

## Article

# Assessing Local Indigenous Knowledge and Information Sources on Biodiversity, Conservation and Protected Area Management at Khuvsgol Lake National Park, Mongolia

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**Abstract:** Indigenous knowledge about biodiversity and conservation is valuable and can be used to sustainably manage protected areas; however, indigenous communities continue to be marginalized due to the belief that their values and behaviors do not align with the overarching mission of conservation. This paper explores the extent of local knowledge and awareness of biodiversity, conservation and protected area management of indigenous communities at Khuvsgol Lake National Park, Mongolia. We investigate current levels of biodiversity awareness and explore perceptions toward conservation values and park management governance. Most respondents had a high awareness of existing biodiversity and held positive attitudes toward nature conservation and protected areas; however, insufficient knowledge of park rules and low levels of trust between local residents and park authorities may undermine conservation objectives in the long run. We identify an unequal share of economic benefits from tourism and preferential treatment toward elite business owners as a source of conflict. Limited information channels and poor communication between local residents and park authorities are also a source for low-level participation in conservation activities. Leveraging the increasing use of information communication technology, such as mobile phones, can serve as a new mechanism for improved information sharing and transparent reporting between local communities, conservationists and protected area authorities.

**Keywords:** protected areas; biodiversity; conservation; protected area management; information communication technology; Mongolia

## 1. Introduction

National parks and protected areas have become the most effective strategy to conserve and protect biodiversity and natural ecosystems [1]. As of 2017, more than 240,000 protected areas exist covering a total of 15 percent of the world's terrestrial area [2]. Under the Convention on Biodiversity and Aichi Biodiversity Targets the world's governments have pledged to increase the number of terrestrial protected areas to more than 17 percent by 2020 (Convention on Biodiversity 2010). However, some experts are calling for even bolder action to preserve at least 50 percent of terrestrial area globally [3,4]. While the international community's decision to increase protected lands is encouraging, those managing protected areas often lack the adequate resources to effectively manage and enforce

park rules and regulations, resulting in inefficient conservation efforts—nearly one-third of the world's protected areas are susceptible to intense human pressure [5]. Furthermore, large numbers of these protected areas, which are home to some of the highest levels of biodiversity in the world, fully or partially overlap the traditional lands of indigenous peoples [6]. The governance authorities and arrangements of these protected lands often do not recognize local inhabitants' traditional knowledge, practices, means of livelihoods, and collective tenure, which can create inequalities that undermine the values that long-term and sustained conservation is based [7].

It has long been believed that problems like pollution, deforestation, species extinction, and soil degradation have been due to local, indigenous misuse of natural resources [8]. Although the need to reduce human impacts on biodiversity has been widely acknowledged, research has found that local people do value, utilize and efficiently manage their environments, suggesting that local involvement is the first and most important line of defense in protecting biodiversity [9]. Since 1994 there has been some acknowledgement by the international community to recognize indigenous peoples' rights and ownership of protected areas, beginning with the World Conservation Union and later the World Commission on Protected Areas [10–12]. Nevertheless, while these efforts suggest a shift from past conservation philosophy, little has been done beyond the declarations and guidelines made on the international stage to ensure that indigenous peoples are included in the decision making and co-management of protected lands [13]. In the face of these challenges, the need for new channels of communication that promote the transparent exchange of information between conservationists, park authorities and indigenous peoples has been established [5,14,15]. Recent studies have identified information communication technologies (ICT) as an emerging tool for conservation in Africa while some development agencies like the World Bank have reported preliminary success implementing information sharing campaigns via mobile phone short message service (SMS) for remote communities in Asia [16,17]. Unlike television and radio, the proliferation of mobile phones, specifically smart phones, provides an opportunity for information exchange and feedback loops between groups and does not have the same cost barrier or need for reliable access to an electricity grid [15].

Two questions addressed in this paper aim to elucidate the generally accepted theory that indigenous communities are aware of their environment, and conservation goals can be better achieved if local communities are engaged and included in the decision-making process. A unique aspect of this study aims to identify current information sources and new channels for information exchange as a means to encourage participation of local and indigenous communities in protected area governance. We ask: (1) What is the current level of local awareness of biodiversity, conservation and protected area management at Khuvsgol Lake National Park (KLNP) in Mongolia and; (2) What are the information sources, usage and usage patterns of information communication technologies within indigenous KLNP households?

To understand the issues addressed in the study we turn to Mongolia, a country home to some of the world's largest remaining wild areas that support a vast and diverse group of native flora and fauna. However, in the face of a rapidly growing mining and tourism industry, conservation of wildlife and traditional pastoral livelihoods are being threatened [18]. In Mongolia, conservation policies are under the direction of the Ministry of Nature, Environment and Tourism, which oversees 64 protected areas covering approximately 21 million hectares or 14% of Mongolia's total terrestrial area [19]. Many of these protected areas overlap with local and indigenous communities and conflicts between public administration officers, park authorities and local inhabitants are occurring with greater frequency [20]. At KLNP the Ministry of Nature, Environment and Tourism has overseen park management and conservation activities since the park was designated as a protected area in 2004. For the most part, conservation law in Mongolia is consistent with international practice; however, there is a significant exception in the law that promotes: (1) the participation of local people and communities in protected area establishment, planning and management; and (2) the sharing of benefits from protected areas with local people [21]. Despite this, government efforts to expand tourism in the Khuvsgol Lake region have increased rapidly with KLNP receiving national and international attention, and while interest

for tourism grows development has fallen short of integrating local communities into the planning and decision-making process and providing an equal share of benefits from the tourism sector.

### *The Setting*

Located in northern Mongolia, along the Russian border, at the foot of the eastern Sayan Mountains, Khuvsgol Lake National Park is designated as a protected area (IUCN Category II) for its ecological importance including natural beauty, high biological richness (794 plant species, 369 animal species, 258 migratory birds), pristine water resources and unique historic and cultural values. The region lies 1645 m above sea level and covers more than 8300 square kilometers. KLNP is classified by the Ministry of Nature, Environment and Tourism as a “strictly protected area”. The region is home to a large number of vulnerable and endangered wildlife and fish species including argali, elk, musk deer, sable, Siberian marmot as well as burbot, grayling, lenok and perch. Despite the protected status of KLNP a variety of challenges continue to exist, including illegal logging, illegal mining, commercial fishing, unregulated development, poor sanitation and water quality, and litter [22].

The namesake of the park, two million-year-old Khuvsgol Lake, is one of seventeen ancient lakes in the world, and is considered to be one of the most pristine fresh water sources on the planet. More than 136 km long, 35 km wide and 262 m deep the lake contains 4% of global fresh water and 70% of Mongolia’s fresh water resources [23].

Present-day inhabitants of KLNP are mainly settled and mobile pastoral households including the Tsaatan, a community of reindeer herders living in the northern part of the reserve [24]. Originally from bordering Tuva Republic, the Tsaatan are one of the world’s last remaining groups of nomadic reindeer herders. Currently, some 40 reindeer households live within the boundaries of KLNP. In addition, nearly 200 mobile pastoral families live at KLNP grazing their herds of sheep, goat, cow, yak and horse in seasonal pasture areas. In recent years, the park has attracted many new residents owing largely to the rapidly growing tourism sector. Within the interior of KLNP there are 2 major districts and a number of sub districts, a few of which have become permanent and semi-permanent tourist areas. Districts included within park boundaries are subject to park regulations; however, laws are often unevenly enforced. Many of the districts within KLNP are some of the poorest in Mongolia [25]. Total population of KLNP has increased from 12,000 in 2001 to nearly 16,000 in 2017 [26].

KLNP has seen a rapid increase in tourist numbers bringing with it profound changes in the local economy. Many mobile pastoral households which had traditionally relied on animal husbandry now make some of their income from the seasonal tourism sector. Common jobs include horse guides, tourist camp operators and sellers of indigenous arts and craft souvenirs. Local communities; however, have limited capacity or resources to fully access tourism-related benefits with most of the business going to the elite tourist camp operators, which can provide higher quality service at lower cost. We find that outside camp operators account for 62 of 82 (76 percent), of all tourist camps at KLNP in 2017 as opposed to 10 percent in 2000. For many pastoral residents, livestock grazing will continue to be a principal livelihood, yet these benefits are in decline due to a growing encroachment of tourism camps onto traditional grazing areas.

From 2010 to 2014, annual tourist visits to KLNP rose from 11,000 to 60,000 [25], largely due to improved road access and reduced visa restrictions. While, the government has targeted KLNP as a key region for development, tourism-related expansion occurs in the absence of planning and there is little to no coordination between KLNP administration, communities, tour operators and tourism facilitators. Uncontrolled sewage and litter from tourism is threatening lake water quality and exerting additional pressure on grazing areas depended on by mobile pastoral households [27]. Recent studies have even reported the presence of high-levels of microplastic pollution within the lake [28].

In carrying out the functions of the park, KLNP is staffed by a small number of administrators and rangers, officially 1 per 32 square kilometers. Interviews with park administrators established that rangers are tasked to enforce park rules and interact with local community members; however, outreach and interaction is infrequent. Park regulations are not made available or published for local

inhabitants to see, leading to an information imbalance that often results in uneven enforcement of park policies. The importance of transparent governance cannot be overstated, as we found it to play a key role in the lack of trust between local community members and park authorities. Furthermore, park rangers lack the adequate training to evaluate human activity as being acceptable or unacceptable based on traditional and cultural values. Examples include citing local inhabitants for harvesting of biomass for cooking and heating, fishing for non-commercial purposes, and grazing of animals in traditional pasture areas. While these activities are officially illegal by Mongolian law, park authorities' unwillingness to recognize local knowledge about the environment may contribute to the marginalization of local citizenry at KLNP.

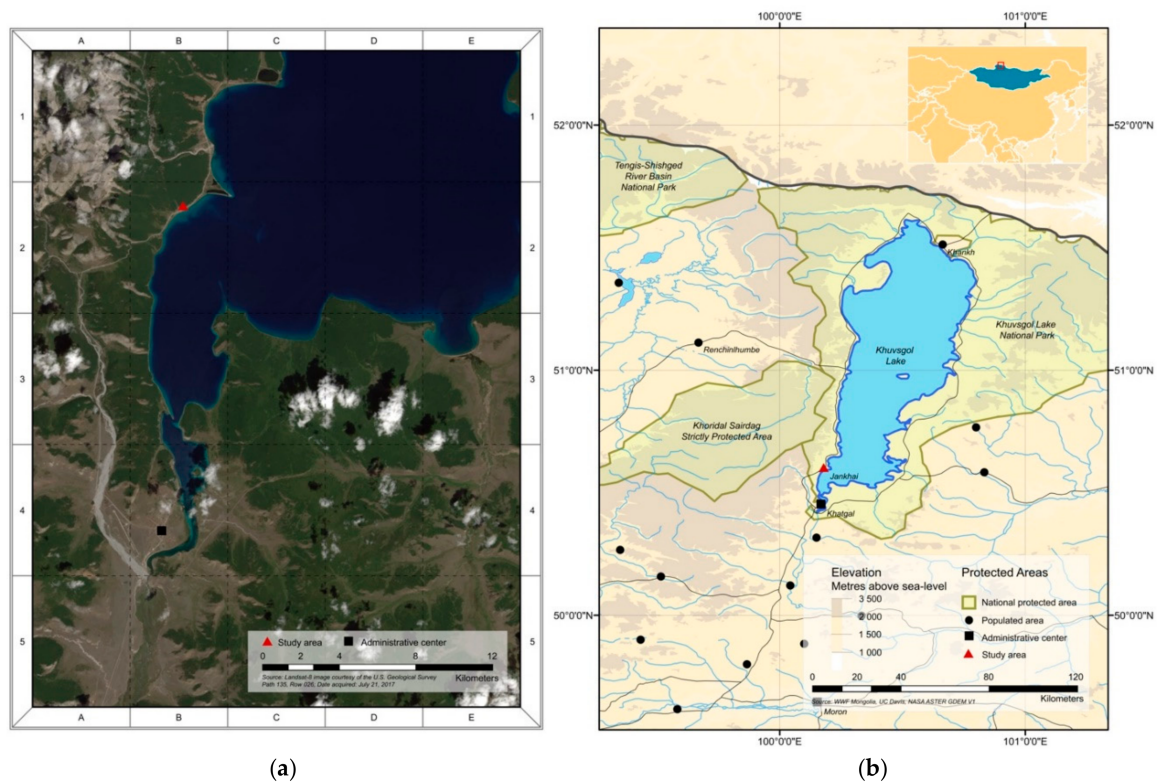
## 2. Methods

Thirty households within KLNP were asked 60 open and close-ended questions designed to assess knowledge on biodiversity awareness, conservation and protected area management within KLNP, including beliefs on environmental protection and conservation, identification of important biodiversity species, and knowledge on rules, regulation and management (Table S1). A unique aspect of this study, the survey also explored information sources, technology adoption and mobile phone use within local and indigenous households.

The survey was carried out during two field seasons: June–September 2016 and July–August 2017 in the district of Jankhai 28 km north of Khatgal, the administrative center (Figure 1) of KLNP. The study area was selected given its high number of settled and mobile pastoral households. It also serves as a major tourist destination for its proximity to the lake and road access and has seen a massive increase in tourism related development in recent years. In total, nearly 200 households were living within Jankhai at the time of the study. To minimize selection bias, a snowball technique sampling method was employed with one person being chosen at random and after asked to identify a friend or acquaintance that could participate in the survey. This sampling method was selected for its reliability and convenience. Of the 200 households, 70 individuals from 30 unique settled and mobile pastoral households were approached due to time constraints and the large distances between households. Of these 30 that were approached, 100% participated in the survey. Data input, coding, classification, categorization and analysis were conducted using STATA 13.0.

A description of the demographic data of participants at KLNP can be found in Table 1. We define settled households as those living in a fixed structure who do not participate in pastoralism, these households own few to no animals and rely less on the environment for their source of livelihood. Mobile pastoral households, on the contrary, dwell in the traditional Mongolian 'ger', a round wooden framed structure surrounded by felt, and depend heavily on the environment to earn a living. Many of these families own a variety of animals including sheep, goat, yak, cow and horse and move seasonally to different grazing areas. We make the distinction between settled and mobile pastoral households in order to compare the latter groups that practice more traditional indigenous livelihoods to the former who are more sedentary and therefore more likely to be involved in conventional occupations and have greater access to information and knowledge resources. Our study sample is representative of regional and national averages [25].





**Figure 1.** (a) Landsat-8 image (Path 135, Row 026; Date acquired 21 July 2017) of study area (2B) and administrative center of KLNP (4B); (b) Map showing environs of KLNP.

**Table 1.** Demographic data of participants at KLNP.

Characteristics	Group	Total
Gender	Female	41 (59%)
	Male	29 (41%)
Age (years)	8–19	16 (23%)
	20–29	19 (27%)
	30–39	6 (9%)
	40–49	10 (14%)
	50–59	10 (14%)
	≥60	9 (13%)
Education	Primary school	40 (57%)
	High school	11 (16%)
	University	2 (3%)
	Vocational training	2 (3%)
Occupation	Herder	31 (44%)
	Fisherman	2 (3%)
	Construction	5 (7%)
	Tourism	9 (12%)
	Teacher	3 (4%)
	Student	10 (14%)
	Pensioner	10 (14%)
Dwelling	Mobile pastoralist	51 (73%)
	Settled	19 (27%)

### 3. Results

#### 3.1. Biodiversity Awareness

In order to understand the level of biodiversity awareness among local residents we asked respondents to identify species within KLNP from photographs and, if identified correctly, state whether they believed the animal was considered endangered, vulnerable, or at no risk (Table 2). Responses indicated that mobile pastoralists have a high degree of knowledge on vulnerable and endangered species in KLNP. Even argali and red deer which graze deep into the Sayan mountains away from pastoral zones were recognized as being animals found within park boundaries and highly endangered. Settled participants reported a similar degree of awareness for protected and endangered species. Many participants also noted that the Khuvsgol Grayling, commonly cited by government agencies as being overfished by local residents, is highly vulnerable and therefore deserving of protection; however, subsistence fishing should be permitted. When questioned how a species became endangered over hunting was the most commonly cited answer among both pastoral and settled households.

**Table 2.** Levels of awareness for key and vulnerable species at KLNP.

Species	Demographic		Total
	Pastoralist	Settled	
Argali ( <i>Ovis ammon</i> )	33 (64%)	12 (63%)	45 (64%)
Musk Deer ( <i>Moschus moschiferus</i> )	44 (86%)	16 (84%)	60 (86%)
Elk ( <i>Alces alces</i> )	45 (88%)	17 (89%)	52 (74%)
Grayling ( <i>Thymallus nigrescens</i> )	48 (94%)	19 (100%)	67 (96%)
Red Deer ( <i>Cervus elaphus</i> )	39 (76%)	16 (86%)	55 (79%)
Reindeer ( <i>Rangifer tarandus</i> )	48 (94%)	19 (100%)	67 (96%)
Sable ( <i>Martes zibellina</i> )	46 (90%)	17 (89%)	63 (90%)
Siberian marmot ( <i>Marmota sibirica</i> )	42 (82%)	15 (79%)	57 (81%)

#### 3.2. Knowledge of Environmental Sensitivity and Park Governance

Table 3 shows the questions asked of participants to assess perceptions on conservation and park management activities. The results reveal a high degree of environmental sensitivity among respondents with 96% of those surveyed answering that they believe environmental protection is essential for their well-being and 90% believing that human activity can irreversibly impact the environment. However, a majority of respondents were not aware of the existence of the park's governing institutions nor had any knowledge on how to report a grievance or negligent human activity to authorities—only 24% of total participants, 24% of pastoralists and 26% of settled households, were able to correctly identify the Ministry of Nature, Environment and Tourism, as the administer of park management. Furthermore, only 19% of respondents could accurately state park rules and regulations related to hunting, fishing, forestry and waste management. Trust between local residents and park management is also low with 39% of pastoralists and 42% of settled households stating an unwillingness by park authorities to redress grievances as a major source of contention. Park inhabitants also noted that outside business owners benefit the most from tourism with only 10% of total respondents believing that local residents have an equal opportunity to share in the economic benefits.

**Table 3.** Perceptions on conservation and park management activities.

Participant Answered . . .	Demographic		Total
	Pastoralist	Settled	
Environmental protection is essential for wellbeing;	49 (96%)	18 (95%)	67 (96%)
Human disturbance can result in irreversible environmental damage;	47 (92%)	16 (84%)	63 (90%)
Is aware of park rules and regulations related to hunting, fishing, forestry and waste management;	11 (22%)	2 (11%)	13 (19%)
Can identify the governing bodies of KLNP;	12 (24%)	5 (26%)	17 (24%)
Park authorities can be trusted to redress grievances;	20 (39%)	8 (42%)	28 (40%)
Certain activities should be prohibited within the park;	35 (69%)	16 (84%)	51 (73%)
Tourism provides an equal share of economic benefits.	6 (12%)	1 (5%)	7 (10%)

In terms of associations across demographics we find little difference in opinion toward conservation and park management between settled and pastoral households. Ninety-six percent of mobile pastoralists consider the environment the most important factor in their wellbeing and consider environmental protection essential. This is also true for 95 percent of those living in settled households.

Seventy three percent of total respondents, 69% for mobile pastoralists and 84% for settled households, expressed the need to prohibit certain activities within park boundaries including hunting of birds, mining and logging of trees. Although the majority of respondents' views aligned with conservation norms a common point of contention was fishing and hunting, which, although prohibited by law, remains an important subsistence activity for many pastoral and settled households. An overwhelming majority of participants answered that they believe local households should have the right to fish and hunt although they answered unfavorably when asked if commercial fishing and hunting should be allowed to promote tourism.

Most respondents answered favorably for the development of the tourism sector; however, improved regulation and access to economic benefits were answered as necessary for local communities. Only 10% of total respondents believed that tourism provided an equal share of benefits and was often cited as a major reason for conflict and distrust with park officials and business owners.

### 3.3. Sources of Information

In Table 4, 94% of respondents stated they obtain some information about the environment from friends and family. Information from local authorities, such as park rangers, accounted for only 26% of information sources. School sources provided 26% of respondents with information about park management and television and radio provided 18% of participants, respectively. We account for low levels of information dissemination across television and radio due to a lack of reliable access to electricity. Twenty percent of respondents claimed to receive some information about biodiversity and conservation through ICT such as mobile phones. While access to an electricity grid is limited, many households own and operate 50-watt solar home systems that can sufficiently charge phones and other portable devices. Connection to the cellular network is also improving as telecommunication companies expand their coverage to serve popular tourist areas.

**Table 4.** Information sources on biodiversity, conservation and park management.

	Demographic		Total
	Pastoralist	Settled	
Personal experience	47 (92%)	19 (100%)	66 (94%)
Television, radio	9 (17%)	4 (21%)	13 (18%)
Local authorities	12 (23%)	6 (32%)	18 (26%)
School	15 (29%)	3 (16%)	18 (26%)
ICT/Internet	11 (22%)	3 (16%)	14 (20%)

Regarding ICT, 84 percent of respondents answered that they own a mobile phone, with 44% of that group using a smart phone (computing and internet capabilities) as opposed to a traditional mobile handset (basic calling features) (Table 5). Sixty-seven percent of those interviewed reported at least occasional use of SMS and 58% use their mobile phone to take photos. Sixty-nine percent of mobile pastoralists reported using SMS and 33 percent responded accessing the Internet at least occasionally with their smart phone. Common barriers to use were poor reception, limited battery life, cost and user ability.

**Table 5.** Mobile phone use within local communities at KLNP.

	Demographic		Total
	Pastoralist	Settled	
Own a mobile phone	42 (82%)	17 (89%)	59 (84%)
Own a smart phone	23 (45%)	8 (42%)	31 (44%)
Utilize messaging and SMS	35 (69%)	12 (63%)	47 (67%)
Occasional use of Internet	17 (33%)	4 (21%)	21 (30%)
Use of social media	11 (22%)	4 (21%)	15 (21%)
Photography and digital media	32 (62%)	9 (47%)	41 (58%)

#### 4. Discussion

We find, in line with previous studies on indigenous values [7–10,29], that local communities at KLNP do value and have representative knowledge about their environment. We identify that poorly developed information channels and low levels of information sharing diminish trust and erode local support for conservation activities. Though a variety of information channels at KLNP exist, many are underutilized. The introduction of conservation themed curriculum in schools and increased outreach by park authorities may be two immediate actions that can be taken to enhance awareness of conservation objectives and improve information exchange between local residents and authorities in a protected area setting [30]. We find that 80 percent of respondents indicate low engagement with park officials and uneven enforcement of park policies as a source of hostility. Park authorities must make clear that they are there to work with and not against local community members. Transparency of institutional rules, regulations and activities is also crucial for achieving local participation in conservation activities [31]. Installing signs or placards within the perimeter of the park and providing households with a list of park rules are two examples that have been cited as effective for informing local citizenry on regulations. In addition, park rangers would benefit from training that helps them assess local activity as being aligned with traditional values and therefore permitted in accordance with international norms. The growing use of ICT including mobile phones and access to the Internet presents a new opportunity to engage the local community with up to date information about conservation activities and park management. Given the limited human resources of the park, ICT should be considered as a primary mechanism for improved information sharing, open dialog, transparent reporting as well as a channel to communicate opportunities for residents to access economic benefits from the tourism sector. If the local population is unlikely to see any economic benefit from tourism long-term sustainability and cooperation is unlikely. If future action plans are inclusive, coherent, and strategic and sustained communication, education and public awareness efforts are made, long-term conservation of KLNP is possible. Finally, the Ministry of Nature, Environment and Tourism should establish a clear plan, based on local and expert consultation, identifying how tourism should be developed within the park over time as well ensure a more equal share of economic benefits reach the local people. Promoting locally run tourist camps, establishing a designated market for locally produced handicrafts, requiring outside run tourist facilities hire local staff, offering entrepreneurial training programs for local residents, and setting a quota for the number of outside owned tourist facilities within park boundaries are just a few examples of efforts that park management can take to include local people in the tourism sector.

Although this study accomplished its aims several limitations would benefit from future study. First, as ICT has only recently been introduced into the local community use patterns will likely evolve as familiarity with the technology improves and more reliable access to the network is achieved. Future studies will want to explore the longitudinal effects of ICT use in more depth. Second, because of limited time and distance between households only a small number of participants were included in the survey. A more rigorous study with a greater number of participants may provide a better understanding of how local residents can actively contribute to conservation activities. Finally, future studies will also want to focus on identifying the relative messages for bridging the information gap between park management and local communities as well as which ICT channels and social media platforms can help establish transparent information sharing.

## 5. Conclusions

In this paper we attempt to assess the local knowledge and information sources on biodiversity, conservation and protected area governance at Khuvsgol Lake National Park in Mongolia. We find, in line with our study objectives, that a majority of participants had a high awareness of biodiversity and held positive attitudes toward nature conservation and protected areas; however, insufficient knowledge of park rules and low levels of trust between local residents and park authorities may undermine the park's conservation objectives in the long run. Limited information channels and poor communication between local residents and park authorities are also a source for low-level participation in conservation activities. The growing use of smart phones and access to the Internet presents a new opportunity to connect community members with conservation activities and provide information on park management. Our results support the accepted wisdom that conservation goals can be better achieved if local communities are engaged and included in the decision-making process and rules, regulations and activities are transparently shared, understood and agreed upon [7–9,14,15]. In the face of the expanding global protected area network, it is also necessary to anticipate how the forces of tourism may impact local economies and livelihoods in the long term. Policy must reflect local knowledge and community involvement in the management and sharing of economic benefits to ensure long-term sustainability of protected areas. Limited operating budgets make ICT, such as smart phones and the Internet, an important mechanism in improving information sharing and collaboration between park residents and conservationists.

**Supplementary Materials:** The following are available online at <http://www.mdpi.com/2073-445X/7/4/117/s1>, Table S1: Questionnaire.

**Author Contributions:** C.M., H.S., B.H., and E.E. conceptualized and designed the study. C.M., H.S., and E.E. carried out the investigation. Project administration was facilitated by C.M., H.S., B.H., and E.E. Visualization and map making was conducted by C.M. C.M. wrote, revised and edited the manuscript.

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