

Review

A framework for understanding the contributions of local residents to protected area law enforcement

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Abstract Terrestrial and marine protected areas have long been championed as an approach to biodiversity conservation. For protected areas to be effective, equitable and inclusive, the involvement of local residents in their management and governance is considered important. Globally, there are many approaches to involving local residents in protected area law enforcement. However, opportunities for comparing different approaches have been limited by the lack of a clear common framework for analysis. To support a more holistic understanding, we present a framework for analysing the contributions of local residents to protected area law enforcement. Informed by a review of the literature and discussions with conservation practitioners, the framework comprises five key dimensions: (1) the different points in the enforcement system at which local residents are involved, (2) the nature of local participation in decision-making, (3) the type of external support provided to local residents, (4) the different motivating forces for participation, and (5) the extent to which local participation is formalized. We apply the framework to three real-world case studies to demonstrate its use in analysing and comparing the characteristics of different approaches. We suggest this framework could be used to examine variation in local participation within the enforcement system, inform evaluation and frame constructive discussions between relevant stakeholders. With the global coverage of protected areas likely to increase, the framework provides a foundation for better understanding the contributions of local residents to protected area law enforcement.

Keywords Community engagement, framework, law enforcement, monitoring, participation, protected areas, rule-breaking

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Introduction

The Kunming–Montreal Global Biodiversity Framework has set ambitious new targets to expand global protected area coverage. As conservationists strive to meet these new goals, the importance of local participation in protected area management is likely to increase. Although the participation of local residents is increasingly recognized as important for informing decisions, improving effectiveness, enhancing equity (Schreckenberget al., 2016) and mitigating conflicts (Beaumont, 1997), knowledge of the current breadth and nature of local participation is limited.

The IUCN defines a protected area as ‘a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values’ (Dudley, 2008, p. 8). Protected areas take a diversity of forms, including reserves, national parks, private lands, and Indigenous and Community Conserved Areas (Brockington et al., 2008). They can be governed by both de jure regulations contained in law and de facto regulations, which are those actually experienced by local residents (Holmes & Brockington, 2012). These regulations seek to control and regulate access to natural resources (Borrini-Feyerabend et al., 2013), but they are only effective if people comply with them. The approaches protected area managers use to improve compliance differ between and within protected areas and reflect institutional values, protected area objectives and available resources. However, effective enforcement is often seen as vital for successful natural resource management (Keane et al., 2008).

Enforcement intends to reduce the benefits people expect to receive from engaging in illegal activity (Albers & Grinspoon, 1997). It can be understood as ‘monitoring adherence to rules and agreements and punishing infractions when they are detected’ (Keane et al., 2008, p. 75). Punishments can take multiple forms and include fines, the confiscation of equipment, prison sentences and social opprobrium (Clarke et al., 1993; Roe, 2015). Enforcing protected area rules effectively through traditional ranger-based approaches is often expensive and impeded by factors such as a lack of funding, and inadequate training and equipment (Ogunjinmi et al., 2008; Meduna et al., 2009; Critchlow et al., 2017). In addition, these approaches can be viewed as externally imposed and unjust, inflicting costs on people

living in the vicinity of a protected area (Poudyal et al., 2018). Heavy-handed approaches to enforcement can marginalize local residents and create conflicts between local communities and authorities (Wilfred et al., 2019). For example, militarized approaches to enforcement can lead to the violation of human rights (Massé et al., 2017). This has been brought to the fore by allegations of human rights abuses by law enforcement personnel in protected areas in various countries, including Cameroon, the Democratic Republic of the Congo, Nepal and India (WWF Independent Review, 2020).

Involving local residents in enforcement offers a means of strengthening or complementing traditional protected area law enforcement strategies and ensuring that protected area management is more equitable and just. Using local knowledge and perspectives can, for example, help develop a more complete information base (Berkes, 2004), identify conditions that lead to rule-breaking behaviour and extend monitoring beyond the purview of rangers (Albers & Grinspoon, 1997; Moreto & Charlton, 2021). For example, in Kerinci Seblat National Park in Sumatra, tip-offs from local informants were found to increase the effectiveness of routine patrols, with the probability of snare detection increasing by over 40% between 2009 and 2010 (Linkie et al., 2015). Similarly, a reduction in elephant poaching in and around protected areas in southern Tanzania was attributed to the participation of local residents in providing information and carrying out joint patrols with state rangers (Lotter & Clark, 2014).

Local involvement can also create social pressure to comply with conservation rules (Albers & Grinspoon, 1997; Moreto & Charlton, 2021), minimize local resistance to conservation initiatives (Berkes, 2007) and enhance the legitimacy of regulations (Beaumont, 1997; Jentoft et al., 1998). In the Barents Sea, for example, fisher representatives have a voice in the regulatory process, and regulations are generally considered to be legitimate, which contributes to compliance amongst individual fishers (Hønneland, 2000).

The term 'community participation' is often used to describe the involvement of local residents in conservation but, under this broad banner, local residents can participate in many different ways and experience different outcomes. Although some local residents may benefit from enforcement and their participation in enforcement activities, others may lose out in relation to both their rights and livelihoods. Local residents can incur different types of costs from participating in enforcement (Swai & Lotter, 2015). For example, informants may risk physical reprisals and ostracism from their communities (Travers et al., 2017). These costs can undermine protected area law enforcement (Akella & Cannon, 2004). Conservation practice has also faced criticism for making simplistic assumptions about communities (Waylen et al., 2013). Rather than being a homogeneous social structure with a set of shared norms,

a community comprises multiple actors with varied interests (Agrawal & Gibson, 1999). Social structuring through factors such as education level and class could influence local community involvement in protected area law enforcement. Participation can be dominated by certain groups within communities (Staddon et al., 2015). For example, in a global survey of the working conditions of protected area rangers, the vast majority of respondents identified as male (Belecky et al., 2019).

There are myriad different approaches to involving local residents in enforcement in protected areas, which differ according to the type and scale of activity being monitored, the aims, the level of support provided by external agencies and the degree of power and responsibility delegated to local residents. However, our understanding of the extent, characteristics and effectiveness of these different approaches, and of the different roles that local residents play and the benefits and risks involved, remains patchy. Existing research into this topic comprises a rich but disconnected set of case studies (e.g. Martin & Martin, 2010; Canney & Ganamé, 2015; Cottar, 2015; Roe, 2015), and opportunities for broader, comparative research have been limited by the lack of a clear common framework for analysis. Here we develop such a framework to help structure our understanding of the ways in which people living in the vicinity of protected areas can contribute to enforcement.

We illustrate how the framework can be used to categorize case studies, using examples from both terrestrial and marine systems in Cambodia and the UK. We show how the framework could be used for the analysis, comparison and evaluation of protected area law enforcement systems to support a more holistic and analytical understanding of the different ways in which local residents can contribute to protected area law enforcement.

Methods

We draw on the IUCN definition of a protected area and apply the definition of enforcement offered by Keane et al. (2008), cited above. We consider local residents to be people living within or on the periphery of a protected area, and we conceptualize contributions as individual or collective actions that can be carried out across a spectrum of control (Pretty, 1995; Danielsen et al., 2009; Ruano-Chamorro et al., 2021).

During November 2020–December 2021, we conducted a narrative review of the literature for information on how, why, where and when local residents contribute to protected area law enforcement. We searched Web of Science Core Collection (Clarivate, USA) for scientific literature and Google Scholar (Google, 2021) for scientific and grey literature. Across these platforms, we searched for literature published in the English language using simple search strings, such as 'local communities' AND 'protected area*';

'biodiversity conservation' AND 'enforcement'; 'protected area*' OR 'reserve' OR 'world heritage site*' OR 'national park*' AND 'community participation' OR 'local participation'. The search terms used were non-exhaustive, and we recognize that enforcement activities may fall within the purview of 'management' or 'monitoring' in certain settings. We did not restrict the search of the literature to a particular geographical area or a specific time frame.

This search strategy culminated in an initial set of results, which we used as a basis for backwards reference searching to identify key literature on community participation in the context of conservation and conservation law enforcement. From these two sets of literature we conducted an additional reference search to compile a bibliography of the community participation literature, a bibliography of the literature on protected area law enforcement and a bibliography of the community policing literature (Supplementary Material 1). Paying particular attention to real-world case studies, we applied a short set of criteria to the community participation and protected area law enforcement literature. Three criteria all had to be met for a study, article or report to be considered for inclusion: (1) A study, article or report that describes a terrestrial or marine protected area or an area that is associated with protected area management such as a buffer zone. (2) A study, article or report that mentions enforcement. In recognition that a protected area can be governed through multiple legal systems (e.g. national law and customary law; Borrini-Feyerabend et al., 2013), we did not apply a strict definition of law enforcement. Rather, we considered law enforcement as synonymous with enforcement of rules. (3) A study, article or report that describes the contributions or participation of local residents. Local residents could refer to Indigenous Peoples and/or members of local community groups. We included literature using terms such as 'community scouts', 'wardens', 'guardians', 'guards' and 'local rangers'.

We coded information on the characteristics of approaches to involving local residents in protected area enforcement and grouped it into the following themes: the aim of the approach, the activities carried out by local residents and the institutional structure of the approach (i.e. how the approach is governed). We also recorded financial and/or non-financial benefits (e.g. a sense of pride) that local residents reportedly receive through their participation. During this data-coding process we discussed emerging themes and refined them. This iterative process resulted in a first draft of the framework.

During February–May 2022, we applied the draft framework to three specific case studies to ground it in real-world experience. We chose the first case study (a community warden patrol scheme in south-west Cambodia) for in-depth analysis and preliminary validation of the framework. We chose this as it represents a relatively widely implemented approach to community engagement and because of the willingness of the implementing partners to engage with

our study. We then chose two other case studies from our literature review, to provide contrasting contexts, geographies and types of involvement of local people. These enabled further refinement and checking of our framework.

For case study 1, a review of project documentation was conducted from Fauna & Flora's office in Phnom Penh, Cambodia, to assess how a community warden patrol scheme related to the components of the draft framework. We also used the draft framework to guide discussions with six Fauna & Flora staff members, two of whom were government counterparts. We considered these individuals to be key informants as much of their day-to-day work focused on the management and coordination of the scheme. We engaged with all Fauna & Flora staff who were potentially key informants. Discussions were semi-structured and concerned the activities of the community wardens, their motivations for participating in the scheme and the support they receive from different stakeholder groups. We also discussed practical considerations regarding applying the framework. Discussions were typically 1 h long, face-to-face in a private setting. We did not record names of staff members, and we collected the information in a notebook. We obtained informed consent verbally.

We coded the information obtained through discussions with Fauna & Flora staff members and mapped it to the components of the draft framework, resulting in a number of modifications. We incorporated 'threat removal', for example, as an additional element of the enforcement system as we felt that the removal of some illegal equipment such as small fishing nets or hooks may not necessarily be done to sanction rule-breakers but instead to remove a threat. However, the confiscation of larger, more valuable equipment, such as a chainsaw, could also constitute a sanction.

Results

Dimensions of local community involvement in protected area law enforcement

The framework comprises five dimensions: (1) the involvement of local residents at different points in the enforcement system, (2) the nature of local participation in decision-making, (3) the type of external support provided to local residents, (4) the motivating forces for local participation, and (5) the extent to which local participation is formalized (Fig. 1). When examined collectively, these dimensions help articulate the characteristics of different approaches for involving local residents in protected area law enforcement.

Involvement of local residents at different points in the enforcement system

Building on the concept of an enforcement chain (Akella & Cannon, 2004), enforcement can be understood as a linked

Dimensions of local community involvement	Description
Involvement of local residents at different points in the enforcement system	Theoretically, local residents can contribute directly or indirectly to different elements of the enforcement system.
Nature of local residents' participation in decision-making	Local residents may contribute to decision-making and/or implementing decisions across different elements of the enforcement system.
Type of external support provided to local residents participating in enforcement	Local residents may receive external support from different stakeholders. Conversely, they may participate without or with limited support from external institutions.
Motivating forces for local residents' participation in enforcement	Local residents may be driven to participate in enforcement by motivating factors that are extrinsic and/or intrinsic in nature.
Extent to which local participation in enforcement is formalized	The extent to which local participation is formalized can vary. Local residents can contribute to enforcement formally and/or informally.

FIG. 1 A framework for structuring understanding of the contributions of local residents to protected area law enforcement.

system comprising seven elements: community engagement, detection, threat removal, arrest, prosecution, conviction and sanctioning (Fig. 2). Within this system, agents and institutions perform different roles and have different objectives and incentives (Robinson et al., 2010). In the context of protected area enforcement, for example, the number of rangers, the skills they possess and the availability of equipment influence the probability of detection (Arias et al., 2016). Although this element is predominantly field-based, the probability of arrest is dependent on factors such as available resources (e.g. rapid transportation) and evidence, whereas the probability of prosecution revolves around the capacity of the judicial system and coordination between legal institutions (Arias et al., 2016). Generally, the effectiveness of the enforcement system is reliant on each element functioning efficiently, meaning that if one element is weak (e.g. there is a low probability of detection or a low rate of prosecution), efforts made to strengthen other elements will be less effective (Akella & Cannon, 2004).

Protected area enforcement systems vary considerably and, in some situations or circumstances, certain components may be bypassed. A sanction such as a monetary fine could, for example, be administered on the spot without processing and engagement with the courts. In addition, some components may be interlinked. For instance, the detection of rule-breaking behaviour could lead to the confiscation of illegal equipment (i.e. threat removal) as well as apprehension.

Theoretically, local residents can contribute directly and indirectly to each element of the enforcement system. For example, community engagement can discourage rule-breaking behaviour before it happens. Local residents could conduct visible patrolling (Massé, 2020) or raise

awareness of rules through soft enforcement. Soft enforcement aims to achieve voluntary compliance by fostering community relations and drawing on education (Pendleton, 1998). This approach to enforcement is pursued in areas surrounding Takamanda National Park in Cameroon, where Village Forest Management Committees have been established to help raise community awareness of the importance of biodiversity conservation (Akenji et al., 2019). A similar approach is followed in the Arapaima Management Project in Guyana, where community awareness campaigns and education have led to social pressure that is thought to have played a greater role in enforcing a harvest ban than the formal structures of a management plan would have achieved (Fernandes, 2006).

Local residents can contribute to detection directly by undertaking patrols and providing intelligence (Lotter & Clark, 2014; Anagnostou et al., 2020), and they can contribute indirectly by carrying out ad hoc activities such as maintaining and/or operating vehicles. Furthermore, local residents can remove threats such as snares, apprehend or detain a suspected offender, serve as witnesses for the prosecution and impose different types of sanctions on rule-breakers (Wilkie et al., 2016).

The role of local residents can also be extended to encompass oversight of the entire enforcement system (e.g. the monitoring of official enforcement agencies; Sabet, 2014; Fig. 2). By providing oversight, local residents can play a direct role in ensuring that protected area enforcement systems are functioning effectively and adaptable to changing circumstances. Although there are few published examples of this in the context of conservation, research into public security highlights the role that citizens can play in overseeing the activities of the police by, for example,

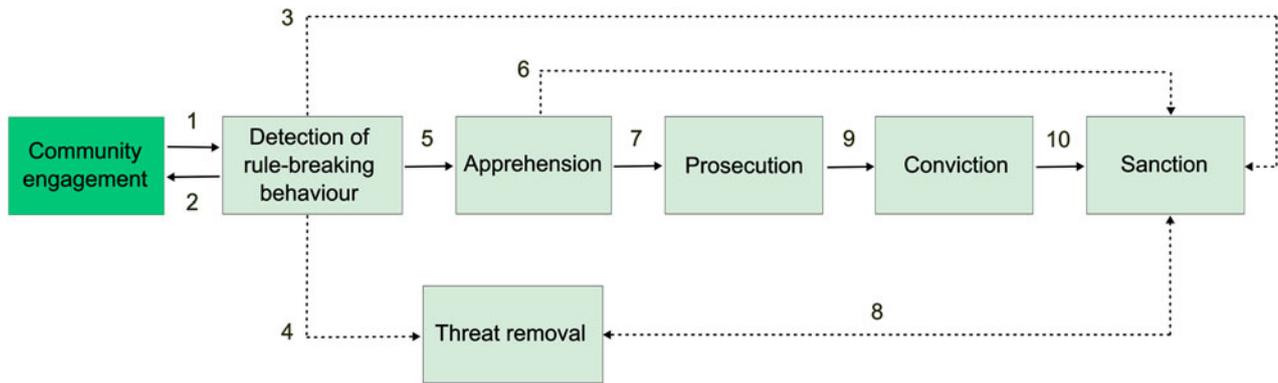


FIG. 2 Building on the concept of the enforcement chain (Akella & Cannon, 2004), local residents can contribute directly or indirectly to different elements of the protected area law enforcement system. Solid arrows highlight the successive nature of the system (in theory). Dashed lines illustrate how certain elements of the enforcement system may be interlinked or bypassed (in reality). Numbers correspond to the following hypothetical examples that serve to demonstrate how elements of the system interact: (1) members of local community groups are employed to conduct patrols and report rule-breaking behaviour; (2) community members dissuade others from engaging in rule-breaking behaviour; (3) local residents apply social sanctions (e.g. shame), and the identified rule-breaker is not arrested; (4) local residents mitigate risks to wildlife by removing threats such as illegal fishing equipment; (5) community scouts conduct patrols in collaboration with enforcement rangers who have the jurisdiction to make an arrest; (6) a rule-breaker is fined on the spot, and there is no engagement with the judicial system; (7) a local resident serves as a witness in court; (8) local residents confiscate valuable equipment (e.g. illegal logging machinery) whilst on patrol, and this removes a threat and constitutes part of a sanction; (9) the evidence provided by a local resident helps to convict a rule-breaker; and (10) community members sanction a convicted rule-breaker (e.g. by imposing a monetary fine).

contributing to the development and measurement of performance indicators (Sabet, 2014). The formation of neighbourhood committees can also provide a level of accountability and draw attention to situations in which enforcement could be improved (Sabet, 2014).

In practice, different elements of the enforcement system may be more or less conducive to local community involvement. For example, there may be fewer barriers to becoming involved in detection efforts than in the judicial process, particularly in systems where courts often fail to prosecute. In these systems, local residents may have limited opportunity to provide evidence in court or have few incentives to stand as a witness, as the perceived costs (e.g. fear of retribution) outweigh the potential benefits. Furthermore, to arrest a suspected rule-breaker legally, local residents must have jurisdiction (Wilkie et al., 2016), and governments may be unwilling to allow local residents to exercise this authority.

Nature of local participation in decision-making

In some systems of protected area governance, responsibility for management could be partially or fully devolved to local residents (Pomeroy & Williams, 1994). In these systems, local residents may participate directly in decision-making about how enforcement is carried out. Local participation in decision-making may relate to protected area enforcement systems more broadly (e.g. how should de jure rules be enforced) or to particular elements of the enforcement system. For example, local residents may contribute to decisions on how, where and when to gather information and carry

out patrols and which personnel should be involved (Turreira-García et al., 2018). In the same way, local residents could contribute to discussions on how prosecution procedures should work. In North Sulawesi, for example, staff from Proyek Pesisir, an initiative between the government of Indonesia and the US Agency for International Development, held formal and informal discussions with community groups to develop and agree on appropriate penalties for violations within proposed community-based marine protected areas (Crawford et al., 1998).

Local residents can also participate by implementing decisions across different elements of the enforcement system. For example, local residents could put detection-based decisions into effect by conducting patrols or providing intelligence and contribute to sanctioning by implementing decisions on how rule-breakers are penalized. This has been observed in Manus Province of Papua New Guinea, where clan leaders decide whether to impose community service or issue monetary fines for violations within restricted fishing areas (Cinner et al., 2005).

Type of external support provided to local residents participating in protected area law enforcement

The contribution of local residents to protected area law enforcement can be characterized by the type of external support provided. External support for local residents can take a variety of forms and can come from a range of stakeholder groups. For instance, in Lower Zambezi National Park in southern Zambia, community scouts are recruited from

local villages to provide intelligence and undertake foot patrols in partnership with Wildlife Police Officers from the Department of National Parks and Wildlife to detect rule-breaking behaviour and remove threats such as snares (Conservation Lower Zambezi, 2020). Community scouts are employed by Conservation Lower Zambezi, a non-profit organization, and local Community Resource Boards, and they receive a salary, training and field equipment (People Not Poaching, 2019). Firearms are provided, along with food rations, medicine, radios and solar chargers (Conservation Lower Zambezi, 2021).

In certain contexts, external support may be more logistical or financial in nature, whereas in other cases local residents may primarily receive technical support from external institutions. For example, in the vicinity of Dja Biosphere Reserve in Cameroon, scientists have been working with Baka communities to address local concerns over wildlife crime (Hoyte, 2021). By listening to local voices, a tool has been co-designed to enable community groups to collect and visualize data on illegal activities using smartphone technology (Moustard et al., 2021). With training provided on how to use the smartphone application (Hoyte, 2021), the data collected by local residents have helped inform enforcement and contributed to 19 seizures without arrest and 36 arrests during December 2017–August 2020 (Moustard et al., 2021; Chiaravalloti et al., 2022).

Motivating forces for local participation in protected area law enforcement

Sources of motivation for participating in protected area law enforcement can be predominantly extrinsic or intrinsic. Extrinsic motivation can be defined as ‘a construct that pertains whenever an activity is done in order to attain some separable outcome’ (Ryan & Deci, 2000, p. 60), whereas intrinsic motivation can be understood as ‘the doing of an activity for its inherent satisfactions rather than for some separable consequence’ (Ryan & Deci, 2000, p. 56). For some local community members, participation may be driven by extrinsic factors. For example, rangers in Kahuzi-Biega National Park in the Democratic Republic of the Congo reported the ability to receive benefits and earn an income as the principal reasons for wanting to work in front-line conservation (Spira et al., 2019). For others, participation may stem from intrinsic motivations to protect livelihoods, territory and cultural heritage (Turreira-García et al., 2018). This could be in response to a lack of regular patrolling and monitoring from formal protected area enforcement agencies (Roig-Boixeda et al., 2018) or come from a sense of duty, as has been found for rangers operating in Mana Pools National Park and Chewore Safari Area in Zimbabwe (Kuiper et al., 2021). In practice, extrinsic and intrinsic motivations can be interlinked. For example, extrinsic factors such as a salary and promotional

opportunities may influence intrinsic motivations to protect biodiversity (Moreto et al., 2019).

Motivational forces for local participation are contextual, and involvement can be influenced by demographic and socio-economic attributes such as land tenure status and household size (Coulibaly-Lingani et al., 2011). Factors that motivate local residents to participate in protected area law enforcement may be economic, social and/or ecological in nature (Kimengsi et al., 2019). These factors could include local social norms being aligned with de jure regulations, social cohesiveness and a sense of belonging (Ruiz-Mallén et al., 2015; Oyanedel et al., 2020), perceived benefits from the protected area and its natural resources, and trust and regular interaction with protected area rangers (Anagnostou et al., 2020). In the community policing literature, social cohesion (i.e. feeling part of a neighbourhood) and police getting to know local residents are thought to influence local participation in crime prevention (Pattavina et al., 2006). Protected area rangers who are local to a conservation area have been found to have better relations with community members than non-local rangers (Parker et al., 2022).

Extent to which local participation in protected area law enforcement is formalized

Local residents can contribute to protected area law enforcement in a formalized way if, for example, they represent the state (e.g. as rangers) and have the official capacity to enforce protected area regulations (Viollaz et al., 2022). Local residents can also operate in a formal capacity by carrying out the specific actions and responsibilities outlined in clearly defined terms of reference. In the Cardamom Mountains of Cambodia, for example, Fauna & Flora and community wardens sign a formal contract that outlines the duties of wardens, the conditions that wardens must abide by, monthly pay and working hours. In this case, community wardens are required to conduct a certain number of patrols each month for the duration of the contract. In other contexts, local residents can formally contribute to enforcement processes by being employed on a full-time basis or by acting in a voluntary capacity.

Local residents can also make substantial contributions to protected area enforcement informally (Moreto & Charlton, 2021). They may serve as cultural brokers to facilitate information flows and interactions between different stakeholder groups (Rizzolo et al., 2021) or by operating as ‘non-professionalized’ agents (Viollaz et al., 2022, p. 125), monitoring the activities and behaviours of others. One framing of this type of involvement is informal guardianship. Empirical research has shown that three key conditions are required for informal guardianship: local resident availability, knowledge of context (i.e. the ability to recognize when local behaviours deviate from the

norm) and willingness to intervene, and that informal guardianship may be augmented by leveraging the sense of empowerment and ownership of local residents over protected area resources (Viollaz et al., 2022).

In practice, protected area law enforcement processes can draw on both formal and informal processes. For example, in Balule Nature Reserve in South Africa, the Black Mambas, a state-recognized anti-poaching unit, conduct formal duties and are also thought to play informal roles as handlers by drawing on social ties and relations to dissuade individuals in the community from engaging in rule-breaking behaviour (Kahler & Rinkus, 2021). An actor may have a formal role (such as membership of the Black Mambas) and contribute informally by monitoring behaviour and promoting compliance when they are off duty (Viollaz et al., 2022).

Applying the framework to case study examples

In this section, we present three real-world case studies to illustrate the different ways in which local residents can contribute to protected area law enforcement. We apply the framework to each case study to illustrate its use in analysing and comparing the characteristics of different approaches for involving local residents in protected area law enforcement. We focus on the structural components of these case studies as illustrations for the framework. None of the case studies have been formally evaluated in terms of their contribution to conservation and well-being outcomes, and so we do not focus on this aspect.

Community wardens in the Cardamom Mountains landscape, Cambodia

Across five sites in Central Cardamom Mountains National Park (Central Kravanh) and Southern Cardamom Mountains National Park (Southern Kravanh) in southwestern Cambodia, Fauna & Flora manages a community warden patrol programme in partnership with the Forestry Administration, a government agency. Implemented over 20 years ago, this programme seeks to protect the Siamese crocodile *Crocodylus siamensis* and its habitat: freshwater wetlands and slow-flowing rivers. Protected under national and international law (CITES Appendix I), the Siamese crocodile is categorized as Critically Endangered on the IUCN Red List as a result of habitat loss, hunting and collection for commercial crocodile farms during the second half of the 20th century (Bezuijen, 2012; Sam et al., 2015).

Selected by village and commune chiefs, community wardens living in close proximity to each site are employed by Fauna & Flora on a part-time basis to undertake regular patrols, collect Spatial Monitoring and Reporting Tool data, report rule-breaking behaviour to enforcement authorities and raise awareness of regulations amongst local residents (Simpson et al., 2006). As outlined in their terms of

reference, community wardens patrol in crocodile sanctuaries established through consultation and agreement between Fauna & Flora, the Forestry Administration and local residents. Sanctuaries are not legally designated but governed by local bylaws that align with de jure protected area rules. These bylaws prohibit electric and dynamite fishing, and the use of nets, multiple hooks and long casting rods. Habitat destruction through activities such as tree felling and water pumping is forbidden, as is the hunting of wildlife with snares and traps.

Fauna & Flora provides community wardens with field clothing, as well as kayaks and motorbikes for patrol purposes. Community wardens also receive remuneration, training and equipment such as GPS devices, cameras and smart mobile devices to collect Spatial Monitoring and Reporting Tool data during patrols. Wardens do not have the authority to make an arrest but can issue written or verbal warnings to perpetrators and remove illegal equipment such as snares and fishing nets.

Community wardens in the Cardamom Mountains landscape predominantly contribute to the detection element of the enforcement system. Participating formally and receiving a monthly salary, community wardens assist the Ministry of Environment in achieving its objectives and, in doing so, receive different types of external support from Fauna & Flora and the Forestry Administration.

The Prey Lang Community Network, Cambodia

In the early 2000s, people living in the vicinity of Prey Lang, a forest ecosystem in the Central Plains landscape of Cambodia, started advocating for the protection of their ancestral forests from illegal logging and agricultural expansion (Prey Lang Community Network, 2021). This led to the formation of the Prey Lang Community Network, an autonomous community monitoring network composed of local residents (Turreira-García et al., 2018).

In recent years, members of this Network have made and implemented decisions on patrolling across Prey Lang Wildlife Sanctuary, a designated protected area. A locally elected steering committee organizes meetings and arranges independent and voluntary patrols to monitor and report rule-breaking behaviour (Prey Lang Community Network, 2022). During patrols, members of the Network apply sanctions to offenders who fail to present a valid logging permit (Prey Lang Community Network, 2022). Equipment used to illegally log timber is seized and social pressure is applied by educating perpetrators on the impacts of their actions (Brofeldt et al., 2018). Offenders are requested to sign a contract stating they will no longer engage in illegal activities, and confiscated items are given to the Ministry of Environment (Prey Lang Community Network, 2022).

The Prey Lang Community Network is an example of community involvement in protected area law enforcement for which limited support is provided by external institutions. Although the Network has previously received grant funding for patrolling and worked with scientists to develop information and communication technology to collect data on rule-breaking behaviour (Brofeldt et al., 2018), it has recently been barred from entering Prey Lang Wildlife Sanctuary because of restrictions related to Covid-19 (Prey Lang Community Network, 2021). As a result, the Network has been collaborating with external stakeholders to analyse satellite data to monitor forest loss (Macinnes, 2020). Members of the Network are therefore operating from beyond the boundaries of a protected area to bring national and international attention to illegal activities occurring within a protected area.

The Community of Arran Seabed Trust, Scotland

In 1995, residents on the Isle of Arran on the west coast of Scotland established the Community of Arran Seabed Trust to raise awareness of a degraded ecosystem and improve the marine environment (Stewart et al., 2020). Comprising volunteers, the Trust, a community-led organization, campaigned for the creation of a no-take zone in Lamlash Bay to protect sensitive habitats and facilitate seabed regeneration (Whiteside, 2018).

The Lamlash Bay no-take zone was designated in 2008, and further lobbying by the Community of Arran Seabed Trust resulted in the designation of the South Arran marine protected area in 2014 (Stewart et al., 2020). Encompassing the Lamlash Bay no-take zone, the South Arran marine protected area aims to protect species and habitats such as seagrass meadows and maerl beds, and, at the time of writing, it is multi-use, permitting creeling in certain areas (COAST, 2012; Stewart et al., 2020). It became fully regulated in 2016, with Marine Scotland, a government directorate, responsible for enforcing legislation (COAST, 2022b). To assist Marine Scotland with enforcement, the Community of Arran Seabed Trust has developed a guide to help local residents provide detailed information when reporting suspected infringements across the no-take zone and marine protected area. The guide helps users to familiarize themselves with the boundary of the marine protected area and the location and activities permitted in different zones, the type of information needed for vessel identification, the need for photographic information, accurate vessel coordinates, time and date information and the contact details of enforcement authorities (COAST, 2022a). Providing tips on how to place a fishing vessel on a chart or map and illustrations of different types of vessels, the guide aims to capture the level of information necessary for prosecution.

The Community of Arran Seabed Trust offers an example of local residents making decisions and overseeing how actionable information can be best provided. The development of guidance helps to raise awareness of protected area rules and provides a framework for people living around Lamlash Bay and the wider marine protected area to report rule-breaking behaviour. Contributing to detection voluntarily, local residents have initially reported the few infringements known to have taken place in the no-take zone and across the marine protected area (Stewart et al., 2020).

Comparing characteristics of different participatory approaches to protected area law enforcement

These three case studies highlight the diversity of approaches for involving local communities in protected area law enforcement and illustrate how the framework can be used to facilitate the analysis and comparison of cases (Table 1). For example, although members of the Prey Lang Community Network and the Community of Arran Seabed Trust have decision-making capacity, community wardens living and working in the Cardamom Mountains put decisions into effect by following specified terms of reference and make collective decisions on when to conduct patrols each month. Furthermore, the extent to which local participation is formalized varies. Community wardens, for example, are employed by Fauna & Flora and receive different types of external support for participating in detection efforts, whereas the Prey Lang Community Network continues to monitor rule-breaking behaviour despite being deemed an illegitimate organization by the state (Prey Lang Community Network, 2021). With regard to similarities, each case study includes some element of participation in detecting illegal activities.

Discussion

Each dimension of community involvement offered in this framework contains complexity. The dimensions should be refined and deepened based on evidence gathered for a particular case study or context. We suggest this framework can be used as a basis for workshop discussions or for conducting a systematic map of the literature to analyse and compare different approaches to involving local communities in protected area law enforcement. Categorizing cases of community involvement by applying this framework could be used to examine the prevalence and diversity of different arrangements for involving local residents in protected area law enforcement and could provide a foundation for a comparative analysis of the effectiveness of different enforcement approaches. In addition, the framework provides a useful structure for evaluating participatory approaches to protected

TABLE 1 The proposed framework for analysing the contributions of local residents to protected area law enforcement (Fig. 1) applied to real-world case study examples to illustrate its utility in comparing the characteristics of different approaches to involving local residents in protected area law enforcement. The information displayed is based on the literature reviewed.

	Community wardens, Cardamom Mountains landscape, Cambodia	The Prey Lang Community Network, Cambodia	The Community of Arran Seabed Trust, Scotland
Involvement of local residents at different points in the enforcement system	(1) Detection (provide intelligence, patrol-based monitoring) (2) Threat removal (3) Sanctioning (social)	(1) Detection (provide intelligence, patrol-based monitoring) (2) Threat removal (3) Sanctioning (social)	(1) Community engagement (raise awareness of rules) (2) Detection (provide intelligence) (3) Oversight
Nature of local participation in decision-making	Participate in implementing decisions, although wardens also have some decision-making capacity	Participate in decision-making & in implementing decisions	Participate in decision-making & in implementing decisions
Type of external support provided to local residents	Financial, training, equipment	Technical	None
Motivating force for local participation	Likely to be a mix of extrinsic & intrinsic motivations	Primarily intrinsically motivated	Primarily intrinsically motivated
Extent to which local participation is formalized	Participating formally & receiving remuneration	Participating informally, with no formal enforcement power	Participating formally in a voluntary capacity
Key references	Simpson et al. (2006)	Brofeldt et al. (2018), Turreira-García et al. (2018), Prey Lang Community Network (2022)	COAST (2022a,b)

area law enforcement and could help frame discussions and facilitate clear communication between people living in and around protected areas and the institutions responsible for their management. Here we discuss some of the practical considerations involved in applying the framework in different ways.

Variation in local participation within the protected area law enforcement system

Local contributions to protected area enforcement operate in politically, socially, economically and environmentally dynamic contexts (Ostrom, 2009). The ways in which local residents participate can change across time and space, and engagement can be influenced by changing political, cultural, economic and social variables. Motivations for participation could, for example, change in response to a perceived threat or in response to new employment opportunities.

Community engagement in enforcement can be influenced by where people live in relation to a protected area and the extent to which local residents depend on protected area resources for their livelihoods. Engagement can also vary between local community groups and Indigenous Peoples. Local participation is likely to depend on the extent to which people have rights over their land and natural resources, the extent to which these rights are recognized and whether people have their own rules upon which enforcement is based. The Ogiek, for example, are an Indigenous People of Kenya whose culture, traditions and identity

centre around their ancestral land, the Mau Forest (Kenrick et al., 2023). The Ogiek have established community scouts to deter illegal logging activity and have developed a protocol that lays out a set of rules for protecting and conserving the forest (Claridge & Kobei, 2023).

In some cases, local participation in decision-making, the type of external support provided to local residents and the motivation for and formalization of participation may each be adequately captured by a simple summary. In practice, however, these characteristics can vary considerably across different parts of the enforcement system. For instance, local residents may receive external support for contributing to detection efforts but receive little assistance when it comes to administering sanctions. Furthermore, dimensions of local community involvement can vary within individual elements of the enforcement system. In Kerinci Seblat National Park, for example, community rangers contribute to detection by participating in routine foot patrols, but they also oversee a network of local informants who inform intelligence-based patrolling (Linkie et al., 2015).

The framework can be used to illuminate this variation, as each dimension of local community involvement can be examined independently across all elements of the enforcement system (Supplementary Table 1). By drawing on the framework, stakeholders such as protected area managers can assess whether, for example, local residents feel they are receiving appropriate support for participating in different elements of enforcement. In Community Resource Management Areas in Ghana (initially introduced by the

forestry administration to incentivize local participation in protected area management), for instance, members consider patrolling and arresting rule-breakers to be key responsibilities, but they feel that uniforms, official identify cards and allowances are needed for them to have capacity to make arrests (Mawutor & Hajjar, 2022). In situations such as this, stakeholders could use the framework in a workshop setting to assess the need for different types of external support across relevant sections of the enforcement system.

Institutions pursuing a participatory approach to protected area law enforcement could use the framework at regular intervals to assess whether, for example, motivations for local participation or perceptions of participation in decision-making are shifting, to support adaptive management (Weeks & Jupiter, 2013). In cases where community groups contribute to protected area enforcement on a collective level, individuals may view their participation in different ways, and there could be a mix of different motivations for participation. As such, the framework could be used in a more granular way to identify differences in opinion and the range of motivations.

Aiding the evaluation of participatory approaches to protected area law enforcement

The framework provides a platform for conducting different types of evaluation of participatory approaches to protected area law enforcement. Firstly, it can be used to support the ex-ante design of law enforcement programmes (Samset & Christensen, 2017). Protected area managers and conservation practitioners can draw on the framework to consider the different ways in which local residents could and potentially should contribute to enforcement. Secondly, it can be used to support an interim evaluation by, for example, supporting government agencies and conservation NGOs to review their approaches to law enforcement, specifically with regard to the role that local residents are playing. Correspondingly, local residents can assess the extent of their participation and level of contribution. This could help to build an understanding of how local involvement in law enforcement is perceived by different stakeholder groups and highlight gaps in local participation (Bennett, 2016). The framework could also be used to assess the perceived relative importance of specific contributions to enforcement (Supplementary Fig. 1) along with the perceived effectiveness and cost-effectiveness of contributions. This could help to inform management decisions and guide protected area managers and conservation practitioners in delegating responsibility and directing resources. Thirdly, the framework could form the basis of ex-post evaluations. Stakeholder groups can use it to structure their examination of outcomes and to reflect and learn (Plummer & Armitage,

2007). This could help to inform the design of future participatory approaches to protected area law enforcement.

Communicating between stakeholders

The framework is intended to help facilitate communication between stakeholders. Conservation practitioners working with local community groups can draw on the framework to aid discussions on how local residents could contribute to elements of enforcement, why and when they may want to participate and how local residents could be supported (Supplementary Table 1). In doing so, the framework could help to clarify expectations, priorities and objectives and ensure that the wishes of local residents align with the aims and objectives of external institutions. Stakeholders should use the framework in an environment that allows the voices of all participants or potential contributors to be heard (Durand & Lazos, 2008; Staddon et al., 2021).

Involving local residents in protected area law enforcement aims to increase the costs of engaging in rule-breaking behaviour (Cooney et al., 2017). However, it does not represent a silver bullet for mitigating illegal activities (Roe & Booker, 2019). Other actions such as incentivizing wildlife stewardship by promoting ecotourism could also help to minimize rule-breaking behaviour (Biggs et al., 2017). Moreover, certain situations, such as escalating militarization of an area, could render local participation in protected area law enforcement inappropriate (Massé et al., 2017). Fundamentally, local residents should benefit from participation and be able to decide for themselves whether they wish to contribute to approaches that are equitable, inclusive and respectful of their rights (Newing & Perram, 2019). As the global network of protected areas expands, further research is required to understand which approaches to law enforcement work best for people and nature in different contexts. This paper aims to facilitate future comparative research by providing a basis for examining the prevalence, variation and effectiveness of different models of community engagement in the context of protected area law enforcement.

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Conflicts of interest None.

Ethical standards This research abided by the *Oryx* guidelines on ethical standards and was approved by the Research and Integrity

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Data availability The data supporting the findings of this study are available within the article and its Supplementary Materials.

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