way Communication and Analytics Platform for Emergency Response and Post-Emergency Recovery Efforts in Sierra Leone. In *Proceedings of the 2015 Annual Symposium on Computing for Development* (London, United Kingdom) (DEV '15). Association for Computing Machinery, New York, NY, USA, 31. <https://doi.org/10.1145/2830629.2830634>
- [55] Agha Ali Raza, Mansoor Pervaiz, Christina Milo, Samia Razaq, Guy Alster, Jahanzeb Sherwani, Umar Saif, and Roni Rosenfeld. 2012. Viral Entertainment as a Vehicle for Disseminating Speech-Based Services to Low-Literate Users. In *Proceedings of the Fifth International Conference on Information and Communication Technologies and Development* (Atlanta, Georgia, USA) (ICTD '12). Association for Computing Machinery, New York, NY, USA, 350–359. <https://doi.org/10.1145/2160673.2160715>
- [56] Steve M. Redpath, Juliette Young, Anna Evelyn, William M. Adams, William J. Sutherland, Andrew Whitehouse, Arjun Amar, Robert A. Lambert, John D.C. Linnell, Allan Watt, and R.J. Gutiérrez. 2013. Understanding and Managing Conservation Conflicts. *Trends in Ecology & Evolution* 28, 2 (Feb. 2013), 100–109. <https://doi.org/10.1016/j.tree.2012.08.021>
- [57] Jakob Reinikka, Ritva Svensson. 1999. *How Inadequate Provision of Public Infrastructure and Services Affects Private Investment*. The World Bank. <https://doi.org/10.1596/1813-9450-2262> arXiv:<https://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-2262>
- [58] Waleed Riaz, Haris Durrani, Suleman Shahid, and Agha Ali Raza. 2017. ICT Intervention for Agriculture Development: Designing an IVR System for Farmers in Pakistan. In *Proceedings of the Ninth International Conference on Information and Communication Technologies and Development* (ICTD '17). Association for Computing Machinery, 1–5. <https://doi.org/10.1145/3136560.3136598>
- [59] Charles Steinfield, Susan Wyche, Tian Cai, and Hastings Chiwasa. 2015. The mobile divide revisited: mobile phone use by smallholder farmers in Malawi. In *Proceedings of the Seventh International Conference on Information and Communication Technologies and Development* (ICTD '15). Association for Computing Machinery, 1–9. <https://doi.org/10.1145/2737856.2738022>
- [60] Saiganesh Swaminathan, Indrani Medhi Thies, Devansh Mehta, Edward Cutrell, Amit Sharma, and William Thies. 2019. Learn2Earn: Using Mobile Airtime Incentives to Bolster Public Awareness Campaigns. *Proc. ACM Hum.-Comput. Interact.* 3, CSCW, Article 49 (Nov. 2019), 20 pages. <https://doi.org/10.1145/3359151>
- [61] Philip K. Thornton, Peter G. Jones, Gopal Alagaraswamy, Jeff Andresen, and Mario Herrero. 2010. Adapting to Climate Change: Agricultural System and Household Impacts in East Africa. *Agricultural Systems* 103, 2 (Feb. 2010), 73–82. <https://doi.org/10.1016/j.agsy.2009.09.003>
- [62] Aditya Vashistha, Richard Anderson, and Shrirang Mare. 2019. Examining the Use and Non-Use of Mobile Payment Systems for Merchant Payments in India. In *Proceedings of the 2nd ACM SIGCAS Conference on Computing and Sustainable Societies* (Accra, Ghana) (COMPASS '19). Association for Computing Machinery, New York, NY, USA, 1–12. <https://doi.org/10.1145/3314344.3332499>
- [63] Aditya Vashistha, Erin Brady, William Thies, and Edward Cutrell. 2014. Educational Content Creation and Sharing by Low-Income Visually Impaired People in India. In *Proceedings of the Fifth ACM Symposium on Computing for Development* (San Jose, California, USA) (ACM DEV-5 '14). Association for Computing Machinery, New York, NY, USA, 63–72. <https://doi.org/10.1145/2674377.2674385>
- [64] Aditya Vashistha, Fabian Okeke, Richard Anderson, and Nicola Dell. 2018. "You Can Always Do Better!": The Impact of Social Proof on Participant Response Bias. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18*. ACM Press, 1–13. <https://doi.org/10.1145/3173574.3174126>
- [65] Aditya Vashistha, Umar Saif, and Agha Ali Raza. 2019. The Internet of the Orals. *Commun. ACM* 62, 11 (Oct. 2019), 100–103. <https://doi.org/10.1145/3343452>
- [66] John Vidal. 2016. The tribes paying the brutal price of conservation. *The Observer* (Aug 2016). <https://www.theguardian.com/global-development/2016/aug/28/exiles-human-cost-of-conservation-indigenous-peoples-eco-tourism>
- [67] Florian J. Weise, Helmut Hauptmeier, Ken J. Stratford, Matthew W. Hayward, Konstantin Aal, Marcus Heuer, Mathata Tomeletso, Volker Wulf, Michael J. Somers, and Andrew B. Stein. 2019. Lions at the Gates: Trans-Disciplinary Design of an Early Warning System to Improve Human-Lion Coexistence. *Frontiers in Ecology and Evolution* 6 (2019). <https://doi.org/10.3389/fevo.2018.00242>
- [68] Galen Weld, Trevor Perrier, Jenny Aker, Joshua E. Blumenstock, Brian Dillon, Adalbertus Kamanzi, Editha Kokushubira, Jennifer Webster, and Richard J. Anderson. 2018. eKichabi: Information Access through Basic Mobile Phones in Rural Tanzania. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18*. ACM Press, 1–12. <https://doi.org/10.1145/3173574.3173707>
- [69] Paige West. 2006. *Conservation Is Our Government Now: The Politics of Ecology in Papua New Guinea*. Duke University Press, Durham [N.C.].
- [70] Susan Wyche and Charles Steinfield. 2016. Why Don't Farmers Use Cell Phones to Access Market Prices? Technology Affordances and Barriers to Market Information Services Adoption in Rural Kenya. *Information Technology for Development* 22, 2 (April 2016), 320–333. <https://doi.org/10.1080/02681102.2015.1048184>
- [71] Susan P. Wyche, Melissa Densmore, and Brian Samuel Geyer. 2015. Real mobiles: Kenyan and Zambian smallholder farmers' current attitudes towards mobile phones. In *Proceedings of the Seventh International Conference on Information and Communication Technologies and Development* (ICTD '15). Association for Computing Machinery, 1–10. <https://doi.org/10.1145/2737856.2738013>
- [72] Maruf Zaber, Bonnie Nardi, and Jay Chen. 2018. Responding to Riverbank Erosion in Bangladesh. In *Proceedings of the 1st ACM SIGCAS Conference on Computing and Sustainable Societies* (Menlo Park and San Jose, CA, USA) (COMPASS '18). Association for Computing Machinery, New York, NY, USA, Article 27, 11 pages. <https://doi.org/10.1145/3209811.3209823>