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Pathways to more inclusive and effective black rhino conservation: Insights from a decade of design and delivery in NW Namibia

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Abstract

Generating evidence from both successes and failures of conservation interventions is critical for improving our capacity to learn how to design, deliver, evaluate and improve such initiatives. This is particularly imperative for highly-threatened and highly-valued species such as Critically Endangered black rhinoceros, which attract large investments of resources and present a high risk of extinction. The systematic generation and assessment of evidence on what methods and mechanisms work, which do not, and under what circumstances is often poorly described and implemented. We present a synthesis of learnings from more than a decade of designing, delivering, evaluating and improving community-based ranger programs in north-west Namibia. We illustrate how adopting an iterative process tracing methodology to generate evidence that enables teams to track and improve their performance over time can provide a foundation for a collective knowledge bank, an enhanced learning process, and tangible conservation outcomes. We illustrate how harnessing the values of key local participant groups in program design can lead to delivering measurable intermediate results along pathways for engaging local

leadership, empowering rangers, and creating income-generating opportunities that, in our case, contributed to a more than 90% reduction in illegal hunting of black rhinoceros. These results manifest with minimal use of conventional militarized law enforcement anti-poaching mechanisms suggesting that, at least in our situation, investing resources into improving the alignment between the value local people attach to protecting rhinoceros and the ways in, and degree to, which a protection programme manifests these values, is an effective, ethical, cost-efficient and socially just strategy. We offer lessons learned synthesized as a mnemonic to "LIVEN" up ranger program to be more locally inclusive and collaborative. Employing fit-for-purpose evaluation methodologies that are focused first and foremost upon internal team learning has become our guiding principle.

KEYWORDS

black rhinoceros, communal conservancies, impact evaluation, incentive-based, inclusive, Namibia

1 | INTRODUCTION

> Obstacles do not block the path, they are the path.
>
> Zen Proverb

Generating evidence from both successes and failures is critical for improving our capacity to learn how to design, deliver, evaluate, and improve conservation programs (Grantham et al., 2010; Knight, 2006). This is imperative for highly threatened and high-value species, such as Critically Endangered black rhinoceros (*Diceros bicornis*) (www.iucnredlist.org), which attract large resource investments and present a high risk of extinction (Ferreira et al., 2022). Despite the risks posed by failures, the systematic generation and assessment of evidence on what methods work, which do not, and under what circumstances, is typically poorly defined and delivered (Ferraro & Pattanayak, 2006; Kleiman et al., 2000; Sutherland & Wordley, 2017).

Numerous philosophies, theories, methods, methodologies, and tools exist for evaluating conservation programs (Knight et al., 2019). Randomized control trials (RTC) are believed by many to be the gold standard for examining causal relationships between inputs and impacts (Grace et al., 2021). However, often this approach is not fit-for-purpose for situations due to cultural, logistical, technical, financial, or sometimes ethical factors, and where determining worth (e.g., how valuable was an intervention?) and/or significance (e.g., how important was an intervention?) (Scriven, 2017) is more feasible and useful. Further, RTC provides a singular "snapshot" in time and while strong in rigor, the findings can be limited in practical application.

1.1 | Conventional rhino conservation and local community collaboration

Despite a long history of calls for inclusive approaches to combat rhinoceros poaching (Biggs et al., 2017; Cooney et al., 2017), the prevailing strategy for protecting rhinoceros in Africa is militarized law enforcement (Ferreira et al., 2022; Ferreira & Okita-Ouma, 2012; SAN Parks, 2021). While law enforcement is necessary as one mechanism in a complementary mix of mechanisms (sensu Tinbergen, 1952; Young et al., 1996), excessively militarized interventions have had, in most cases, limited success, potentially promoting resistance to cooperation from local people (Duffy et al., 2015; Lunstrum, 2014; Lunstrum & Givá, 2020; Massé et al., 2017). The IUCN African Rhino Specialist Group recently sought to identify common characteristics of effective rhinoceros conservation programs – multi-stakeholder partnerships that devolved decision-making to local institutions performed best (Ferreira et al., 2022). The value and effectiveness of local institutions have been identified as foundational for the conservation and protection of other species and ecosystems (Keeley et al., 2019; Nel et al., 2015); however, the effective implementation of systems for learning from evaluation is rare (Catalano et al., 2018; Knight et al., 2019; Redford et al., 2018). The work we present here can provide other practitioners insights into how to promote local team learning through evaluation. Designing and delivering rhinoceros conservation through local institutions is likely to deliver greater merit, significance, and/or worth for rhinoceros, justifying the greater investment in time and effort that engaging multiple stakeholders in complex partnerships often entails. However, few examples exist of how to design, deliver, and evaluate

inclusive rhinoceros conservation initiatives that explain the causal pathways of effectiveness (Ferreira et al., 2022).

1.2 | Rhino custodianship and community-based rhino conservation in northwest Namibia

Namibia, which sustains over one-third of the global population of black rhinoceros (Ferreira et al., 2022), has a long history of collaborative rhinoceros conservation (Joubert, 1996; Loutit, 1996; Loutit & Owen-Smith, 1989; Owen-Smith, 2010). Despite black rhinoceros being owned and managed by the national Ministry of Environment, Forestry and Tourism, they established the Rhino Custodianship Program in 1993, creating contractual partnerships with private landowners and registered Conservancies on communal land (Kotting, 2020). These contractual partnerships enabled local Namibians to host black rhinoceros on their lands in exchange for regular monitoring and reporting of rhinoceros' welfare. The opportunity to generate benefits from rhinoceros tourism was key to not only securing a contract but also ensuring robust monitoring was maintained (Sullivan et al., 2021). By 2020, the program grew to 25 commercial farms and 10 communal Conservancies covering over 3.3 million hectares (Kotting, 2020), demonstrating how the approach successfully promoted and achieved range expansion, a key goal of the National Black Rhinoceros Management Strategy (Ministry of Environment, Forestry and Tourism, 2022).

The strategy also aligned well with Namibia's growing community-based natural resource management model (i.e., Conservancy) which has been arguably relatively successful (Wenborn et al., 2022), although persistent challenges limit its overall success, such as elite capture and limited governance capacity (Hoole, 2010; Sullivan et al., 2016). Prior to Conservancies, "auxiliary game guards" were employed jointly between conservation organizations and Traditional Authorities to combat poaching (Loutit & Owen-Smith, 1989). These game guards became permanent fixtures within Conservancies, leading wildlife monitoring within their boundaries focused often on high conservation priority species such as elephant (*Loxodonta africana*) and huntable game such as springbok (*Antidorcas marsupialis*).

However, a more *fit-for-purpose* approach was required for black rhinoceros. In the early 2000s, wildlife monitoring methods aimed simply to record species, not individuals (Stuart-Hill et al., 2005) while monitoring required extended field trips that spanned weeks, not days, as black rhinoceros range across remote, rugged landscapes distant from human settlements (Cunningham & Berger, 1997; Owen-Smith, 2010). Since Rhino Custodianship required regular, individual rhinoceros monitoring records, game guards required training, tools, and support to fulfill government requirements.

Save the Rhino Trust (SRT) adopted specialist monitoring of black rhinoceros in the 1980s (Britz & Loutit, 1989). Founded as a non-governmental animal welfare organization in 1982, SRT employed local trackers to monitor individual rhinoceros, with data stored in an individual-based rhinoceros database (Britz & Loutit, 1989). SRT and the Conservancy game guards of the Rhino Custodianship Program converged when Conservancy leadership made a public pledge during a rhinoceros security meeting in 2011 to commit their game guards to monitor rhinoceros. They also requested SRT to build *their* capacity in lieu of hiring additional trackers to work for SRT. This became the Conservancy Rhino Ranger (CRR) Incentive Program (Muntifering et al., 2015, 2017), a rhinoceros protection partnership for co-creating pathways to harness the values and strengths of a diverse group of stakeholders seeking to protect rhinoceros. Here we present our CRR design, delivery, and evaluation approach, refined over more than a decade of direct experience, comprising (1) a Theory of Change (ToC) that elucidates our design and delivery of an approach to reduce the poaching threat to rhinoceros; (2) an assessment of the evidence for impacts along four theorized causal pathways between our strategies and our main threat reduction impacts; and (3) a synthesis of lessons learned from failures and successes.

2 | METHODS

2.1 | Study area

Our study area covers approximately 25,000 sq. km of communal land in northwest Namibia (Figure 1). Rainfall grades from 10–20 mm in the far west to over 200 mm in the east (Mendelsohn et al., 2022). This nutrient-rich, basaltic landscape, with a relatively high density of natural springs and preferred vegetation (*Euphorbia* spp., *Catophractes alexandri*), has promoted a productive black rhinoceros population compared to neighboring landscapes with less preferred vegetation on poor soils (Loutit et al., 1987). Land tenure comprises (1) three state-administered tourism concessions where tourism rights have been devolved to neighboring Conservancies, and (2) 14 communal Conservancies participating in the CRR Program. Four main ethnic groups occupy this landscape – ovaHimba, ovaHerero, Nama-Damara, and Riemvasmaak – comprising mostly semi-pastoral

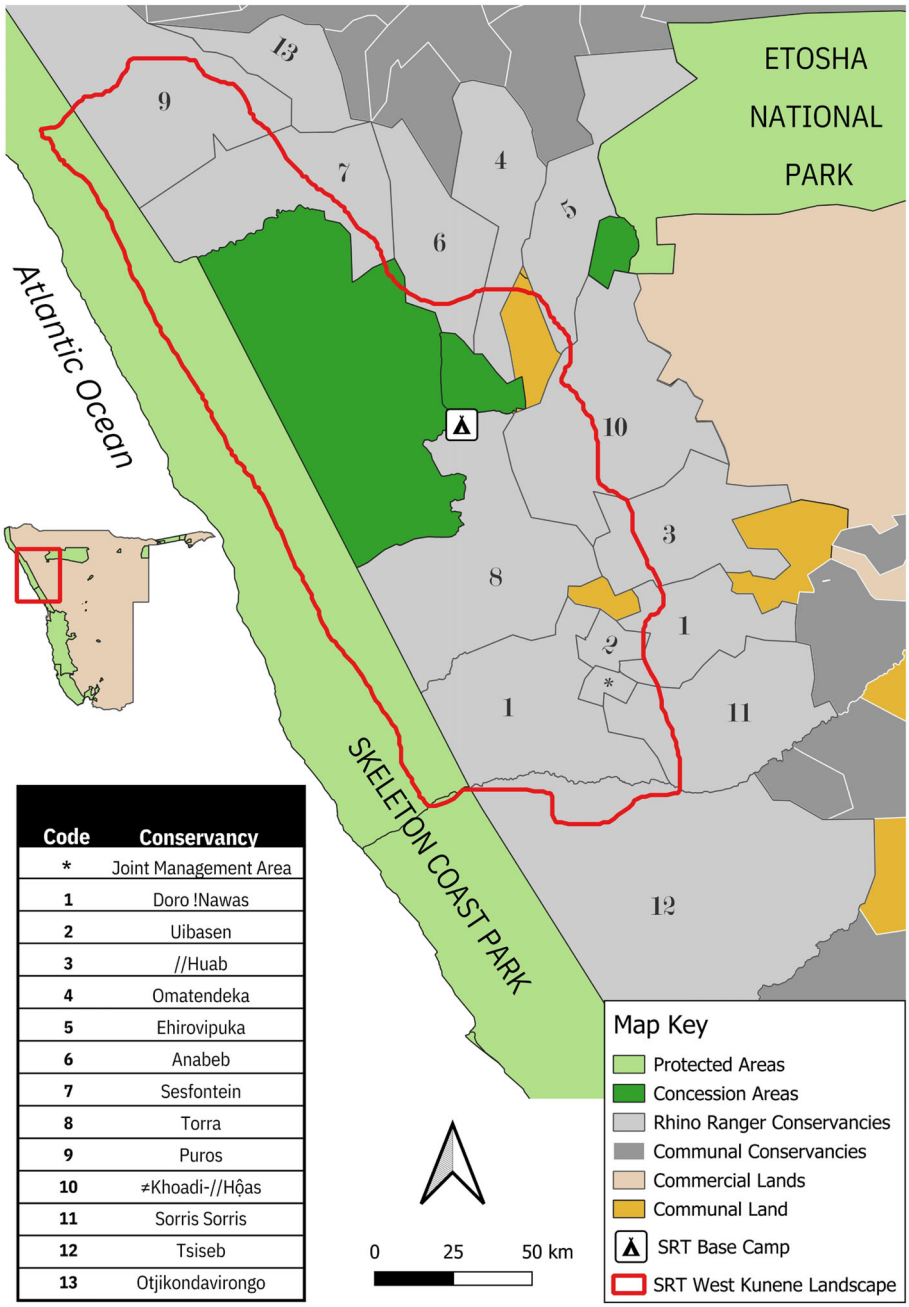

FIGURE 1 Map of the northwestern Namibia study area, including the Save the Rhino Trust (SRT) field base (the SRT logo) from where ranger deployments were implemented.

communities grazing goats, sheep, or cattle. Overall poverty is relatively high, with a multidimensional poverty index score of 64.1% for the region (Namibia Statistics Agency, 2021), and a literacy rate of 67% (Mendelsohn et al., 2022). Approximately 21,500 inhabitants are registered members of their Conservancy within the northwest rhinoceros landscape (NACSO, 2019).

2.2 | Process tracing to illustrate design theory and evaluate impact

We employed a theory-based, largely qualitative impact attribution method known as process tracing (Beach, 2013) to systematically examine and validate the degree to which the hypothesized underlying mechanisms linking hypothesized impacts (or causes) in a causal pathway chain hold true.

While quantitative methods (e.g., RCTs) offer statistical support for assessing an intervention's effectiveness (Grace et al., 2021; Zavaleta et al., 2023), they typically do not provide insight into *how* impact emerged (but see Ferraro & Hanauer, 2014; O'Garra et al., 2023). One strength of process tracing is that it maps causal pathways to decipher how a specific action may have produced a specific output, outcome, or impact over time (Zavaleta et al., 2023). Process tracing is well-suited when participants possess deep knowledge of a situation and its

context, as well as sufficient time and resources to gather and analyze evidence over a (typically) multi-year, timeframe. In addition to determining impact, process tracing allows us and our collaborators to determine the worth (e.g., how valuable were our activities?) and/or significance (e.g., how important were our activities?) which provided us insights into some of the wider, and intangible, benefits that our project provided. Our specific project situation and purposeful focus on learning and adaptation ensured process tracing was fit-for-purpose. Having participants in our project apply process tracing ensured a deeper, richer learning opportunity, that also built trust and self-belief. This also promoted the self-reflection required to examine personal cognitive biases through a fit-for-purpose systemic approach which promotes the institutionalization of learnings from the individuals that comprise our partner organizations (Catalano et al., 2018). These benefits are less readily available using purely quantitative approaches to evaluation, especially those undertaken by external "experts" who do not have the knowledge of the project situation that can only be developed through long-term participation. Process tracing can prove challenging in this regard, as some participants are deeply personally invested in their work, and have close relationships within the CRR Program, which may challenge the surfacing of failures. Process tracing involves five steps, which we detail below: (1) develop a ToC; (2) develop testable hypotheses; (3) identify evidence to test hypotheses; (4) collect data; and (5) test hypotheses by analyzing data (Beach, 2013).

2.3 | Developing a theory of change

A ToC is an illustrative logical description of how specific actions are hypothesized to achieve specific threat reduction impacts that produce desired outcomes (Conservation Measures Partnership, 2020; Salafsky & Margoluis, 2021). The assumptions that link sequential steps can be quantitatively or qualitatively assessed. Ideally, a ToC is designed prospectively and evaluated following the implementation of actions to assess impact. Retrospective ToCs have been used to assess which assumptions hypothesized to deliver action were met and which were not (Belcher et al., 2020). ToC is widely promoted and used by the Conservation Measures Partnership (2020) (Margolius & Salafsky, 1998; Salafsky et al., 2002; Salafsky & Margoluis, 2021) with a growing number of cases using ToC to assess effectiveness (Eshoo et al., 2018, see Miradi Share online).

Our first step in developing a ToC was defining the root problem. The "rhinoceros problem" has historically been labeled a "war against poachers" (Duffy, 2014) and defined using a cost–benefit calculus focused on strengthening law enforcement to increase "costs" to poachers (Milner-Gulland & Leader-Williams, 1992). This calculus is problematic yet has historically permeated rhinoceros conservation activities and is evident in recent rhinoceros protection strategies (Ferreira et al., 2022; Ferreira & Okita-Ouma, 2012). While law enforcement should probably feature in any rhinoceros conservation strategy, situation-specific problem definitions that seek to identify and harness the value local people attach to protecting rhinoceros from poaching are likely to be more effective (Biggs et al., 2017; Cooney et al., 2017; Muntifering et al., 2017). This fundamental belief guided our large-scale multi-stakeholder institutional framework which was foundational to our design (Figure 2 - see S2.3.1 in the Supplementary Materials for more details on the explicit linkages between institutions). Specifically, at the local level, we pursued this strategy by leveraging the strengths and value demands presented by a diverse stakeholder network including (1) Conservancy leadership, (2) conservation non-government organizations (NGOs), (3) local rangers, (4) local farmers and (5) private sector tour operators.

We *retrospectively* developed a ToC in 2018 for the period 2012–2017 by reviewing CRR working group minutes between 2011 and 2017, previous strategic plans, and first-hand accounts from individuals (Muntifering, 2019). We then *prospectively* developed and applied a ToC between 2019 and 2023, adjusting actions to test assumptions as opportunities emerged (i.e., monitoring key metrics, graduate student research, CRR Support Group meetings) (Figure 3, see Figure S2.3 in the Supplementary Materials for a more detailed ToC.

We structured our ToCs upon four theoretical causal pathways (strategies) that we theorized would each harness a set of values that contributed to a reduction in poaching (Clark, 2002) across a mix of stakeholder groups. We described our foundational design strategies as: (1) establish the CRR Support Group; (2) co-create and sign Partnership Agreement Letters between Rhino Custodians Conservancies and supporting NGOs; (3) design a unique identity and brand; and (4) establish joint-venture agreement templates for expanded rhino tourism opportunities (see Muntifering, 2019). We detail these foundational design strategies and their pathways further in the Supplementary Materials S2.3.1–S2.3.5 in the Appendix S1.

2.4 | Develop testable hypotheses and identify evidence

Along each of our causal pathways, each ToC mapped a series of expected key results hypothesized to reduce poaching. To track effectiveness along each pathway, we identified 14 quantitative or qualitative indicators of

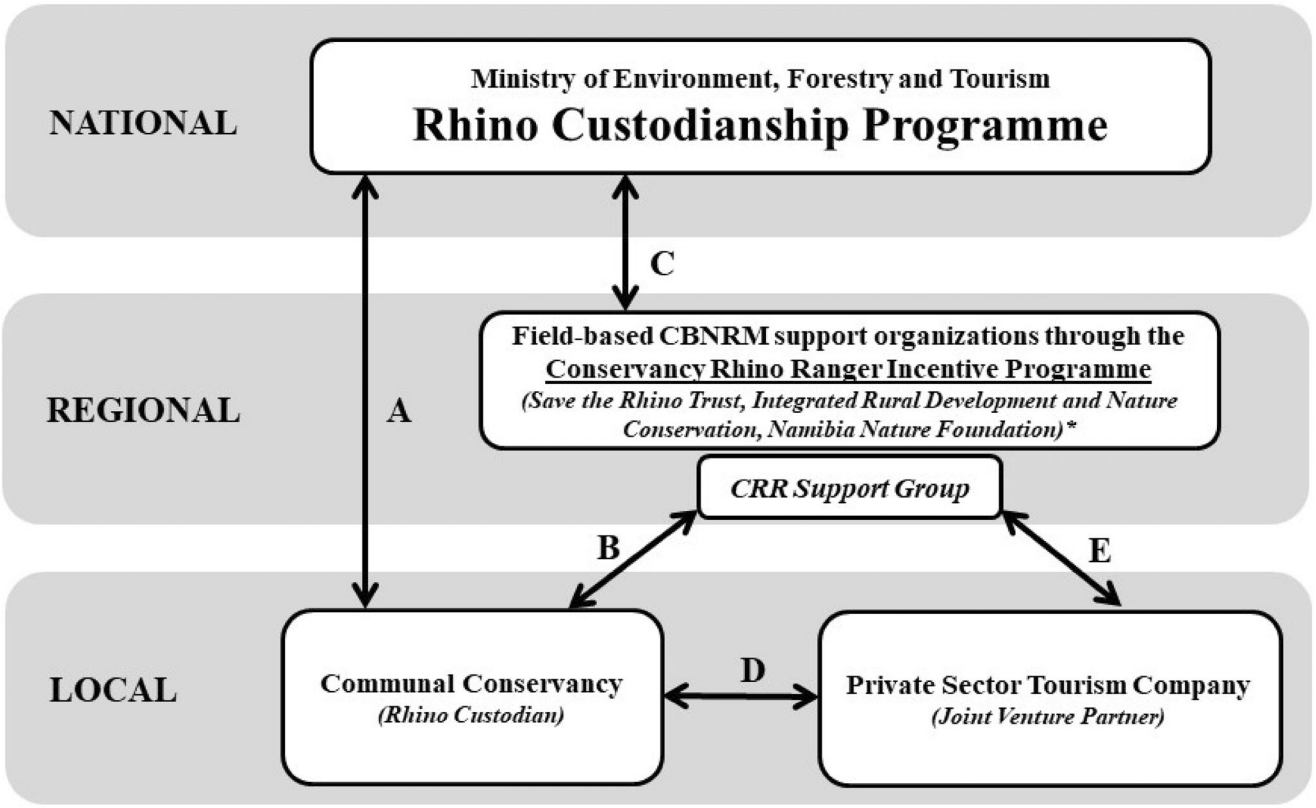

FIGURE 2 Institutional framework for a rhinoceros protection approach in northwest Namibia that is founded upon the inclusion and values of local communities. *Field-based organizations have slightly different roles in the region in their collective efforts to support Conservancies with rhinoceros conservation operationalized through the Conservancy Rhino Ranger Incentive Programme. Save the Rhino Trust provide direct rhinoceros monitoring support, training in rhinoceros monitoring and tourism, and possess a specific mandate from government to oversee the management of all rhinoceros monitoring data in the region. Integrated Rural Development and Nature Conservation and Namibia Nature Foundation also support some rhinoceros monitoring work but primarily support Conservancies with enterprise development activities including facilitating partnership agreements with potential and existing Joint Venture tourism partners.

desired results indicated in the ToC as results boxes with a unique label in the light gray objective circle (Figure 3). Table 1 outlines each specific hypothesis including the type and source of evidence used to assess the effect of each strategy.

2.5 | Analysis of evidence

Quantitative methods such as RCTs and Bayesian statistical techniques are not fit-for-purpose in some, or many, complex adaptive systems (much as adaptive management is appropriate for only a subset of natural resource management problems; Allen & Gunderson, 2011). Knight et al. (2019) provide multiple reasons for these limitations (a supplementary list is provided in S2.5 in the Supplementary Materials).

Our collective goal was to learn and grow as a collaborative group of local Namibian institutions. Self-determination is an essential goal in post-colonial countries where poor and marginalized communities with low levels of formal education are common, which necessitates community-led actions. This is an international principle enshrined in the United Nations Charter (Chapter 1). "Learning by doing" – which includes failing – is foundational to embedding performance improvement practices throughout these community-led actions (Catalano et al., 2018). We adopted a *fit-for-purpose* approach to simplify and promote uptake and learning by middle and senior managers with little to no background in statistics (Knight et al., 2019; Zavaleta et al., 2023).

We established a simple ordinal "streetlights" ranking method based on the RED, YELLOW, and GREEN colors whereby managers would interpret a RED to "stop" and rethink, a YELLOW to "slow down" and assess before proceeding, and a GREEN to "go" along the pathway confident their prior assumptions in the causal pathway were supported. If evidence suggested little to no support for a hypothesis, we scored it a RED; if we discovered some evidence supporting a hypothesis but also some evidence against we scored a YELLOW; and if our

TABLE 1 Underlying pathway intermediate result hypotheses, evidence types, and sources.

Strategy pathway	Evidence label	Hypotheses	Type and source of evidence	Class
Key design result	Coll.1	Increased number of local institutions collaborating to support Conservancy Rhino Rangers	Number of unique institutions recorded over time in SRT SMART database	Green
Pathway 1: Ranger values	P1.1	Increased number of mobilized and motivated Conservancy – employed rangers	Recorded "employees" over time from SRT SMART database	Green
	P1.2	Greater frequency of patrols	Number of patrol field days over time from SRT SMART database	Green
	P1.3	Increased patrol effectiveness with expanded coverage	Number of Patrol Sectors covered over time from SRT SMART database	Green
	P1.4	Decreased time to detect and report poaching	Time between estimated death and carcass detection using Mortality Forms	Green
	P1.5	Increased individual rhino sightings	Individual rhino sightings roster from SRT SMART database	Yellow
Pathway 2: NGO values	P2.1	Maintained or Enhanced high quality information	Subjective comparison using expert knowledge	Yellow
	P2.2	Increased frequency of and confidence in ranger performance reports	Past versus present reporting products	Green
Pathway 3: Conservancy leadership values	P3.1	Increased number of contracts signed between tour operators and Conservancies	Annual counts recorded by SRT	Green
	P3.2	Increased number of Conservancies receive revenue directly from rhino	Annual counts recorded by SRT	Green
	P3.3	Conservancies take greater ownership and investment in the program	Annual expense records of Conservancies	Red
Pathway 4: Local farmer values	P4.1	Increased willingness to report rhino information and potential threats	Qualitative independent research	Yellow
	P4.2	Reduction in or elimination of local collusion with poachers	Proportion of arrests following poaching event, National Crime Arrests Database	Yellow
Main threat reduction	TR.1	Reduction of illegal hunting on rhinoceros	Counts of illegal hunting of rhinoceros cases from SRT SMART database	Yellow

observations recorded primarily strong evidence in support of a hypothesis we scored it a GREEN. While each assumption scoring discussion often involved some level of debate, consensus was always reached among the group. These simple yet easily understandable classes could be considered similar to the conventional process tracing evidence affirmation categories of "Straw in the Wind," "Hoop," and "Smoking Gun" (Van Evera, 1997). Similar scoring methods have been used to enact robust environmental decision-making in South Africa (Pierce et al., 2005).

3 | RESULTS

The *number of institutions directly collaborating* (Coll.1) through the CRR Program since its inception in 2012 has grown from 4 local institutions in 2012–1 NGO, 1 Conservancy, and 2 private sector tourism companies – to 25 institutions in 2023–14 Conservancies, 3 Conservation NGOs, and 8 private sector tourism operators offering rhinoceros tracking tourism with Conservancies. Due to this substantial increase, we rated this hypothesis as GREEN.

3.1 | Pathway 1 – Ranger values

The number of *mobilized CRRs* (P1.1) more than doubled from inception over the first 5 years ("Pathway 1"; Figure 2) from 16 in 2012 to 35 in 2017). A nearly 5-fold increase emerged by 2023 (95 active CRRs). Notably, the current cohort comprises 17 all-female CRRs (18%) from none at the baseline. This growth in the ranger workforce led to a 327% increase in *patrol effort* (P1.2) (team field

days), despite a slow initial phase where new CRRs were mobilized through a limited number of SRT vehicles for patrols. Further, the proportion of CRR contributions relative to NGO staff grew from 14% during baseline in 2012 to averaging 60% for the past 3 years (Figure 2). We classified these two hypotheses (P1.1 and P1.2) as GREEN.

Patrol effectiveness (P1.3) (i.e., spatial coverage) grew from an average of 25% of patrol sectors monitored per month to an average of 90% coverage by 2023, including a greater than 95% coverage of patrol sectors with resident rhinoceros. We thus rated P1.3 as GREEN. Patrol effectiveness also led to a substantial decrease in *poaching detection* time (P1.4) with early cases (2012–2014) estimated to take weeks or months before detection ($\overline{X} = 170$ days $\pm$ 143 days with 2 carcasses estimated to be older than 1 year; $N = 16$) to only a few days for the past 5 poaching cases between 2020 and 2023 ($\overline{X} = 1.4$ days ± 0.5 days with 3 carcasses found the day after it was poached; $N = 5$) yielding another GREEN rating. Lastly, we found a 33% increase in the frequency of an *individual rhinoceros sighting* (P1.5) from an initial monthly average of 35% ($\pm$11%) at baseline in 2012 to a sustained average of between 46% and 50% per month between 2020 and 2023. We classified this hypothesis as YELLOW since improvements could be made to continually increase the monthly percentage of individual rhinoceros sightings.

3.2 | Pathway 2 – NGO Values

The structure outlined in Pathway 2 combined with the adoption of SMART Conservation software (Cronin et al., 2021) is hypothesized to lead to *maintained or enhanced high quality data information* (P2.1). When compared with previous data management systems (Microsoft Excel and ArcGIS) there is little doubt that SMART, which was implemented by SRT in 2014, improved efficiency and confidence. For example, at baseline prior to SMART, patrol and individual rhinoceros sighting information was manually entered into an Excel spreadsheet from paper standardized patrol report and rhinoceros identification forms. No track log data was captured, only daily kilometers walked were recorded using handheld Garmin GPS devices and transcribed onto patrol reports. While SMART was not fully implemented immediately across all teams, SMART desktop software still enabled managers to transfer data more quickly from paper to digital format. Moreover, SMART's integrated tabular and mapping interface enabled managers to quickly review and assess data quality within minutes following entry. Further improvements followed as more rangers received training in the use of SMART. However, early data audits revealed that this performance improvement was coupled with a performance decline: it created a situation where the ease of uploading data and moving-on introduced data errors. We designed "data quality control checklists" in 2018 that provided a stepwise list for managers to ensure all data were accurately captured. A further annual audit was introduced where all patrol data was scrutinized by senior managers during the process of producing our annual population assessment report. Despite our efforts to catch errors before the year end, the data still require a some "cleaning" during the annual audit. Thus, we classified the evidence for this result (P2.1) as YELLOW as some evidence supported our hypothesis but others remain a work in progress.

Once able to ensure high quality data, we theorized we would be able to produce *higher quality reports more regularly* (P2.2). SMART provided numerous reporting options, from real-time queries to detailed documents with figures, tables, and infographics. For example, if a rhinoceros was not observed for more than 3 months, our Director of Field Operations wanted to know when and where the last sighting occurred. A customized query produced this information within seconds. We also established a Ranger Honor Roll which consisted of a series of six bar charts that tracked three key performance metrics (active field days, foot kilometers, and number of rhino sightings) measured monthly and cumulatively (year-to-date). Ranger pride in these metrics encouraged higher performance. These statistics were displayed prominently at the SRT field headquarters, from where all CRR patrols were deployed. Lastly, prior to implementing SMART, patrol performance assessments were only produced for individual donors per grant contract and the rhinoceros population assessments once every 5 years. SMART enabled tracking of performance on demand using simple figures such as custom "speed dials" that presented current versus annual target performance levels (see Figure S2 – Supplementary Section in the Appendix S1). These advancements led us to publish annual rhinoceros population assessments instead of only one every 5 years. These "traces" of strongly positive evidence to support our hypothesis. We classified this result (P2.2) as GREEN.

3.3 | Pathway 3 – Conservancy leadership values

Our first Pathway 3 result emerged from the *ranger proficiency* result in Pathway 1. We hypothesized that once rangers become proficient at rhinoceros monitoring and conservation tourism, we would observe an increase in the number of *contracts signed* (P3.1) between private sector tour operators and Conservancies supporting ranger teams. The number of contracts grew from two at baseline

to nine independently established contracts. Compared with the baseline of a single Conservancy receiving revenue from rhinoceros tourism, these new contracts *increased the distribution of revenue from rhinoceros* across eight of 12 Conservancies supporting ranger teams, with two Conservancies having planned new rhinoceros tracking activities for the near future (Table 2) (P3.2). Additional evidence prior to the COVID-19 pandemic found rhinoceros tourism delivered over USD$1,000,000 to Conservancies between 2014 and 2019 (Muntifering, Guerier, et al., 2023; Muntifering, Malherbe, et al., 2023). We classified these two results (P3.1 and P3.2) as GREEN.

Lastly, we hypothesized that Conservancies generating more income directly from protecting rhinoceros would demonstrate greater ownership by *increasing investment* in the program (P3.3). Evidence partially confirmed the hypothesis, as eight of the 14 Conservancies – each with at least one rhinoceros tourism operation – re-invested income into employing more rangers, parallel with increasing income from rhinoceros tourism (Muntifering, Guerier, et al., 2023; Muntifering, Malherbe, et al., 2023). However, we found little to no evidence of Conservancies investing in other aspects of the program. We classified this result (P.3.3) as RED; while supporting evidence was not entirely absent, the result was certainly not nearly what was expected. Lastly, we retrospectively noted a potential "leap of faith" that additional income from rhinoceros would lead to *enhanced pride, gratitude, and respect in rangers* (Pathway 4) facilitated by an increased distribution of benefits by Conservancy. Our qualitative research found little to no evidence to support this missing hypothesis (Naro et al., 2020).

3.4 | Pathway 4 – Local farm values

We hypothesized that a set of intermediate results (ToC; Pathway 4) was expected to drive results further along this causal pathway. First, we expected engaged farmers to display an increased *willingness to communicate* directly with rangers, in particular to *report rhinoceros movements* in their area, as well as suspicious human threats (P4.1). Team leaders who conducted farm visits reported farmers communicating almost immediately after visits were initiated, and unanimously agreed that communication quickly increased, especially regarding observed rhinoceros movements. SRT's Principle Field Officer suggested that since farm visits were suspended in 2023 (due to lack of funding) the frequency of communication has decreased substantially (M. Nawaseb, pers. comm.) supporting the hypothesis that visits enhanced communication. However, independent research suggested that cooperation with law enforcement is not always guaranteed, especially when it requires reporting criminal behavior of fellow residents (Schneider, 2022). Given the mixed results, we classified this hypothesis as YELLOW.

We also theorized that a decreasing tolerance to poaching should lead to a *decrease in local people engaging or colluding with poachers*. We sought to track the number of arrests made of local people residing within the partner Conservancies as our evidence for, or against, affirming this result. Despite "home town" being an attribute in the National Wildlife Crime Database, it was often not recorded. In our area, only 8 of 38 arrests had a "home town" attribute recorded. Of these 8, none were from the local area. Further anecdotal evidence suggests few to no arrests of long-time local residents (S. Uri-Khob, pers. com.) were made. While this somewhat supports our hypothesis, we remain cautious due to the low sample size and classified this as YELLOW (P4.2) (Figure 3).

3.5 | Reduced poaching of rhinoceros

After a dramatic escalation of rhinoceros poaching during the program's pilot phase in 2013 and 2014, when nearly 60% of rhinoceros poaching cases between 2013 and 2023 occurred, the number of

TABLE 2 Conservancy and private sector tourism partnerships in rhinoceros tracking tourism.

Year established (ended)	Conservancy partner(s)	Private sector partner	Contract
2003	Torra, Anabeb, Sesfontein	Wilderness Safaris Namibia	Contract
2005	Khoadi Hoas	Journeys Namibia	Contract
2015	Torra	Gondwana Collection (initially Camelthorn Safaris)	Contract
2016 (2022)	Huab	Ultimate Safaris	Contract
2018	Puros, Sesfontein	Natural Selection	Contract
2017	Torra	Matiti Safaris	Ad-hoc
2019	Torra	Blue Crane Safaris	Ad-hoc
2021	Sesfontein	Nature Friends Safaris	Ad-hoc
2023	Doro !Nawas, Uibasen, Sorris Sorris	Ultimate Safaris	Contract

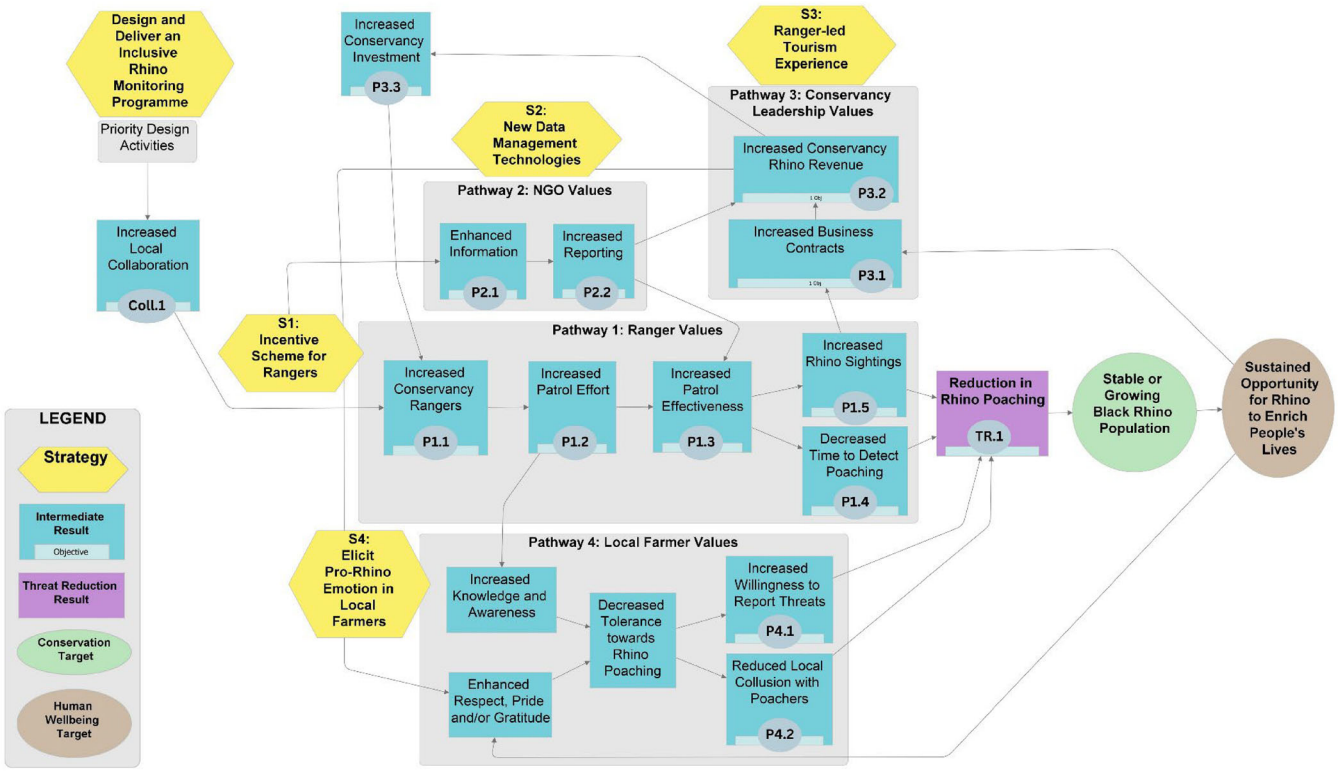

FIGURE 3 A Theory of Change for a rhinoceros protection approach in northwest Namibia that is founded upon the inclusion and values of local communities. Gray circles represent an indicator or hypothesis.

recorded cases dropped substantially from 2015 onwards, with only four poached rhinoceros during a 4-year period between 2020 and 2023 – all of which occurred during the first 6 months of the COVID-19 pandemic (Figure 4). Changing poaching behavior is a complex challenge requiring a mix of complementary mechanisms; perhaps the strongest link between inclusive rhinoceros monitoring and reduced poaching is best illustrated by time series data which clearly suggest a strong negative relationship between rhinoceros poaching and simultaneous increases in overall monitoring effort, and also a large proportional increase in the contributions by Conservancies relative to NGO rangers (Figure 4). Despite these positive trends, since we did not explicitly test alternative hypotheses, such as enhanced law enforcement, we classified this hypothesis (TR.1) YELLOW, emphasizing the importance of ongoing monitoring and the need for broadening our evidence base to include additional complementary mechanisms.

4 | DISCUSSION

Our findings from the past decade of designing, delivering, and monitoring "traces" of evidence along our four causal pathways suggest that, overall, our inclusive rhinoceros management model, operationalized as the Conservancy Rhino Ranger program, has been an effective approach for reducing rhinoceros poaching in northwest Namibia. Our quantitative and qualitative "traces" confirmed the majority of our hypotheses along our four primary pathways: nine of the 14 hypotheses appear fully confirmed (GREEN); four partially confirmed (YELLOW); one for which the hypothesis was denied (RED).

Several key factors appear to have contributed to the effectiveness of our approach. We refer collectively to these using the mnemonic LIVEN.

4.1 | Locally-led

First, our experience in northwest Namibia strongly suggests that the program design, delivery, evaluation, and adaptation processes, particularly problem solving, are effective when devolved to **Local** ("L") communities and (if any) local, field-based organizations directly supporting communities on the ground. Our "traces" support approaches previously championed: "Let the Locals Lead" (Muntifering et al., 2017; Smith et al., 2009). The devolution of power and public demonstration of respect cultivates authentic collaboration and inspires a call-

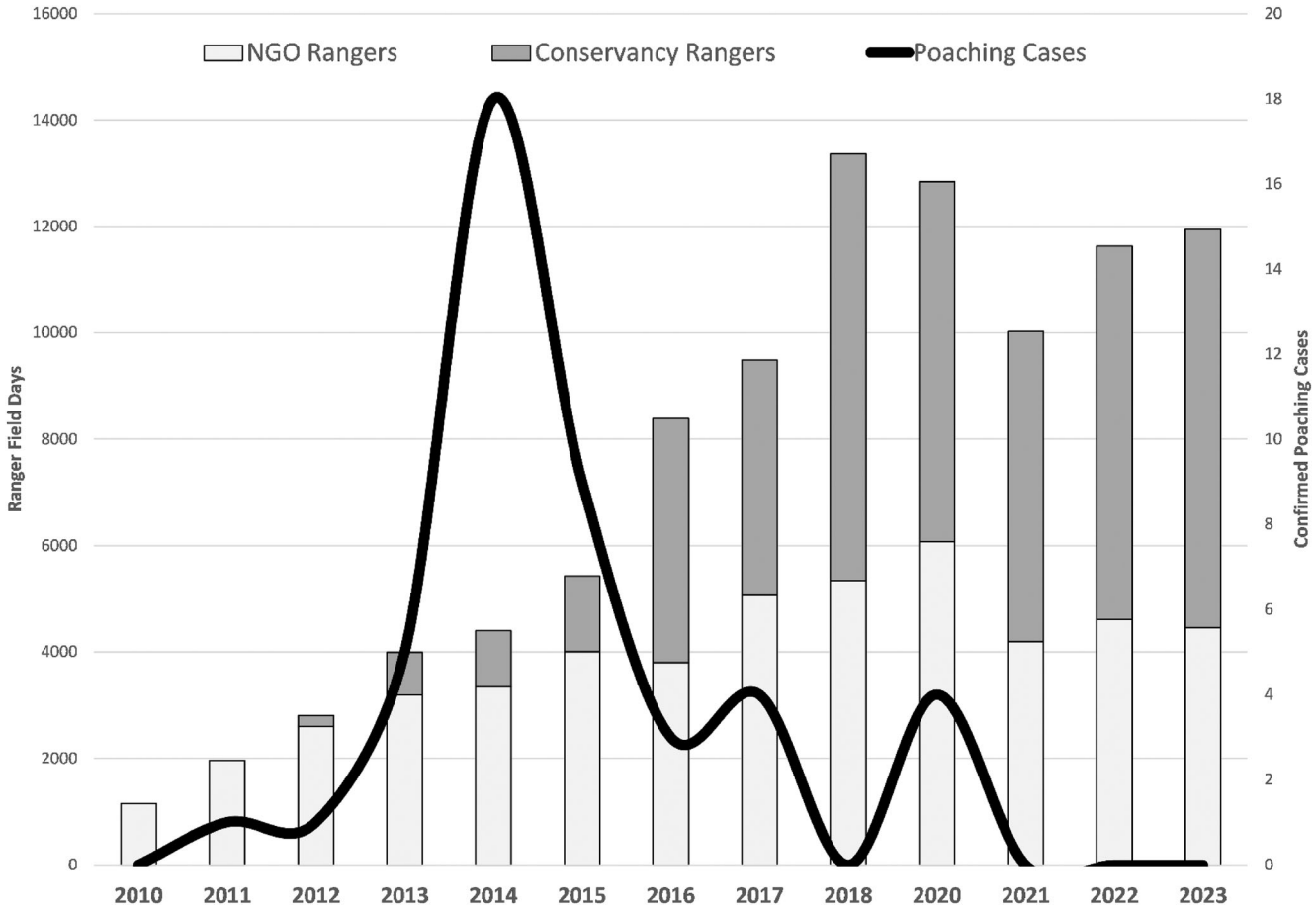

FIGURE 4 Relationship between annual ranger team field effort and illegal rhinoceros poaching. The program pilot period was considered to be 2012–2013.

to-action by local people. Engaging the institutions they traditionally seek to realize values through, if approached in culturally appropriate ways, empowers them. The CRR support group leveraged the knowledge of local people, their experience and expertise, to adapt the program when "traces" suggested the actions comprising a causal pathway were failing to deliver desired results. For example, vehicle-based patrols were replaced with new rangers deployed to patrol on foot and operating from a network of fly camps. This decision, actioned in 2015, led to a dramatic increase in *Patrol Effort*. Further, a farm visit initiative emerged from team leaders expressing a desire to build more productive relationships with farmers, the development of which was informed by targeted research utilizing a Theory of Planned Behavior framework (Ajzen, 1991) to develop an empirical understanding of local factors that could improve pro-rhinoceros behavior in local farmers (Shivute & Muntifering, 2016). Here, a new suite of complementary mechanisms was forged as a causal pathway to be actioned by the local support organizations responsible for rhino conservation embedded within the CCR support group. This pathway and intervention was also influenced by insights provided by an independent researcher to refine our assumptions (Naro et al., 2020).

4.2 | Incentive and value-driven

Incentives ("I") should be designed, delivered, evaluated, and adapted to harness specific desired **Values** ("V"). We intentionally selected incentives engaging basic human values sought by our stakeholder groups either through what experience deemed as necessity (i.e., knowing what is needed to conduct effective rhinoceros monitoring in the landscape based on SRT's 40 years of firsthand experience) or simply situationally desirable (i.e., learning by listening to what motivates people based on individual or group conversations, social media). We learned that the relative importance of values is dynamic and may evolve over time, meaning actions, and sometimes causal pathways, will need to be adapted. For example, as ranger's skills improve, they may shift value demands toward money or respect (often actioned

through targeted public recognition). In our experience, the monetary and non-monetary performance incentives are powerful motivators for rangers operationalized through clear, structured bonus payments each month and annual award ceremonies (Muntifering, 2019). It is essential to continually monitor values to ensure that actions (e.g., incentives) are aligned with contemporary value demands. Previously, we have used a problem-orientation approach to policy design (Muntifering et al., 2017) by posing fundamental questions based upon Clark (2002) such as "what values are being sought by whom through which institution(s)?" Framing strategies using value-based questions promotes a more holistic, situation-specific approach to managing wicked problems (Knight et al., 2019). When problems are not addressed situationally, top-down approaches often promote solutions that differ dramatically from a locally inclusive process (Naro et al., 2020) and are less effective in the long-term.

4.3 | Evidence-based

Our "traces" demonstrate the importance of carefully selecting and regularly monitoring **Evidence** ("E") along theorized causal pathways. Most of our evidence was gathered continuously and, coupled with appropriate tools (i.e., SMART) provided frequent opportunities to track which activities were working, which were not, and inform discussions on how pathways might be adapted.

Our experience strongly indicates that, in multi-stakeholder situations where special interests are at play, such as private sector tourism (Garen, 2000), "traces" provide a neutral, common ground upon which to debate effectiveness, failures, and adaptions. For example, our 20 years designing, delivering, evaluating, and adapting rhinoceros tourism activities was underpinned by a common value: minimize or eliminate disturbance to rhinoceros (Muntifering et al., 2020). As we gathered intelligence to drive discussions on which actions would meet tourists' expectations for consistent rhinoceros viewing experiences that might minimize or eliminate disturbance, it was clear to all stakeholders that evidence from direct observation would drive subsequent prescriptions and policies (Muntifering et al. 2019a; Muntifering et al. 2019b). How evidence is valued was also important. We purposively traded-off a sophisticated methodology (i.e., RCTs or Bayesian statistics) against a fit-for-purpose methodology that is intuitively understood by local managers and team leaders and, most critically, that provides sufficient information to reliably, ethically, and cost-effectively trigger adjustments to actions when needed.

4.4 | Neutral Identity

The letter "N" in LIVEN stands for our **Neutral** ("N") branding for the Conservancy Rhino Ranger Program. While this may seem like a trivial item, we are not the only conservation program that operates in a space riddled with competing interests and egos, especially around recognition and fundraising. These factors compromise effective, ethical, and authentic collaboration expressed as a reluctance to support "someone else's program" (Catalano et al., 2019). Given the complexity of rhino conservation programs, collaboration should be a top priority for any organization or institution seeking to achieve lasting impact at scale. While this is easier said than done, creating neutral identities for a common interest (i.e., supporting local communities' efforts in conservation) may foster greater collaboration. Just like no single action will save threatened wildlife (Tinbergen, 1952; Young et al., 1996), no single institution has all the mechanisms, tools, methods, methodologies, knowledge, expertise, and experience to solve the rhinoceros poaching problem. In our experience, we learned that we didn't simply craft a new, unique branding that represented the common interests of saving rhinoceros and supporting local communities. We created a positive identity "space" that stakeholders could rally around without feeling under-recognized.

Our belief that internal team learning should be our ultimate guiding principle has only been reinforced by our experience. We argue that team learning is ultimately more fundamental to our long-term effectiveness than "objective" quantitative assessments of impact. In complex adaptive systems, particularly where intangible dimensions of the system are driving change, objectivity of an observer is a myth. For example, members within a team may have different perceptions of the "right" evaluation question to pose, the bounds of influence a project presents, or the extent to which goals have been achieved. A fit-for-purpose evaluation methodology – in our case, process tracing – is foundational to team learning as it provides a system for testing Theories of Change to produce situation-specific information to support decision-making (Knight et al., 2019). Participant learning is optimized by having participants, rather than independent "experts," undertake the process tracing approach. This approach is ongoing throughout the life of the CRR Program, and so takes substantially more time and training to implement. It does, however, empower disenfranchised members of a community. Despite producing a reasonably effective rhinoceros management approach in northwest Namibia centered upon the values of promoting collaboration and inclusivity

through local institutions, we readily acknowledge the limitations of our work as well as failures to achieve desired results. If characteristics of the complex adaptive system that our Kunene landscape embodies were to change dramatically, our approach may not be effective. For example, a substantial rapid increase in market size and market value of rhinoceros horn could mark a shift in the values of local communities.

First, process tracing does not make statistical inference about cause-and-effect relationships like RCTs. For example, our results cannot claim that the observed increase in patrol frequency *caused* a reduction in rhinoceros poaching and thus should be interpreted with careful consideration. While our ToC may appear comprehensive in examining activities implemented to reduce rhinoceros poaching in our landscape, it did not capture every strategy and action that took place during the evaluation period. For example, an intelligence initiative was initiated in late 2015 that included rewarding "informers" with monetary payments. While this initiative was largely facilitated by a single individual, several additional informal informer networks were also established around this time. We did not include intelligence in our ToC, due to the secretive nature of its design and delivery. However, preliminary evidence suggests that this action had limited effect on increasing local people's willingness-to-cooperate with law enforcement (Schneider, 2022) and so was unlikely to have played a significant role in reducing poaching. Time spent thinking critically about how to design intelligence systems that are just, locally accepted and that foster authentic cooperation with law enforcement organizations is well warranted and lessons are emerging (Lunstrum & Givá, 2020; Sjostedt et al., 2022). Pursuing these improvements is critical, as a fundamental goal of inclusive rhinoceros protection strategies is to complement conventional law enforcement approaches (Massé et al., 2017; Muntifering et al., 2017). However, care must be exercised to ensure that law enforcement and inclusive rhino protection do not conflict (Duffy et al., 2015). Another externally imposed law enforcement action not included in our ToC was the involvement of the Namibian police force in ranger monitoring patrols in 2015, where each ranger team was accompanied by 1 or 2 armed members of the Namibian police force. Despite being armed, the Namibian police were not trained in conventional militarized anti-poaching tactics. Their presence and mandate were primarily to ensure ranger's safety. Given protection was their mandate and their physical presence was primarily in the field, the often-reported negative impacts of militarized forces on local people (Duffy et al., 2015) were likely trivial. Yet research into if, or how, this affected local peoples' perceptions toward rhinoceros protection would be useful for designing future approaches.

Lastly, perhaps the greatest challenge we experienced was motivating Conservancy leadership to accept greater ownership and associated investment in the program over time. Despite the substantial growth in the number of Conservancy-employed rangers, which requires a large financial investment, we expected a slow but steady shift in Conservancy's willingness-to-finance additional expenses beyond ranger employment (which amounts to roughly 25% of total program costs). We suspect this reticence is due to (at least) three persistent issues. First, Conservancy leadership has a high turnover, with most committee and chairperson terms only lasting 2–4 years. High turnover can result in newly elected leadership being unfamiliar with all a Conservancy's projects and perhaps not feeling the connection and identity that the original founding leadership would have. This can lead to a lack of support, especially when committees face additional leadership and governance challenges, which are not uncommon across the Conservancy landscape in Namibia (Bollig, 2016; Schneider, 2022). Further, resistance from Conservancy staff to requested support from the CRR Support Group was not uncommon, especially regarding requests for vehicles to deploy and replenish field gear for their rangers. Failure to introduce a process for shifting the incentive provision to Conservancies has created a situation whereby Conservancies are reluctant to take on these additional costs. More recent activities, including facilitating annual field excursions for new committee members to observe their rangers in action in the field, as well as new ranger performance reports produced from SMART and distributed quarterly to Conservancy staff, are hoped to strengthen Conservancy commitment and inspire greater pledges and demonstrations of support in the future. We have also proposed creating a new steering committee comprised of *current* Conservancy leadership to review progress and set the impending year's agenda.

In conclusion, as we scan the horizon, we aim to shift our model from a "partnership" arrangement with local communities toward a more "autonomous" community-led institution (Dawson et al., 2024), one inclusive of a large missing demographic – the broader local community consisting primarily of youth. While an assumption that a Conservancy benefits from rhinoceros trickle down to its members is intuitively appealing, research suggests that this has been limited (Naro et al., 2020; Schneider, 2022). Future strategies will expand beyond the ranger-focused model that further demonstrates how securing a future for rhinoceros on a landscape can

enrich local people's lives and can contribute toward uplifting local communities in rural Africa. While we present our case on rhinoceros in rural Africa, the principles underpinning the LIVEN approach are highly transferrable to other species and contexts particularly where and when a shift in the way local people engage with, and value, wildlife is sought.

AUTHOR CONTRIBUTIONS

All authors made substantial contributions toward the design and delivery of the program. Jeff Muntifering and Andrew Knight led the manuscript preparation. All authors reviewed the final draft and approved its submission.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

Due to the security of any information that pertains to black rhinoceros in Namibia, as per the Ministry of Environment, Forestry and Tourism, our raw data used in this study are not available to the public. However, special conditions may grant access to specific datasets, and interested parties may contact the lead author.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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