Conservation in the Human Landscape

by

Alexandra Elizabeth Sutton

Graduate Program in Environment
Duke University

Date:_______________________

Approved:

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Stuart L. Pimm, Supervisor/Chair

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William Sutherland

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Martin Doyle

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Jeff Vincent

Dissertation submitted in partial fulfillment of
the requirements for the degree of Doctor
of Philosophy in Environment in the Graduate School of Duke University

2017
ABSTRACT

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Abstract

The protection of global biodiversity and the conservation of the earth’s natural resources are paramount to future wellbeing of mankind. Humans are a hugely influential part of the global ecosystem, and the ways in which we use, create, and change global biodiversity patterns are as important to understand as the ways in which those patterns function without our interference. Of more specific importance is an understanding of the ways in which human values, behaviors and practices (especially those surrounding leadership, management, and finance) relating to biodiversity management can be helpful or harmful as we attempt to meet our self-determined goals of global conservation.

To that end, the first chapter of this dissertation focuses on the potential influence of leadership and management on outcomes in wildlife reintroduction programs. Wildlife reintroductions and translocations are statistically unlikely to succeed. Nevertheless, they remain a critical part of conservation because they are the only way to actively restore a species into a habitat from which it has been extirpated. Past efforts to improve these practices have attributed the low success rate to failures in the biological knowledge (e.g., ignorance of social behavior, poor release site selection), or to the inherent challenges of reinstating a species into an area where threats have already driven it to local extinction. Such research presumes that the only way to improve reintroduction outcomes is through improved biological knowledge. This emphasis on biological solutions may have caused researchers to overlook the potential
influence of other factors on reintroduction outcomes. I employed a grounded theory approach to study the leadership and management of a successful reintroduction program (the Sea Eagle Recovery Project in Scotland, UK) and identify four critical managerial elements that I theorize may have contributed to the successful outcome of this 50-year reintroduction. These elements are:

(i) Leadership & Management: Small, dedicated team of accessible experts who provide strong political and scientific advocacy ("champions") for the project.

(ii) Hierarchy & Autonomy: Hierarchical management structure that nevertheless permits high individual autonomy.

(iii) Goals & Evaluation: Formalized goal-setting and regular, critical evaluation of the project’s progress toward those goals.

(iv) Adaptive Public Relations: Adaptive outreach campaigns that are open, transparent, inclusive (esp. linguistically), and culturally relevant.

This study represents an initial, but valuable inquiry into the ways in which leadership and management can impact programmatic (and therefore, biodiversity) outcomes.

The second chapter of this dissertation explores the potential relationship between financial mechanisms and outcomes in non-governmental biodiversity conservation programs. Although local laws, trends, and market forces often shape the specific laws and market conditions under which conservation transactions occur, focusing analysis on the broader mechanisms of transfer may provide new opportunities
to identify patterns, improve efficiency, and link transfer mechanisms to conservation outcomes.

Through a series of seven brief, descriptive case studies built around interviews with senior officers at US non-governmental organizations, this chapter seeks to highlight potential linkages between inflows of conservation dollars, financial mechanisms used to transfer them to conservation actors/entities/organizations, and eventual outflows of conservation dollars into measurable outcomes. This chapter also presents a preliminary framework for categorizing mechanisms and predicting their impacts on availability and outflow of conservation dollars. Although the framework fails to predict all outcomes, its failure highlights several emergent themes in the impact of financial mechanism, including:

(i) longer time horizons of funding availability can decrease the value of conservation investments, but increase accountability

(ii) time-bound (or time-limited) funding mechanisms can create uncertainty and decrease investment in program outcomes

(iii) mechanisms granting greater control to donors/investors can decrease the autonomy and adaptability of conservation organizations, and can skew outcomes toward donor biases

We hope that these results are useful as a first step toward the greater consideration of financial mechanisms in conservation planning and financial analysis.

The third chapter of this dissertation applies principles of the first two chapters
as part of an in-depth look at one conservation initiative: the Anne K. Taylor Fund’s Boma Fortification Program, taking place in Narok County, Kenya. In the pastoral steppe of East Africa, lions (*Panthera leo*) kill livestock. The subsequent lethal retaliation by livestock owners has helped reduce lion numbers by more than 80% and driven it from most of its historic range. This conflict is especially intense along the western edge of the Maasai Mara National Reserve in Kenya, where some of the densest lion and livestock populations in Africa overlap.

We evaluated the efficacy and cost-effectiveness of implementation for one proposed solution – the Anne K. Taylor Fund’s subsidized construction of fortified, chain-link livestock fences (‘bomas’) – in reducing livestock loss to depredation. We collected 375 predation reports from 308 semi-structured household interviews and predation records. We used these data to study the impact of subsidised boma fortification on the depredation of cattle, sheep and goats. Of 179 fortified bomas, 67% suffered no losses over one year; of 60 unfortified bomas, only 15% had no losses over one year. Furthermore, losses of greater than five animals per year occurred at only 17% of fortified bomas, compared to 57% of unfortified bomas. The overall reduction in losses to predation at fortified bomas equated to savings of more than $1,200 USD per household per year, but with a return on investment of 778%, partially fortified bomas are vastly more cost effective than fully fortified bomas (return on investment = 349%).

However, the broad applicability of the boma fortification approach is uncertain, as its financial structure relies heavily on a single large donor to act as subsidizing
entity. This single-supplier approach introduces cost inefficiencies, as well as supply chain vulnerabilities. Future fortification programs should consider alternative decentralized approaches to strengthen supply lines and scale the solution.

These chapters collectively represent a thorough examination of the human dimensions of conservation – and the ways in which leadership, management, finance, and valuation can contribute to harmful or helpful outcomes in the effort to preserve global biodiversity.
Dedication

Dedicated to my brother, David Dewaine Sutton (1971 - 2016), who taught me to laugh, love, and listen to NPR.

He now rests in the boughs of an American Yellowwood (Cladrastis lutea) in the Rock Creek section of Oak Hill Cemetery in Washington D.C., planted below Bridge Avenue at approximately 38°54′45.8″N, 77°03′19.2″W on November 4th, 2017.

Here I sit between my brother the mountain and my sister the sea. We three are one in loneliness, and the love that binds us together is deep and strong and strange.

– The Great Longing, Khalil Gibran
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Introduction

There is no higher goal than the preservation of all the beauty and diversity of our natural world. This is because, in the pursuit of protecting our global ecosystem – and all its complex, distinct, and divinely beautiful parts, we find that we are also protecting our own humanity. We are inextricable from, and dependent upon, the ecosystems in which we live. For this reason, protecting and conserving the world’s biodiversity is a goal of foremost importance to people everywhere in the world.

This dissertation attempts to make a contribution toward that goal, focusing in particular on the human dimensions of global sustainability and biodiversity conservation. Specifically, I have been interested in the leadership, management, and funding of biodiversity conservation initiatives. Why do we design protected areas and conservation projects in the ways that we do? How do we decide what’s worthy of protection, and once we have decided – how do we carry it out? Who gets asked? Who gets included? Who has a stake in seeing a conservation project succeed? The chapters herein explore these questions and more through a series of global case studies (Scotland, Kenya, and the United States), crossing disciplinary and methodological borders to identify the best and most useful paradigms for biodiversity planning.

In Scotland, anthropological methods guided my exploration of leadership and management in wildlife reintroduction programs. I embedded myself into a single program – the Sea Eagle Recovery Project (SERP; 1975 - 2012) in Scotland – where I used interviews, document analysis, and participant-observation notetaking to reconstruct a
narrative history of the project, its pitfalls, and its successes. By studying in-depth this particular group of wildlife biologists, I was able to take a critical eye to the human traits and behaviors that may have helped bring the white-tailed sea eagle back to the United Kingdom.

In the United States, I drew on the fields of business and finance to guide my inquiry into the most effective contract designs for donor-funded biodiversity initiatives. I conducted interviews with seven initiatives managed by conservation organizations headquartered in the United States, collecting data about the challenges and benefits of their individual funding contract structures. From this work, I was able to build a picture of the broader pipeline of conservation funding, drawing lessons from the seven case studies to illuminate areas in which the design of the relevant funding contracts exerts an influence on conservation outcomes.

In Kenya, I used a mixed methods to better understand the ephemeral phenomenon of livestock losses to predators in the western Maasai Mara region. In this part of the world, conflict with livestock drives retaliatory killings that decimate predator populations – taking particular toll on the African lion, whose numbers have declined sharply over the last four decades. I embedded myself over the course of two years into the Trans-Mara and Mara North communities, working with local lodge owners and an anti-poaching team funded by the Anne K. Taylor Fund to conduct household interviews and livestock surveys of Maasai households above and below the Oloololo Escarpment. These interviews and surveys reveal patterns in demography,
economics, and husbandry behaviors of the Mara region. From this, we are able to test our primary hypothesis: that fortified bomas (cattle pens constructed using stronger posts, chain-link fences, and barbed wire) are not just an effective, but a cost-effective means to protect livestock and prevent lion killing. The inclusion of a cost-benefit analysis embeds this work in a larger movement toward integrating better financial information into conservation planning and enhancing sustainability, and the overall research itself is structured as a contribution toward the literature body of the evidence-based conservation movement.

Collectively, these chapters demonstrate a commitment to interdisciplinary thinking; a desire to contextualize conservation research in its social, economic, and political environments; and an example of conservation science conducted in service to both nature and humanity.
Chapter 1. Leadership and Management Influences the Outcome of Wildlife Reintroduction Programs

1.1 Introduction

Wildlife reintroductions are complex, expensive, and time-consuming. Worse, they are statistically unlikely to succeed, as repeated audits have shown (Clark & Westrum 1989; Griffith et al. 1989; Kleiman 1989; Fischer & Lindemeyer 2000; Reading et al. 2002; Lipsey & Child 2007; Seddon et al. 2007, Reading et al. 2013). They are also the only way to restore an extirpated species to its prior home in cases where natural recolonization is impossible or unlikely, and for this reason, reintroductions remain an essential tool in conservation (Tear et al. 1993; Ostermann et al. 2000).

1.1.1 Understanding Success and Failure in Wildlife Reintroductions

Much of the previous literature has attributed failures in reintroduction to deficiencies in the biological knowledge. Such theories presume that reintroduction outcomes are constrained only by the availability of biological data (e.g. Armstrong & Seddon 2007, Cook et al. 2010). If this were the case, then reintroductions of data-rich species (e.g. wolves, lions) would be reliably more successful; they are not.

Some fault may lie in the inherent fragility of reintroduction procedures: the combined vulnerabilities of (i) small founding populations (Pimm et al. 1988; Pimm 1989); (ii) complex extinction causes (e.g. the passenger pigeon, which suffered simultaneously from overhunting, habitat loss, fragmentation of food landscapes, and lost cohesion of social groups [Bucher 1992]); and (iii) potential loss of behavioral or
genetic integrity due to captive breeding (Jule et al. 2008) may prove insuperable in the re-establishment of an extirpated population.

Reintroduction is also relatively novel within the broader context of conservation—only within the past 40 years has it become a commonly-used scientific tool, and has had little time to form a body of knowledge about best practices to guide projects (Kleiman et al. 1994; Sarrazin and Barbault 1996; Stanley Price & Soorae 2003; Seddon et al. 2007, Robert et al. 2015).

It should come as no surprise, therefore, that most reintroductions fail. There has been some evidence that supplementary movements (such as the overwhelmingly successful [94%] grazing mammal translocations of South Africa, documented in van Houtan et al. 2009) may flourish, but overall success rates remain low. Estimated rates of success vary between reviewers (46% - Griffith et al. 1989; 11% - Beck et al. 1994; 20% for restoration projects overall – Lockwood & Pimm 1999; 26% - Fischer & Lindemeyer 2000; 53% for wild-born carnivores, 32% for captive-born – Jule et al. 2008), but the pattern remains clear: in recreating an absent population, some efforts succeed; most do not.

1.1.2 Understanding Success and Failure in Organizations

Organizations, likewise, may succeed but often fail. This failure can be linked strongly to the organization’s internal activity: the set of behaviors and values that establish professional norms and direct operations within an institution. This set of behaviors and values has been termed organizational culture, and has been under study since the early 1980s in the business and management research fields (see: Schein, 1984).
An organization’s culture manifests in every aspect of the institution, including such structures as administrative hierarchies, staff competencies and experience, financial resources, and management practices (Schein, 1990; Schein, 2010; Lunenburg, 2011). Expectations about each of these inform and restrict decision-making within an organization, and in doing so, culture becomes directly influential on outcomes (Barney, 1986; Schein, 1990; Schein, 2010). This is a complex explanation for an intuitive phenomenon: that a well-run organization will perform better than a poorly-run one.

Despite conservation’s origins in scientific practice, it is fundamentally an applied field, and as such, relies on practice and operation to achieve desired outcomes. In this sense, a conservation initiative, entity, or project does not differ from other organizations, and is just as subject to the influence and impact of human and organizational factors. In fact, organizational experience, preference, and priorities direct every decision about reintroduction from the first recognition of the loss of a species. Biases towards charismatic species, cultural preferences, the geopolitical context of reintroduction, the depth of existing scientific knowledge, and questions of physical accessibility all shape projects in their planning phases. Organizational structures, staff selection and experience, leadership and management styles, funding availability, and cultural identity all shape projects throughout their working phases. Professional status, disciplinary culture, publication bias, and funding availability or obligations all influence projects in their monitoring phrases. So why have these areas been understudied?
1.1.3 Understanding Wildlife Reintroduction Outcome as Organizational Performance

Past reviews of reintroduction outcomes have focused almost exclusively on identifying broad, biological prerequisites for success (Morris 1986; Kleiman 1989, Wolf et al. 1996; Sarrazin & Barbault 1996; Wolf et al. 1998; Fischer & Lindemayer 2000; Stanley-Price & Soorae 2003), limiting focus on the potential influence of human and organizational (i.e. human dimensions) factors (O’Rourke 2014). Some attention has been paid to the issue of bias in species selection for reintroduction (Seddon 2013; Bajomi et al. 2010; Seddon et al. 2005), but these studies are few and recent, and comprise only a small portion of the overall literature.

Leadership and day-to-day management, for example, form the foundation of any reintroduction program. Yet they are discussed sparingly in the general discourse, and very few places discuss them in the early literature: only Morris (1986) and Kleiman (1989) acknowledge the necessity of engaging with the public and obtaining the governmental support. Reading & Miller’s (1994) chapter expressed some interest in organization and management: “Endangered species recovery programs could be greatly improved by addressing their professional and organizational weakness.” (p. 73), and a brief (but skeptical) acknowledgment exists in Wolf et al.’s (1996) paper: “Although management techniques are not applied uniformly among translocation programs…little relevant data exist to indicate whether this was an important issue.” (p. 1150). Other contemporary researchers continued to downplay the potential impacts of
these non-biological factors, arguing instead that demography, genetics, and ecology were the truly decisive influences on success (Sarrazin & Barbault 1996).

Reading et al. returned to the topic in 1997, but the researchers used a mailed questionnaire approach that provided data too coarse to link specific aspects of leadership and management (in their terms: ‘valuational and organizational considerations’) to program outcomes. Miller touched momentarily on the issue again in 1999: “A well-trained and dedicated staff with the appropriate expertise is crucial to program success… For that reason, careful attention to the organizational structure of the decision-making body is crucial to maintaining an efficient and effective program,” (p.65) but subsequent studies did not further pursue this suggestion. And although Beck made overtures toward this in his introduction to a special issue of the Association of Zoo & Aquarium’s Communiqué in 2001, saying “…reintroduction is as much a sociological, political and economic undertaking as it is biological,” attention to the topic remained limited thereafter.

In the last year, three publications have significantly advanced the dialogue on leadership and management as pertains to reintroductions:

Post & Pandav’s (2013) review of tiger reserves (where several reintroductions have taken place) in India highlighted the criticality of leadership, finding that “the presence of ‘conservation champions can dramatically affect the performance of individual reserves.’” (‘Champions’ were first defined by Andersson & Bateman in 2000 as ‘Individuals who…possess environmental knowledge and skills [that] are key factors
in the mobilization of support.

O’Rourke’s (2013) case study of the reintroduction of the white-tailed sea eagle to Ireland encouraged several management shifts for future projects (greater engagement in stakeholder dialogue, increased emphasis on the human dimensions of reintroductions, and adoption of a holistic, interdisciplinary approach to future projects) and concludes, “The reintroduction of a species into its former range is only partly about biology – socio-economics, politics and social acceptability [are] equally important.” (p. 135)

And last, but hardly least: the International Union for Conservation of Nature (IUCN) has released an updated (2013) version of its Reintroduction Guidelines. The guidelines revisit many of the general recommendations from the original document, but expound further on some related to our topic, most particularly in Sections 4.1 (“Goals, objectives, and actions”); 5.2 (“Social feasibility”); 8.1 (“Social, cultural and economic monitoring”); and in Annexes 2.5, 3.1.14, and 6.3.5 (Definitions, Deciding When, and Risk Analysis).

Each of these provides valuable support for increased emphasis on understanding the impact of human dimensions on reintroduction outcomes, but none delve deeply into the internal organizational factors that might support or detract from potential success.

My study augments the findings of previous researchers with an in-depth exploration of the impact of both human dimensions and organizational factors on the

1.1.4 A Brief History of Sea Eagles

The white-tailed sea eagle (*Haaliaeetus albicilla*), in the family *Accipitridae*, is the largest bird of prey in the United Kingdom (Figure 1). It possesses a wingspan over 2 m, and an average male/female weight of 4.5/6 kg, with females significantly larger than males (Love 1983; Royal Society for the Protection of Birds 2006). Adults of the species are brown with pale heads and white, wedge-shaped tails, yellow beaks, yellow unfeathered legs, and golden eyes (Love 1983; RSPB 2006). The white-tailed sea eagle’s (hereafter, “sea eagle”) range extends over most of northern Europe and Asia, with roaming birds observed as far south as the Mediterranean (RSPB 2006). The eagles further have a long history in Scotland, with referent placenames dated as early as 500 CE (Evans et al. 2012) and representations appearing in Pictish carvings predating the Stone Age (Love 1983). The diet of the eagle consists primarily of fish and small mammals, with occasional predation of small birds and scavenging of carrion.
1.1.4.1 Extinction

White-tailed sea eagles (*Haaliaeetus albicilla*) were large, bold birds that quickly habituated to humans, dined on managed grouse, and predated lambs; they were therefore intolerable pests to British gamekeepers and crofters of the 19th century (Love 1979; Love 1983; Lister-Kaye 1994; RSPB 2005; SNH 2010). Further, sea eagle specimens became a favorite of Victorian egg collectors, and traders regularly raided the birds’ nests (Love 1983). The sea eagle thereby began to decline in the 19th century, and was extinct in Britain by the early 20th. The last wild pair were on the Isle of Skye in 1916, and
the last wild individual was shot in Shetland in 1918 (Baxter & Rintoul 1953; Love 1983; Mudge et al. 1996; Bainbridge et al. 2002).

When the sea eagle reintroduction began in 1975, the project faced major challenges that put it at high risk for a lack of success:

1.1.4.2 Ongoing Land Use Conflict

Significant changes had taken place in the British economy, wildlife laws, and gamekeeping practices since sea eagles were extirpated in 1918, suggesting that the original threats to the birds had likely diminished so far as to be negligible by the mid-1970s. However, contemporaneous studies of the golden eagle (Aquila chrysaetos) revealed ongoing challenges with persecution, habitat loss, and disturbance (e.g. Newton 1972).

1.1.4.3 Experimental Failure

Two pilot reintroduction attempts were made in 1959 and 1968 (Sandeman 1965; Dennis 1969; Green et al. 1996), but by 1975, when the official reintroduction began, not a single bird had reestablished in Scotland.

1.1.4.4 Limited Biological Knowledge

In 1975, no body of knowledge about the process of reintroduction existed upon which project members might have based their work. Although the eagle was plentiful in Norway, scientists knew little about its ecology in Scotland (Love 1979). Bird reintroductions are, as a whole, less successful than mammalian projects (Wolf et al. 1996), and carnivores less than omnivores (Wolf et al. 1998). Raptor reintroductions are
thus doubly cursed, and although overrepresented as a percentage of bird reintroductions (Seddon et al. 2005), are more likely to fail.

1.1.4.5 Lack of Government Support

The Wildlife & Countryside Act of 1981 established clear guidelines for the importation and release of native species into the United Kingdom, but prior limitations set by the Animals (Restriction of Importation) Act of 1964 had already established a precedent of strictly avoiding the importation of any animal to the country. Morris (1986) notes that even after the 1981 Act granted greater license, a strong fear of unintentionally harmful introductions persisted. And since such a large-scale bird project had no precedent at that time in Britain, support for such a risky – if pioneering – project was limited, hard-won and tentative. (Tingay & Katzner 2012).

1.1.4.6 Conclusion & Success.

From 1975 – 2012, the Sea Eagle Recovery Project released 167 juvenile birds, resulting in 350+ adult animals and 65+ breeding pairs across Scotland (Smith 2007; Patterson 2010; Scottish Natural Heritage 2014). Releases between 1975 and 1998 resulted in 42 territorial pairs (Evans et al. 2009; Hipfner et al. 2012), rising to 44 territorial pairs by 2008/9 (Sea Eagle Project Team 2008; Grant et al. 2011) and 79+ territorial pairs by 2013 (Scottish Natural Heritage 2014). By the Project’s conclusion, the popular media (PBS 2010; BBC 2013), conservation literature (Whitfield et al. 2009, van Wieren 2012), and government leaders (SNH 2014; National Farmers Union of Scotland 2014) all agreed that the project had been a success.
In the study presented here, I explore some of the ways in which human and organizational factors (specifically: leadership and management) of the recovery project may have contributed to this successful outcome.

1.2 Methods

I drew on data from multiple sources – interviews, observations, archival records, publicity documents, scientific publications, internal reports, and multimedia materials – as well as two traditions of inquiry: the case study and grounded theory methods. This approach relied on interviews with human subjects, and was approved by the Texas A&M University Institutional Review Board under IRB Protocol #20080131.

1.2.1 Selection of Focal Project

I chose the Sea Eagle Recovery Project because of its length (>40 years), status at the time of research (ongoing), success, and relative celebrity within the country (SNH 1995; RSPB 2006; BBC 2008; Evans et al. 2009). Of further benefit was the fact that the reintroduction took place in four discrete phases: a pilot study in Fair Isle, the first phase in the Inner Hebrides, the second in Western Scotland, and the third in Eastern Scotland. These discrete phases allowed me to compare shifts in leadership and management across the length of the project, providing a natural experiment that gave insight into how different approaches might have influenced outcomes.

1.2.2 Data Collection

I conducted face-to-face, in-depth, semi-structured confidential interviews with verbally consenting, voluntary participants who had been full-time project employees
for at least three months during any phase of the reintroduction program. I asked about individual interviewee’s experience with sea eagles during, before, and after the reintroduction, as well as the organizational structure of the project during the individual’s time of employment, and the overall experience of working with the project (for a full list of guiding questions, see Appendix 1). I also asked interviewees to recommend other potential interviewees (the “snowball method”; Goodman 1961).

In interviews, I made use of a modified logic model framework, based in the Gugiu & Rodriguez-Campos semi-structured interview protocol (2007), to guide the interview process. This method consisted of a series of introductory questions which ask basic information about the interviewee, followed by a series of open-ended questions intended to encourage the speaker to speak freely about their experiences. I set no time limit for the interviews. This approach allowed me to collect detailed accounts of the program and work in-depth with my interviewees to gain an understanding of organizational culture (Lincoln & Guba 1985; Erlandson 1993).

I conducted interviews with 13 interviewees in various locations (convenient to the interviewee) across Scotland, but eliminated two candidates post hoc. This is because one interviewee turned out to have worked for less than three months on the reintroduction (and therefore did not meet the criteria for inclusion), and because one interviewee’s recordings were entirely lost due to technical failure.

I therefore conducted 17 total interviews, but after two eliminations, only 15 of these were ultimately used. I also conducted follow-up interviews via Skype with four
of the six most experienced interviewees (those who had worked through at least two phases of the reintroduction); two were excluded because of schedule unavailability.

In addition to interviews, I gathered documents including but not limited to public outreach papers and pamphlets, children’s education books, curricular materials, internal and external newsletters, newspaper and internet articles, blog posts, books, informational and recruitment brochures, DVDs, recorded TV programs, community flyers, and other informational packets either presented by or related to the project. I collected these items from archival collections at the Royal Society for the Protection of Birds (RSPB) Scotland headquarters, the Scottish Natural Heritage (SNH) offices, a variety of wildlife centers located around the country, and from private collections.

1.2.3 Data Analysis

1.2.3.1 Manual Typology

Extracting useful information from qualitative data first necessitates organizing the collected data into discrete groups or categories (Caracelli & Greene 1993; Stake 1995; Creswell 2007). I began by grouping my interviews, documents, and notes into broad, meaningful types (e.g. children’s books; brochures; journal articles; scientist interviews; non-academic texts). I then read and analyzed each document, identifying and highlighting (“tagging”) recurrent concepts to create a preliminary data chart (“typology”) (Caracelli & Greene 1993; Creswell 2007). As I read, I tagged discrete and overlapping passages, words, or phrases that described a particular thought, idea, or concept. This process matches the overall approach that both Stake (1995) and Creswell
(2007) suggest for conducting either grounded theory or traditional case study research. My tagged and highlighted passages resulted in an initial list of over 57 discrete ideas, concepts, and experiences; I then grouped these discrete experiences into a shorter list of eight categories (see: Experience Type Codes, Table 1). I then tagged discrete, descriptive characteristics within each Type (e.g. ‘It was really quite helpful having our supervisor around a lot.’ would have been categorized as Contact with Supervisor/Frequent/Positive; see Experience Characteristic Codes, Table 1).

Once I completed this process for all of my collected documents, interviews, multimedia, and texts, I created a final data chart encompassing all the concepts, their characteristics, and the strength of their recurrence across multiple data sources. The typology I extracted from that final data chart is presented in Table 1.
Table 1. Typology of management themes and characteristics emergent from the Sea Eagle Recovery Project

<table>
<thead>
<tr>
<th>Experience Type (ET) Codes</th>
<th>Descriptive Experience Characteristic (EC) Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact with Supervisor (CS-)</td>
<td>Frequent (F)</td>
</tr>
<tr>
<td></td>
<td>Positive (+)</td>
</tr>
<tr>
<td>Position/Job Duties (JD-)</td>
<td>Autonomous (A)</td>
</tr>
<tr>
<td></td>
<td>Primary (P)</td>
</tr>
<tr>
<td></td>
<td>Fieldwork (Fw)</td>
</tr>
<tr>
<td></td>
<td>Administrative work (Aw)</td>
</tr>
<tr>
<td></td>
<td>Public Relations work (PRw)</td>
</tr>
<tr>
<td></td>
<td>Supervision of Others (So)</td>
</tr>
<tr>
<td>Relationship with Coworkers (RC-)</td>
<td>Shared Responsibilities (SR)</td>
</tr>
<tr>
<td></td>
<td>Egalitarian (E)</td>
</tr>
<tr>
<td>Goal-Setting and Evaluation Process (GSE-)</td>
<td>Proximate (P)</td>
</tr>
<tr>
<td></td>
<td>Formal (L)</td>
</tr>
<tr>
<td></td>
<td>Beneficial (+)</td>
</tr>
<tr>
<td></td>
<td>Frequent (F)</td>
</tr>
<tr>
<td>Contact with Public (CP-)</td>
<td>Positive (+)</td>
</tr>
<tr>
<td></td>
<td>Frequent (F)</td>
</tr>
<tr>
<td>Public/Media Relations (PR-)</td>
<td>Internally Generated (Y)</td>
</tr>
<tr>
<td></td>
<td>Positive (+)</td>
</tr>
<tr>
<td></td>
<td>Frequent (F)</td>
</tr>
<tr>
<td>Program Progress (PP-)</td>
<td>Good (G)</td>
</tr>
<tr>
<td>Program Performance (PO-)</td>
<td>Good (G)</td>
</tr>
</tbody>
</table>
1.2.3.2 Digital Typology

After the construction of a manual typology, I imported all interviews and digital documents into NVivo 10, a qualitative analysis software program, and then used the manual typology as a guideline for inductive digital analysis. This approach afforded me the opportunity to code more precisely and to explore the data with greater nuance, including queries and cross-tabulations of thematic overlap (Auld 2007; NVivo 2013).

1.3 Results

Interviews averaged 45 minutes, and all took place at times and locations of the interviewee’s choice.

1.3.1 Interviewee Demographics

Interviewees had worked an average of 18.3 years on the Sea Eagle Recovery Project, and had lived in Scotland an average of 30.8 years (more than half of interviewees were lifelong residents of Scotland). Six interviewees had worked through more than one phase of the reintroduction; four had served during the earliest phases of the project (1968 – 1990) and ten had served during the latter phases of the project (1990 onward). Nine of eleven interviewees were men (Table 2).

Most were currently employed by the Royal Society for the Protection of Birds (n=4) or Scottish Natural Heritage (n=3); one interviewee was employed by Forestry Commission Scotland; and the remainder (n=3) were self-employed. During their work on the reintroduction, six of the 11 interviewees had been employed by the Royal Society for the Protection of Birds, the majority remainder (n=4) had been employed by
Scottish Natural Heritage. One interviewee had been employed by multiple organizations, beginning with the Nature Conservancy Council.

Table 2. Demographics of Sea Eagle Recovery Project interviewees

<table>
<thead>
<tr>
<th>Gender</th>
<th>Employer During Sea Eagle Recovery Project</th>
<th>Length of Time Living in Scotland</th>
<th>Years Working with Sea Eagle Recovery Project</th>
<th>Phases*</th>
<th>Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>RSPB</td>
<td>40 years</td>
<td>41</td>
<td>All</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>SNH</td>
<td>20 years</td>
<td>19</td>
<td>2+3</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>SNH</td>
<td>Whole life</td>
<td>19</td>
<td>2+3</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>RSPB</td>
<td>20 years</td>
<td>8</td>
<td>1+2</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>RSPB</td>
<td>Whole life</td>
<td>1</td>
<td>2+3</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>SNH</td>
<td>Whole life</td>
<td>10</td>
<td>2+3</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Several</td>
<td>Whole life</td>
<td>41</td>
<td>All</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>RSPB</td>
<td>Whole life</td>
<td>15</td>
<td>2+3</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>SNH</td>
<td>5 years</td>
<td>25</td>
<td>2+3</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>RSPB</td>
<td>20 years</td>
<td>25</td>
<td>1, 2, 3</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>RSPB</td>
<td>4 years</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

*Phases refer to the following:
1959 – Pilot Phase (Fair Isle)
1975–1985 – Phase 1: the Hebrides (Isle of Rum)
1993–1998 – Phase 2: Western Scotland (Wester Ross)
2007–2012 – Phase 3: Eastern Scotland (Fife)
1.3.2 Interview Summary

Interviewees referenced a number of recurrent human and organizational issues that may have been influential to project outcomes, comprising four overall experience themes, which are highlighted below:

**Theme 1: Leadership/Management, Hierarchy & Autonomy**

**Theme 2: Goals, Targets & Evaluation**

**Theme 3: Public Relations/Community Outreach**

1.3.2.1 Theme 1: Leadership & Management, Hierarchy & Autonomy

More than half of interviewees’ total reports on the nature of their experience described contact with supervisors as infrequent (n=4, 57%) but positive (n=4, 57%). These reports were made concurrent with verbal and nonverbal expressions of neutrality. More than half of interviewees described their work as autonomous (n=6; 54.5% of respondents) and all interviewees could clearly identify their own supervisors and key project advisors, as well as accurately detail the chain of command above and below them (n=11; 100% of respondents). Most interviewees’ reports described the structure of their program as hierarchical (n=45, 51.72%). Most reports on the nature of work within the reintroduction also described specialized assignments and clear task division between employees (n=43, 65%). Early phase participants reported slightly less hierarchy and greater autonomy than later-phase participants, but the difference was marginal, and overall descriptions were consistent throughout reintroduction phases (Figure 2).
Figure 2. Consistency in describing the nature of work in the Sea Eagle Recovery Project across phases

1.3.2.2 Theme 2: Goals, Targets & Evaluation

Interviewee reports on the nature of goal-setting differed by phase, with Pilot Phase (1968) reports tending to describe the goal-setting process as infrequent (n=3, 100% of reports) and \textit{ad hoc} (n=4, 100% of reports) while Official Phases (1975 – 2012) reports tended to describe the process consistently as infrequent (n=6, 100% of reports) but formal and bureaucratic (n=30, 94% of reports).

The frequency with which interviewees discussed the impact of long-term goal setting increased with the project’s progression, with the organizational influence of goal-setting arising four times more frequently with reference to the last phase of the project than the first (Pilot Phase frequency – 1; Phase 1 frequency – 1.75; Phase 2 frequency – 3.28; Phase 3 frequency – 4).

Evaluation likewise was discussed more frequently as influential to success in the latter phases of the project (Pilot Phase – 1.75; Phase 1 – 2.75; Phase 2 – 3.29; Phase 3 – 3.71). Descriptive reports of the nature of evaluation were consistent across phases:
evaluation within the project was generally formal (n=27, 77% of reports), took place on an ongoing or *ad hoc* basis (n=20, 67% of reports), and was handled internally (i.e. did not involve an external agency or auditor; n=10, 100% of reports) (Figure 3).

![Figure 3. Demonstrating consistency in the nature of evaluation throughout the Sea Eagle Recovery Project](image)

1.3.2.3 Theme 3: Public Relations & Community Outreach

Conflict and Persecution was by far the most frequently reported Public Relations issue (n=102 reports), nearly doubling in frequency-of-mention between the first and last phases of the project (Phase 1 frequency: 3.25; Phase 4 frequency – 5.28) across all four phases of the project. Tourism was a distant second in frequency of discussion (n=12 reports). Concurrent with interviewees’ reports of conflict and persecution were verbal and nonverbal expressions of feelings of frustration, sadness, anger, and/or resignation/fatigue (Figure 4).
1.4 Discussion

Four critical factors in the human and organizational foundation of the Sea Eagle Recovery Project contributed to its success, helping it to overcome the challenges of limited biological knowledge, poor early support, and failures in its experimental pilot. These four critical success factors are common to all reintroduction projects, and the manner in which the Sea Eagle Recovery Project executed them could serve as an example for wildlife reintroductions worldwide:

1.4.1 Leadership & Management

A small, dedicated team of experts who served as strong scientific leaders in addition to political advocates provided a huge boon to the project (as first suggested in Clark & Westrum 1989). Roy Dennis and John Love invested huge amounts of time and personal capital in the first two decades of the Sea Eagle Recovery Project; their activities included everything from personally releasing the birds to giving testimony to local and
national governance in support of more supportive wildlife laws.

Roy Dennis had already been working in the highlands of Scotland for nearly a decade and was the director of the Fair Isle Bird Observatory when he began work on this project. By chance, his 1968 trial release of four birds coincided with a visit to the bird observatory by John Love, a zoology undergraduate from the University of Aberdeen (Love 1983; Love, 2006; Tingay & Katzner, 2012). By the time the project officially began in 1975, Dennis and Love had been working on re-establishing the bird for more than sixteen years. Love & Dennis became the senior leaders of the program, and while they recruited other scientists and experts to work with them, they maintained executive control over the project. This lent the project a sense of continuity and set a structure that (in combination with ongoing evaluation) buttressed the reintroduction against internal negligence. Without long-term, consistent leadership of this nature, it is unlikely that the reintroduction would have overcome its initial challenges.

This ‘champion’-style leadership (Andersson & Bateman 2000; Post & Pandav 2012) is the most consistent and perhaps most important advantage that the Project enjoyed, and was evident through all four phases of the reintroduction. This style of leadership fits into a larger categorization of ethical and transformational leadership – a style known to support positive organizational outcomes and guide employee attitudes with minimal interference in day-to-day employee operations (Toor & Ofori 2009). This minimal interference is reflected in the infrequency/positivity of interviewees’ reports.
1.4.2 Hierarchy & Autonomy

Positive contact with leadership and operation within a hierarchical framework (i.e. clear chains of command; assigned roles differentially by rank, etc.) improved employee morale and productivity by raising individual accountability and allowing a high degree of autonomy in completing those tasks. This management approach was well suited to both the specific needs of reintroduction projects (i.e. quick, decisive, responsive action in the field) and the desires of its participants (i.e. freedom to self-direct throughout the day), leading to marked efficiency.

The business literature suggests that autonomy confers significant benefits to performance in the presence of high-variety tasks, or when task interdependence within a group is high (Dodd & Ganster 1996; Langfred 2000). This has direct relevance for conservation programs, in which employees work as part of a team, must perform varied tasks competently, and must respond quickly and independently to changing conditions (Soulé 1985; Clark & Westrum 1989). Retaining high autonomy — even within a strict hierarchical structure — thus likely confers useful benefit to conservation practitioners.

Sea Eagle Recovery Project employees had a unique flexibility to take independent action when necessary, but also to ‘fall in’ to a known and clearly-defined hierarchy when expert assistance (provided by strong, dedicated leader-experts) was needed; this was yet another benefit conferred on the Project by its organizational culture which may have contributed to its success.
1.4.3 Goal-Setting & Evaluation

Scrutiny surrounding the advent of the Sea Eagle Recovery Project meant that Dennis, Love, and other project managers were under pressure to demonstrate clear, measurable success. This came initially in the form of annual reports on bird release numbers, rate of establishment, cost per bird, etc. These early reports were the precursors to the more formalized reporting system established by the Joint Nature Conservancy Council in the later Western phase.

Ongoing, critical internal evaluation (for an early advocacy of this method, see: Kleiman et al. 1999) strengthened the validity of the project’s practices and improved support among supporting entities (e.g. the Joint Nature Conservancy Council, Scottish Natural Heritage). The amount of accountability in an organization may reflect in its performance rating and evaluation process. Theoretically, the implementation of performance ratings increases accountability by holding participants responsible for actions taken and results produced. In reality, this may not always be the case, as performance ratings and evaluations may be inefficient, inappropriate, or counterproductive to improving performance (Halachmi 2002; De Lancer Julnes 2006; Tilbury 2006).

Indeed, certain interviewees reported increasing concerns about the potentially negative impact of goal-setting and evaluation (“But I worry nowadays that they’re becoming too structured; that there’s just too many goals, that…some of it has become unnecessarily bureaucratic.” - Interviewee #13, 2009); this warranted further inquiry. An
analysis of coding similarity using Jaccard’s coefficient confirmed that these interviewees were outliers; they had participated in the Pilot Phase of the project, a time during which formal evaluation of any kind was close to none, perhaps making them more aware of later changes in guidelines and evaluation of the project.

Overall, the clear goalposts and regular (if infrequent) evaluation of progress conferred yet another benefit on the Sea Eagle Recovery Project. This is in part because the establishment and evaluation of goals requires good organizational governance (e.g. clear structure and diligent leadership) as a pre-existing condition for efficacy; in this way, these three elements are woven into a framework to build success, and the sea eagle reintroduction was fortunate to possess them.

1.4.4 Public Relations & Conflict

It can be difficult to parse the contribution of public relations to the ultimate performance of an organization or project. This is because the intangible benefits of improved relationships, improved legitimacy, or improved public opinion can be difficult or cumbersome to measure (Bennett & Gabriel 2001; Likely 2003; Phillips 2006). Wildlife reintroduction programs are uniquely interrelated with issues of public sentiment (Clark & Westrum 1989; Kleiman 1989; Seddon et al. 2007). Thus, the likely relationship between public relations and program performance has definite salience to this field.

Indeed, incidents of persecution and conflict, particularly with local crofters and fishermen marred the earliest phases of the sea eagle reintroduction. Unexpectedly, the
project had to contend with this onslaught of human-wildlife conflict. By the end of 2004, 25% of eagle mortality was attributable to persecution (JNCC 1988; Love 2006). The trauma of these events weighed heavily on the project and its participants, making it the most-often cited public relations issue across all interviews, with 85 references made by 10 of the 11 interviewees (“Persecution is a major problem that some hard-line people will never give up – poisoning, especially -- and that’s when sea eagles become vulnerable. But hopefully…the new generation will be better educated.” - Interviewee #7, 2009).

This early experience laid the painful paving stones for later shifts in the public relations strategy, however, and these shifts may have benefited the reintroduction — and the eagles — overall. The adaptive public approach that Project leaders eventually adopted reflected a growing understanding of the value of cultural sensitivity, inclusivity, transparency, and local “ownership” of conservation initiatives (for an example of unsuccessful implementation of this strategy in Ireland, see: O’Rourke 2014). Shifting the discourse with the public toward scientific openness, direct address of complications and problems, improved linguistic parity, and linking the reintroduction to the public’s regional identity were likely key to engendering better support and eventually allowing the Project to succeed:

“We had two clutches of eggs stolen in one year and some local residents said, ‘Why didn’t you ask us to help watch the nest?’ So, we did. And it worked quite well. People have to, you know, get really involved and to feel that they are making a contribution. And it gave a sense of some importance in the community. Had we not done that, and sort of persisted in doing things the way
we were, we’d be running the risk of saying, ‘Well, actually, these aren’t your birds at all. They are our birds. ‘Keep away from them.’ And that’s really the wrong attitude to take.” - Interviewee #11, 2009

This adaptive public relations strategy, begun as a reaction to conflict, became a meaningful and significant element of the Project’s organizational culture, and yet another contributing factor in the reintroduction’s success (for further discourse analysis, see: Arts et al. 2012).

1.5 Management Recommendations

Although these findings are limited by their exploratory (and therefore preliminary) nature, I draw on them to suggest four recommendations about best practices for organizational management in wildlife reintroduction projects:

1. **Leadership & Management**: Reintroductions benefit from dedicated, consistent, long-term ‘champion-style’ leadership.

2. **Autonomy & Hierarchy**: Reintroductions benefit from a clear hierarchical framework that serves as support for high employee autonomy in the field.

3. **Goal-Setting & Evaluation**: Reintroductions benefit from consistent, regular evaluation of progress toward formally established goals.

4. **Public Relations & Outreach**: Reintroductions benefit from adaptive public relations strategies that are open, transparent, inclusive (esp. linguistically), and culturally relevant.
1.6 Conclusion

The potential value of examining the conservation initiative (in this case, the reintroduction program) as an organization has been deeply neglected in the conservation literature. Despite its exploratory nature, the findings of this study suggest a specific and potentially fruitful direction which future research could take. Following studies could examine, broadly and comparatively, the differential outcomes of conservation initiatives with differing leadership and management styles. Such a comparative study would be a useful contribution to the growing wealth of literature related to conservation leadership and management.
Chapter 2. Optimizing Contracts in Donor-Funded Biodiversity Conservation Initiatives

The structure of contracts between donors and conservation non-governmental organizations (NGOs) has a critical influence on the usefulness of funds given in support of donor-funded biodiversity conservation initiatives (conservation initiatives). The nature of the relationship between donors and NGOs is analogous to partner firms embarking on joint ventures, with the motivations of each partner strongly oriented toward reducing risk through contractual safeguards. However, excessively complex contractual structures can prove counterproductive, creating onerous processes that produce negative impacts on conservation outcomes. In this paper, we propose a framework for optimizing funding mechanisms (viewed as one type of contractual safeguard) by examining three factors in their design, and the associated outputs/impacts of each:

(1) ownership: the completeness with which legal possession is transferred from donors to NGOs, which may impact an NGO’s certainty of access to funds.

(2) oversight: the ability of donors to control or restrict the use of funds – even after transfer to a conservation NGO – which may impact an NGO’s autonomy in setting conservation goals & priorities.

(3) time horizon: the period over which the transfer is executed, which may impact an NGO’s freedom to spend funds.

We then test the predicted outcomes of our framework against seven case studies
of U.S.-based conservation initiatives, looking specifically at the self-reported impacts on our three proxy measures of outcome: (i) prioritization; (ii) spending, and (iii) funding security.

**KEYWORDS** conservation funding, environmental philanthropy, contract mechanisms

### 2.1 Introduction

The US$300 billion gap in funding to support global biodiversity conservation (hereafter “conservation”) is a major challenge to achieving critical conservation goals, and has already contributed to our failure to meet the 2010 United Nations Convention on Biological Diversity (CBD) targets (Bos, Pressey, & Stoeckl, 2015; F Huwyler, Käppeli, Serafimova, Swanson, & Tobin, 2014; Waldron et al., 2013; Kerrie A. Wilson et al., 2007). Globally, the total funds flowing to conservation are estimated at US$52 billion per year (F. Huwyler, Kaeppeli, Serafimova, Swanson, & Tobin, 2014), far short of the nearly US$400 billion needed to meet the CBD’s 2020 targets (F Huwyler et al., 2014; Waldron et al., 2013).

While this gap persists, the total number of conservation organizations in the United States has continued to grow at approximately 4.6% annually since 1980, exceeding 26,000 distinct entities in 2005, and anticipated to surpass 44,000 by 2017 (Straughan, 2008). Over the same period, annual philanthropic giving in the United States has grown at an average rate of only 3.1% annually (Bivin, Osili, McKitrick,
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Bergdoll, & Claire, 2017). This difference in growth rates means that conservation non-governmental organizations (hereafter, “NGOs”), which are already uniquely vulnerable to financial fluctuations (Larson, Boyer, & Armsworth, 2014), are operating in an increasingly competitive funding landscape.

In response, many NGOs have shifted toward a greater emphasis on efficiency and outcomes, relying on traditional capitalist strategies to optimize their use of available funds (Bishop & Green, 2010; Holmes, 2012; Jenkins, 2010).

This emphasis on efficiency & optimization in NGOs has been central to the nascent field of conservation finance (Clark, 2012), manifesting in an extensive discourse surrounding two primary questions:

1. **What is the optimal allocation of conservation funds?**

   Broadly, this is the debate of whether money spent on conservation is spent on the ‘right’ conservation (Brooks et al., 2006; Carwardine et al., 2008; Delfin & Tang, 2007; Halpern et al., 2006; Holmes, 2012; Kiss, 2004; Larson, Howell, Kareiva, & Armsworth, 2016; Marsh et al., 2007; Waldron et al., 2013; Kerrie A Wilson, McBride, Bode, & Possingham, 2006; Kerrie A. Wilson et al., 2007; Wu & Boggess, 1999)

2. **What are the most cost-effective expenditures of conservation funds?**

   This is the body of literature on cost-effectiveness in conservation (Paul R. Armsworth, Acs, et al., 2012; Paul R Armsworth, Cantú-Salazar, Parnell, Davies, & Stoneman, 2011; Paul R. Armsworth & Sanchirico, 2008; Carwardine et al., 2008; Ferraro & Simpson, 2006; Kessler et al., 2011; Laycock, Moran, Smart, Raffaelli, &
White, 2011; Moran, Laycock, & White, 2010; Naidoo et al., 2006), supported by the evidence-based conservation movement codified at www.conservationevidence.com (Pullin & Knight, 2001; Pullin & Stewart, 2006; Sutherland, Pullin, Dolman, & Knight, 2004).

In the scope of these questions, the discourse on efficiency & optimization in conservation has centered on the four stages of the funding pipeline (Fig. 1), with little attention paid to the frameworks and mechanisms which underpin and connect these various stages. This limited scope of prior research means that studies of contract optimization in conservation must necessarily rely on current research in other disciplines. In this paper, we have chosen to draw on analogous studies in the business literature.
Figure 5. The conservation funding pipeline
2.1.1 Positioning this Research in the Business, Rather Than Philanthropic or Non-Profit Literature

Research into the behavior and economics of non-profit organizations is extensive and wide-ranging [as in the comprehensive overviews provided by (Powell & Steinberg, 2006; Renz, 2016)], but most research into non-profit contracting has sought to explore the nature of arrangements between non-profit organizations and government agencies. This work has looked extensively into the nature and structure of public service contracts, providing valuable insight into both the opportunities and challenges presented by these collaborations (Saidel, 2017; Van Slyke, 2006). However, this field has also relied on a restrictive definition of contracts as payment-for-services exchanges [as in (Ferris & Graddy, 1986; Milward, 1994; Pettijohn, Boris, De Vita, & Fyffe, 2013)], excluding other contract types such as those present in the philanthropic transactions with which we are primarily concerned.

An alternative sector for positioning this paper is environmental philanthropy, which studies “the giving of time and money in support of environmental issues through environmental nongovernmental organizations” (Greenspan, Handy, & Katz-Gerro, 2012). Like all philanthropic research, this subfield focuses heavily on the recruitment stage of the funding pipeline (Fig. 1), asking questions about the economics and psychology of donor motivations, behaviors, and decision-making (Delfin & Tang, 2007; Kolm & Ythier, 2006); or reporting observable patterns in philanthropic giving and donor recruitment (Associates, 2013; Association, 2015). This work has provided a
wealth of information on the management and retention of environmental donors but has presented few opportunities to critically examine the processes which occur once funds reach the recipient – the primary goal of our study.

As our study is source-agnostic (i.e., the ‘donor’ role may be fulfilled by private individuals, grantmaking foundations, government entities, or private companies) and focused on how conservation dollars are managed rather than where they come from, we feel the body of literature more closely related is that of the finance and business sectors, where the NGO can be examined as a type of firm (Paul R. Armsworth, Fishburn, et al., 2012), rather than the non-profit/philanthropic sectors. We, therefore, refer to studies of joint ventures in business, where contract optimization is well-examined in the published literature.

2.1.2 Donor-funded Conservation Initiatives as a Form of Joint Venture

Joint ventures are “vehicles used to conduct...activities both within the United States and internationally” (Unkovic, 1984), and can be defined by five characteristics: (i) they are established by express or implied contracts; (ii) they are formed for a specific and definable purpose, and a limited duration; (iii) each participant contributes assets for a shared purpose; (iv) participants share a common set of expectations and goals; and (v) participants share in profits, losses, and control/management of the venture (Gutterman, 2002).
A donor-funded biodiversity conservation initiatives (hereafter “conservation initiative”) is a project, program, or campaign created to advance a single conservation goal. Conservation initiatives are specific efforts (criteria 2), jointly planned/contracted (criteria 1) and embarked upon by two partners with a shared set of goals: non-governmental conservation organizations and donor entities (criteria 4). In meeting these criteria, the conservation initiative matches most of the definition of a joint venture, but two criteria require further discussion.

2.1.3 Asymmetric Asset Contribution (Criteria 3) & Profit/Loss Sharing (Criteria 5) in Donor-Funded Conservation Initiatives

The contribution of assets for a shared purpose (criteria 3) manifests differently in a conservation initiative than in a typical joint venture; this is because most conservation initiatives have an asymmetric asset contribution pattern that is less common among joint ventures. In many donor-NGO relationships, the donor gives funds, and the organization provides expertise, management, or other forms of capacity. This funding arrangement generally places the NGO at a disadvantage, as there are fewer donors – particularly for large, costly projects – than capable conservation organizations. This means that assets contributed by the donor are more valuable than those contributed by the NGO, and leads to asymmetry in the asset contribution pattern.

However, this is not entirely unprecedented in the joint venture literature, and the implications of asymmetry in joint ventures are at least partially explored in studies of equity ownership and knowledge dependency. For our work, the relationship
between partners possessing different amounts of equity (the majority and minority partners) is analogous to the asymmetric contribution pattern in the donor-NGO relationship. Research into equity in joint ventures has found that although equity ownership can be used to exercise broad control over the venture, it can also jeopardize outcomes if control is exerted too heavily over the minority partner (Chalos & O’Connor, 2004). Further, research into knowledge specificity demonstrated that when one partner in a joint venture possess significantly greater expertise (usually, but not necessarily, of the local geographic context in which a venture takes place), the non-expert partner is disadvantaged, and the expert partner gains bargaining power (Inkpen & Beamish, 1997).

This means that equity asymmetry could be at least partially offset by knowledge asymmetry – and in conservation initiatives, the NGO is most often the expert partner. Potentially, therefore, economic power lost to asymmetry in the asset contribution pattern could be recouped elsewhere in the donor-NGO relationship, making the overall asset contributions of the two partners roughly equal – again equivalent to an interfirm relationship.

Sharing in profits and losses (criteria 5) is also manifested slightly differently in conservation initiatives than in typical joint ventures. The goals of conservation organizations are oriented toward producing a public good (the positive ecological outcome), and therefore desired outcomes extend beyond traditional metrics of profit and loss. However, because the inherent goal of biodiversity conservation efforts is to
preserve the global diversity of species, conservation initiatives may be evaluated by biological markers of increase/decrease in their target ecosystems. In this sense, an increase in the number of species protected or preserved is equivalent to a ‘profit,’ while a decrease is equivalent to a ‘loss.’

Clarifying and solidifying this equivalency means that we can now look to the joint venture literature to draw conclusions about how donors and NGOs might design funding contracts to produce the most desirable outcomes (i.e., maximize the likelihood of biological success) as the result of a conservation initiative.

2.1.4 Linking Contract Design to Outcomes in Joint Ventures & Conservation Initiatives

In the business literature, research into optimal contract design is extensive, but the relationship between contractual structures and performance has been poorly explained (Schepker, Oh, Martynov, & Poppo, 2014). The complexity of outcome measurement presents an ongoing challenge to making direct causal linkages, and empirical research has not yet resolved this gap in knowledge.

In conservation, direct linkages between contracts and performance are further complicated by endemic failures in the measurement of conservation impacts and results – including inconsistent language, contrasting stakeholder monitoring goals, weak indices, non-standardized assessment approaches, and varying definitions of success (Bottrill & Pressey, 2012; Ferraro & Pattanayak, 2006; Howe & Milner-Gulland, 2012; Stem, Margoluis, Salafsky, & Brown, 2005). Despite a growing movement toward
standardized, evidence-based frameworks for reporting conservation outcomes (Kapos et al., 2009; Pullin & Stewart, 2006; Salafsky, Margoluis, Redford, & Robinson, 2002; Sutherland et al., 2004), these problems persist.

In this paper, we avoid attempts at drawing direct linkage between contract design and performance, and instead link three singular elements of contract structure (ownership, oversight, and time horizon) to three self-reported variables of output (prioritization, expenditure, and funding security), which serve as proxy measures of actual conservation outcomes [as permitted in (Howe & Milner-Gulland, 2012)]. This provides the opportunity for future meta-analyses to link these common outputs to measurable outcomes, and thus to the findings of our framework.

2.1.5 Outcomes & Risk of Failure in Joint Ventures & Conservation Initiatives

In joint ventures, partner firms are generally concerned with two types of risk: (1) relational risk (i.e., failure to adhere to contracts), and (2) performance risk (i.e., failure to reach the desired goal) (Das & Teng, 2001). In response to these risks, partner firms may attempt to retain control through contractual safeguards which minimize perceived risk and maximize perceived likelihood of project success (Geringer & Hebert, 1989). The greater the perceived risks, the more complex the contractual safeguards may become (Anderson & Dekker, 2005; Ding, Dekker, & Groot, 2013; Luo, 2002; Luo & Tan, 2003) – despite little evidence that increased contractual safeguards positively impact performance (Lee & Cavusgil, 2006).
Although donors and NGOs both are concerned with performance risk, the asymmetric asset contribution structure of a conservation initiative means that NGOs must also be concerned with relational risk (i.e., meeting donor requirements). This dual set of risks may drive them to seek contractual structures which reduce the risk of funding-related performance failures (e.g., onerous bureaucracy or frustrating donor restrictions that impede effective work), while simultaneously reducing the risk of relational failure (i.e., termination of the donor relationship). By contrast, donors are largely concerned with performance risk, and are therefore oriented toward contractual safeguards that limit the NGO’s autonomy and reinforce donor control. The difference in these risk concerns creates inherent tension in the design of contractual structures, including transfer mechanisms. Efforts to resolve this tension may lead to non-optimal compromise structures that impede funding flow and obstruct positive conservation outcomes.

2.2 Theoretical Framework

In this framework, we envision funding mechanisms as a form of contractual safeguard, and suggest that the opposing desires of donors and organizations to reduce their perceived risks may lead to overly-complex mechanisms that have negative downstream impacts on actual conservation outcomes.
These funding mechanisms can therefore be categorized by three specific elements of their design, and the variables of output which describe potential downstream impacts of each:

<table>
<thead>
<tr>
<th>Ownership</th>
<th>Funding Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>the completeness with which legal possession is transferred from donors to NGOs</td>
<td>an NGO’s certainty of access to funds</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oversight</th>
<th>Prioritization</th>
</tr>
</thead>
<tbody>
<tr>
<td>the ability of donors to control or restrict the use of funds – even after transfer to an NGO</td>
<td>an NGO’s autonomy in setting conservation goals &amp; priorities.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time Horizon</th>
<th>Autonomy to Spend</th>
</tr>
</thead>
<tbody>
<tr>
<td>the period over which a transfer of funds takes place</td>
<td>an NGO’s freedom to spend funds</td>
</tr>
</tbody>
</table>

**Figure 6. Variables in the design of funding mechanisms & their predicted impacts**

The questions driving these predicted impacts are further explained in Table 1, with the predicted impacts detailed more thoroughly in Table 2. To assist with envisioning how some of these mechanisms and impacts might tie together, Table 3 provides eight fictional examples.
Table 3. Questions defining the three variables and their anticipated impacts.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Question</th>
<th>Potential Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership</td>
<td>How is ownership transferred between entities? Is partial ownership retained indefinitely, fully transferred, or something in between?</td>
<td>Pros: Slower or partial transfers of ownership can protect assets from mismanagement or rapid depletion by the NGO.Cons: Incomplete transfers of ownership can raise the stakes of relational failure and trigger anxiety about funding security. This can lead NGOs to duplicate funding efforts or increase contractual complexity.</td>
</tr>
<tr>
<td>Oversight</td>
<td>Who has oversight over how and where funds are spent? Is oversight retained indefinitely, fully transferred, or something in between?</td>
<td>Pros: Slower or partial transfers of oversight can provide opportunity for additional training or capacity building in the NGO.Cons: Incomplete transfers of oversight can reduce an NGO’s autonomy to prioritize funds according to its information, expertise, and organizational mandates.</td>
</tr>
<tr>
<td>Time Horizon</td>
<td>Over what time period is the transaction completed? Are transactions restricted to a specific period of time?</td>
<td>Pros: Longer time horizons may reduce the likelihood of rapid depletion, and may present an additional or alternative opportunity for training or capacity building in the NGO.Cons: Disbursement schedules may also reduce the ability of an NGO to effectively spend money when and where it’s needed.</td>
</tr>
</tbody>
</table>
Table 4. Predicted impacts of the three variables

<table>
<thead>
<tr>
<th>Case #</th>
<th>Who is overseeing how and where funds are spent or disbursed?</th>
<th>Who has legal ownership of the funds?</th>
<th>Over what time horizon do transfers take place?</th>
<th>Predicted Impact: NGO’s Autonomy to Prioritize (Prioritization)</th>
<th>Predicted Impact: NGO’s Freedom to Spend Funds (Expenditure)</th>
<th>Predicted Impact: NGO’s Certainty about Funds (Funding Security)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a.</td>
<td>NGO</td>
<td>NGO</td>
<td>Immediate</td>
<td>High NGO oversees funds &amp; sets priorities</td>
<td>High NGO owns funds &amp; can spend at will</td>
<td>High NGO receives funds quickly &amp; owns them</td>
</tr>
<tr>
<td>1b.</td>
<td>NGO</td>
<td>NGO</td>
<td>Extended</td>
<td>High NGO oversees funds &amp; sets priorities</td>
<td>Medium NGO owns funds &amp; can spend pending Donor transfer</td>
<td>Medium NGO receives funds slowly, but owns them</td>
</tr>
<tr>
<td>2a.</td>
<td>NGO</td>
<td>Donor</td>
<td>Immediate</td>
<td>Medium NGO oversees funds, but Donor retains final say</td>
<td>Low Donor owns funds, but NGO can spend at will</td>
<td>Medium NGO does not own, but receives funds quickly</td>
</tr>
<tr>
<td>2b.</td>
<td>NGO</td>
<td>Donor</td>
<td>Extended</td>
<td>Low NGO oversees funds, but Donor retains final say</td>
<td>Low Donor owns funds &amp; NGO can spend pending Donor transfer</td>
<td>Low NGO does not own &amp; receives funds slowly</td>
</tr>
<tr>
<td>3a.</td>
<td>Donor</td>
<td>NGO</td>
<td>Immediate</td>
<td>Low Donor oversees funds</td>
<td>Medium NGO owns funds &amp; can spend</td>
<td>High NGO receives funds</td>
</tr>
<tr>
<td>Donor</td>
<td>NGO</td>
<td>Timeliness</td>
<td>Donor oversees funds &amp; can shape priorities</td>
<td>Donor owns funds &amp; can spend at will, via own priorities</td>
<td>Donor is in charge and releases funds slowly</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>------------</td>
<td>-------------------------------------------</td>
<td>----------------------------------------------------------</td>
<td>------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>3b.</td>
<td>Donor</td>
<td>NGO</td>
<td>Extended</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Donor oversees funds &amp; can shape priorities</td>
<td>Donor owns funds &amp; can spend pending Donor transfer &amp; via Donor priorities</td>
<td>Medium NGO receives funds slowly, but owns them</td>
</tr>
<tr>
<td>4a.</td>
<td>Donor</td>
<td>Donor</td>
<td>Immediate</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Donor oversees funds &amp; sets priorities</td>
<td>Donor owns funds &amp; can spend at will, via own priorities</td>
<td>Medium Donor is in charge but releases funds fast</td>
</tr>
<tr>
<td>4b.</td>
<td>Donor</td>
<td>Donor</td>
<td>Extended</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Donor oversees funds &amp; sets priorities</td>
<td>Donor owns funds &amp; can spend on own timetable &amp; priorities</td>
<td>Low Donor is in charge and releases funds slowly</td>
</tr>
</tbody>
</table>
Table 5. Fictional example cases, illustrating predicted impacts

<table>
<thead>
<tr>
<th>Case #</th>
<th>Example Case (Fictional)</th>
<th>Predicted Impact: NGO’s Autonomy to Prioritize (Prioritization)</th>
<th>Predicted Impact: NGO’s Freedom to Spend Funds (Expenditure)</th>
<th>Predicted Impact: NGO’s Certainty about Funds (Funding Security)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a.</td>
<td>An anonymous donor makes a cash donation of US$100,000 to a local conservation organization.</td>
<td>High NGO oversees funds &amp; sets priorities</td>
<td>High NGO owns funds &amp; can spend at will</td>
<td>High NGO receives funds quickly &amp; owns them</td>
</tr>
<tr>
<td>1b.</td>
<td>A wealthy patron donates $500,000 to a local NGO, in the form of 10 annual donations of $50,000 each.</td>
<td>High NGO oversees funds &amp; sets priorities</td>
<td>Medium NGO owns funds &amp; can spend pending Donor transfer</td>
<td>Medium NGO receives funds slowly, but owns them</td>
</tr>
<tr>
<td>2a.</td>
<td>A venture capitalist sets aside $200,000 of his personal funds to spend as directed by a local prairie restoration NGO</td>
<td>Medium NGO oversees funds, but Donor retains final say</td>
<td>Low Donor owns funds, but NGO can spend at will</td>
<td>Medium NGO does not own, but receives funds quickly</td>
</tr>
<tr>
<td>2b.</td>
<td>A manufacturing company agrees to pay $300,000 (over 10 years) in conservation offset activities, as directed by a forestry NGO.</td>
<td>Low NGO oversees funds, but Donor retains final say</td>
<td>Low Donor owns funds &amp; NGO can spend pending Donor transfer</td>
<td>Low NGO does not own &amp; receives funds slowly</td>
</tr>
<tr>
<td>3a.</td>
<td>A whale watching group funds a $15,000 whale monitoring training grant through a local ocean conservation NGO.</td>
<td>Low Donor oversees funds &amp; can shape priorities</td>
<td>Medium NGO owns funds &amp; can spend at will, via Donor priorities</td>
<td>High NGO receives funds quickly &amp; owns them</td>
</tr>
<tr>
<td></td>
<td>A community foundation establishes a $1 million fund for land purchases by an NGO, with funds disbursed as each purchase is approved by the foundation’s board of directors.</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3b.</td>
<td>Donor oversees funds &amp; can shape priorities</td>
<td>NGO owns funds &amp; can spend pending Donor transfer &amp; via Donor priorities</td>
<td>NGO receives funds slowly, but owns them</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A wealthy birder seeks an NGO willing to help him create a $100,000 awareness campaign about feral cats, effective immediately.</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>4a.</td>
<td>Donor oversees funds &amp; sets priorities</td>
<td>Donor owns funds &amp; can spend at will, via own priorities</td>
<td>Donor is in charge but releases funds fast</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A government capacity-building grant provides quarterly funds for the purchase of approved equipment via budget request.</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>4b.</td>
<td>Donor oversees funds &amp; sets priorities</td>
<td>Donor owns funds &amp; can spend on own timetable &amp; priorities</td>
<td>Donor is in charge and releases funds slowly</td>
<td></td>
</tr>
</tbody>
</table>
2.3 Methods

This study sought to explore and describe the potential ways in which funding mechanisms (as a type of contractual safeguard engendering greater complexity) could create downstream impacts on NGO effectiveness in the conservation sector. We developed a theoretical framework of potential mechanisms and their anticipated impacts, then used a descriptive case study approach to compare the predictions of our framework against the perspectives of recipient NGOs who were partners in donor-funded conservation initiatives. In keeping with a qualitative case study approach, we drew our data from two main sources:

1. interviews with employees who had served as directors or managers of a conservation initiative undertaken at a U.S.-based non-governmental organization (NGO) within the last ten years (since 2007)

2. annual reports, technical reports, and other data published by or about the initiative

In our approach, we are explicitly concerned with the perspective of NGOs (recipients of funding) and the ways in which they both experience and perceive funding mechanisms to impact conservation outcomes. For this reason, we did not interview donors about their motivations or intentions in the design of funding mechanisms.

Although our approach certainly satisfies the broad definition of a qualitative case study with an explanatory approach (Baxter & Jack, 2008; Yin, 2003), it even more
closely reflects the goals and presuppositions of congruence testing (George & Bennett, 2005), a “theory-centered alternative” to traditional case study analysis (Blatter & Blume, 2008) which “tests whether the predicted value of the dependent variable, in view of the values of the case’s independent variables, is congruent with the actual outcome in the case” (Bennett, 2004).

When applied to case study research, congruence testing (or congruence analysis) permits a researcher to build a theoretical framework, make predictions, and then compare those predictions to empirically observed outcomes, using the points of non-congruence to test the strength of the theoretical framework itself, as well as to draw inferences about underlying processes (Beach & Pedersen, 2016). In this paper, we design a framework around three mechanism variables (oversight, ownership, and time horizon), make predictions about the consequences for conservation initiatives, then draw inferences about the relative strength of our framework and the overall funding process by identifying points of non-congruence in our conservation initiative case studies.

The goal of our work also fits particularly well with congruence analysis: we do not seek to draw generalizable conclusions from our work, but rather to “address a broader theoretical discourse” (Blatter & Blume, 2008) about the nature of contracts and mechanisms within the conservation sector.
2.3.1 Delimitations

We restricted our units of study to conservation initiatives undertaken by U.S.-based conservation non-governmental organizations (NGOs) from 2007 – 2017. This helped avoid potentially confounding processes that may have differed between countries (e.g. legal restrictions on organizational behavior; tax incentives for donors), as well as procedural differences driven by trends in management style and changes in the broader funding landscape. We also hoped to make data more comparable across organizations and initiatives by looking exclusively at one type of tax structure [the 501(c)3], thereby limiting variability of the funding process between organizations sharing that structure.

2.3.2 Interview Methodology

Interview Protocol. — We designed the interview protocol to be performed as a conversational, informal, semi-structured (or ‘structured open-response’) qualitative interview, conducted either in person or by voice interaction (i.e. phone, Skype, WhatsApp, Google Hangout, appear.in, etc.), and approximately 45 minutes – 1 hour in length. We did not collect interviews anonymously, but the identity of respondents is confidential and we have anonymized all financial data (i.e. only numerical ranges are stated).

During the interview, participants were asked to reflect on their experiences in planning, executing, monitoring, and evaluating a conservation program, with particular attention paid to the funding and financial management of their programs.
Because our interviews were not entirely unstructured, a general schedule of the questions posed to interviewees can be found in our interview protocol, which was cleared as exempt through the Duke Institutional Review Board (Appendices A, B).

We chose the semi-structured interview type because it centers on the interviewee-interviewer interaction, empowering both the respondent and interviewer to explore tangents, contexts, and spontaneous questions during the interview, while also allowing both participants to adjust and contextualize the way and order in which questions are asked (Bernard, 2011; Clifford, Cope, Gillespie, & French, 2016; Silverman, 2016; Wengraf, 2001; Yin, 2003, 2015). This interview type ultimately provides rich, contextual data that can be uniquely valuable to the case study approach (Hancock & Algozzine, 2006), and is specifically appropriate to elite interviewing.

**Interviewee Selection.** — We interviewed only directors, managers, or other senior leaders of conservation initiatives that met the case study restriction criteria (see above). We restricted our interviews only to these roles because we wished to collect data from individuals with firsthand knowledge of all (i.e. donor sourcing → program expenditure) or most (e.g. funding allocation → program expenditure) of the funding process for the conservation initiatives under study, and who would have had the authority to prioritize, budget, and spend the funds that the conservation initiative received.

**Interviewee Recruitment.** — Because we did not intend to draw generalizations about the broader phenomenon of conservation funding, but instead desired to
accurately understand and represent the process by which mechanism choice could be tied to outcomes, we restricted our interviews only to respondents holding senior professional roles in qualifying conservation initiatives. This qualified our work as ‘elite’ or ‘expert’ interviewing, a type of interview requiring greater sensitivity, flexibility, and subject competence on the part of the interviewer (Harvey, 2011; Kakabadse & Louchart, 2012), as well as presenting unique challenges to recruitment and engagement of interviewees (Aberbach & Rockman, 2002; Goldstein, 2002; Richards, 1996).

In order to effectively approach and recruit a sufficient sample of conservation program senior professionals meeting the criteria for respondents, we employed a referral-based sampling approach (Biernacki & Waldorf, 1981), led by five ‘entry point’ informants. These five informants were senior professionals with whom we had pre-established professional rapport, and were non-randomly selected to represent a range of experiences with funding models and programmatic outcomes.

We then reached out by email to invite each informant to participate in a one-hour interview about their own experiences with qualifying conservation initiatives; after these interviews, we then asked each informant for referrals to at least one other potential interviewee who met the case study and interviewee criteria, and whom they subjectively judged to be able to answer our research questions. This approach reflects a close study of the arguments made by Tansey (2007) in favor of non-random sampling of elite interviewees when conducting process tracing qualitative research; primarily, we sought to maximize the depth of knowledge that our respondents would have about the
specific process we wished to study, and to reflect that process accurately, rather than to produce a generalizable sample from which we could draw conclusions about the broader conservation funding landscape.

From the pool of referred interviewees, we then targeted those whose experiences would fill the unrepresented types of funding model/programmatic outcomes still left to explore within our theoretical framework.

This type of non-random sampling does not provide generalizability across all conservation initiatives, but is appropriate for a process tracing analytic approach, within a descriptive case study methodology.

2.4 Interview Results

The results of the case studies & interviews are summarized in Table 4 and Table 5; overall, we conducted nine interviews from April 2016 – May 2017, resulting in >8.5 hours of interviews. We ultimately included seven of these in our analysis; one interviewee was excluded because of their role in the initiative under study, and one further interview was redacted.
Table 6. Summary of case studies conducted

<table>
<thead>
<tr>
<th>Case Studies</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Interviews Conducted</td>
<td>9</td>
</tr>
<tr>
<td>Total Number of Case Studies Included</td>
<td>7</td>
</tr>
<tr>
<td>Time Period of Interviews</td>
<td>April 2016 – May 2017</td>
</tr>
<tr>
<td>Average Length of Interviews</td>
<td>1 hour</td>
</tr>
<tr>
<td>Range of Interview Length</td>
<td>28 minutes – 87 minutes</td>
</tr>
<tr>
<td>Case Study Funding Sources</td>
<td>Legal Settlement, Sales Revenue, Family Foundations, Individual Donations, Membership Dues, Government Grant</td>
</tr>
<tr>
<td>Range of Funding Received</td>
<td>&lt;$US100,000 -- &lt;$US50,000,000</td>
</tr>
</tbody>
</table>

Table 7. Summary of case study reports

<table>
<thead>
<tr>
<th>Case #</th>
<th>Area/Topic of Focus</th>
<th>Funding Source</th>
<th>Funding Mechanism</th>
<th>Funding Schedule</th>
<th>Funding Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regional Ecosystem Restoration</td>
<td>Legal Settlement</td>
<td>Cash Transfer</td>
<td>One-Time</td>
<td>&gt;$50 million</td>
</tr>
<tr>
<td>2</td>
<td>Charismatic Megafauna Reintroduction</td>
<td>Membership Dues &amp; Product Sales</td>
<td>Unrestricted Fund Transfer</td>
<td>Periodic</td>
<td>$100,000 - $250,000</td>
</tr>
<tr>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>4</td>
<td>Ecotourism &amp; Marine Protected Areas</td>
<td>Family Foundation</td>
<td>Restricted Grant</td>
<td>Annual</td>
<td>$5 - $10 million</td>
</tr>
<tr>
<td>5</td>
<td>Technology for Species Conservation</td>
<td>Family Foundation</td>
<td>Restricted Grant</td>
<td>Biennial</td>
<td>&lt;$100,000</td>
</tr>
<tr>
<td>6</td>
<td>Anti-Poaching Intervention</td>
<td>Individual Donations</td>
<td>Cash Transfer</td>
<td>Periodic</td>
<td>$100,000 - $250,000</td>
</tr>
<tr>
<td>7</td>
<td>Anti-Wildlife Trafficking Awareness</td>
<td>Membership Dues</td>
<td>Pooled Funds</td>
<td>Annual</td>
<td>$100,000 - $250,000</td>
</tr>
<tr>
<td>8</td>
<td>Anti-Wildlife Trafficking</td>
<td>Government Agency</td>
<td>Performance-Based Payment</td>
<td>Annual</td>
<td>$5 - $10 million</td>
</tr>
</tbody>
</table>
The findings of these seven analyzed cases are detailed further below:

2.4.1 CASE STUDY 1 – Type 1a

Initiative: Regional Ecosystem Restoration

Funding Source: Legal Settlement

Funding Mechanism: Cash Transfer, One-Time, Length Restricted (>10 years)

Amount: >US$50 million

2.4.1.1 Congruence Testing Results

<table>
<thead>
<tr>
<th>Oversight</th>
<th>Ownership</th>
<th>Time Horizon</th>
<th>NGO’s Autonomy to Prioritize</th>
<th>NGO’s Freedom to Spend Funds</th>
<th>NGO’s Certainty about Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGO</td>
<td>NGO</td>
<td>Immediate</td>
<td><em>High</em></td>
<td><em>High</em></td>
<td><em>High</em></td>
</tr>
</tbody>
</table>

2.4.1.2 Background

This conservation initiative is a remediation and research initiative housed within a large national organization. It has the broad mandate of supporting research and policy activities related to community & economic development and environmental remediation (including biodiversity restoration) across a multi-state region of the United States.

2.4.1.3 Funding

The program was funded by a criminal penalties settlement paid by an energy company found guilty of environmental regulation violations, with program activities slated to take place over an extended period (>10 years).
The uncommon structure of a large settlement payment makes this a unique program, both within its organization's portfolio and within the broader conservation landscape. Because the litigation settlement was paid out as a relatively short-duration series of direct cash transfers, it is an ideal example of a mechanism whereby both control and ownership of funds are simultaneously and completely transferred. Because of this mechanism’s position relative to these two axes, the settlement transfers made a large amount of funding immediately and fully available for use by the program, with full control of the funds held by the NGO for the life of the program. As the interviewee described:

*We definitely have a lot of autonomy over how we spend our money – we have our advisory board, but the staff ultimately has a great deal of latitude on how we spend our money.*

### 2.4.1.4 Impacts & Outcomes

As described by the interviewee, this funding mechanism presented both benefits and challenges to the program. The simplicity and immediacy of the transfer conferred vastly greater autonomy than a conservation effort would have otherwise enjoyed; this, in turn, granted the program the ability to self-determine a programmatic mandate and areas of key focus.

This freedom also allowed the program to fund a wider breadth of studies, and to fund studies with a longer required time horizon (e.g. projects related to community resilience). This permitted the program to behave in ways that were more exploratory, more experimental, and longer-focused than its contemporaries within the same
organization could not (“[This program] is unique because our funding is secure and long-term.”).

However, the volume of funds transferred introduced new complexities, particularly surrounding the management and logistics of funding, as in this quotation from the interviewee:

The challenge is: if [I'm] starting from scratch and wanting to give money away, then I need a grants management system (virtual or IT based), I need a staff that knows how to run that system, I need a system for writing the RFAs (request for applications) in which you’re clearly communicating what you’re looking for and then respond to, you need reviewers. Basically, you suddenly need this whole infrastructure to give away all this money, and if you don’t have the expertise then you have to find it.

2.4.2 CASE STUDY 2 – Type 1b

Initiative: Charismatic megafauna reintroduction

Funding Source: Membership Dues & Product Sales

Funding Mechanism: Unrestricted Fund Transfer, Periodic, Perpetual (no length restriction)

Amount: US$100,000 – US$250,000

2.4.2.1 Congruence Testing Results

<table>
<thead>
<tr>
<th>Oversight</th>
<th>Ownership</th>
<th>Time Horizon</th>
<th>NGO’s Autonomy to Prioritize Predicted vs. Reported</th>
<th>NGO’s Freedom to Spend Funds Predicted vs. Reported</th>
<th>NGO’s Certainty about Funds Predicted vs. Reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGO</td>
<td>NGO</td>
<td>Extended</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
</tbody>
</table>
2.4.2.2 Background

This conservation initiative is an ongoing effort by a large, national conservation NGO, operated in partnership with Tribal and regional governments in the United States. The initiative was developed after a successful wildlife reintroduction in Yellowstone National Park, and has been in operation for over 20 years.

2.4.2.3 Funding

The conservation initiative is funded largely by lump-sum cash transfers from individual donations and matched foundation grants. These funds are broadly earmarked for use on the program, but are not restricted by donor requirements:

I would say overwhelmingly, the support...that we’ve received has been not limited by a particular organization or donor’s preconceived notion of how things should work... a donor or foundation basically says ‘we believe in this effort, and here’s a check. Make it happen.’

Other unrestricted funds are received from sales and membership revenues, most of which are received as a result of the organization’s broader publications and membership programs:

We did have an artist who designed [a piece of work] and she donated that... So people bought that...and, less the cost of making it, the remaining funds went directly to the program. So that’d be one example. [The parent organization’s funds are] largely membership dues and also the...funds related to purchase of their magazines. So what funds our unrestricted [fund], largely, is membership money and magazines.

2.4.2.4 Impacts & Outcomes

The interviewee repeatedly highlighted the value of this unrestricted funding mechanism (even describing the program as “lucky” and “fortunate”) and stating
unequivocally that it was a critical factor in achieving effective conservation outcomes by providing the necessary flexibility and adaptability to make quick, autonomous changes in the field:

Having that flexibility of unrestricted funding and being able to adapt is critically important and that’s why...foundation funding and private donors who really just have a personal connection to the concept of bringing [these animals] back to tribal lands is critical. They believe in that, and they trust in us and our partnerships with tribes to make it happen, and that gives us the freedom to be successful. So that flexibility is critical.

2.4.3 CASE STUDY 3 – Type 2a

No case study was immediately available for this type of funding.

<table>
<thead>
<tr>
<th>Oversight</th>
<th>Ownership</th>
<th>Time Horizon</th>
<th>NGO’s Autonomy to Prioritize: Predicted</th>
<th>NGO’s Freedom to Spend Funds: Predicted</th>
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<td>NGO</td>
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<td>Medium</td>
<td>High</td>
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</tbody>
</table>

2.4.4 CASE STUDY 4 – Type 2b

Initiative: Create an Ecotourism Industry through Designation of Marine Protected Areas

Funding Source: Family Foundation

Funding Mechanism: Restricted Grant, Annual, Length Restricted (5 years)

Amount: US$5 million – US$10 million total budget
2.4.4.1 Congruence Testing Results

<table>
<thead>
<tr>
<th>Oversight</th>
<th>Ownership</th>
<th>Time Horizon</th>
<th>NGO’s Autonomy to Prioritize Predicted vs. Reported</th>
<th>NGO’s Freedom to Spend Funds Predicted vs. Reported</th>
<th>NGO’s Certainty about Funds Predicted vs. Reported</th>
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<tbody>
<tr>
<td>NGO</td>
<td>Donor</td>
<td>Extended</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

2.4.4.2 Background

This conservation initiative was operated by a large conservation NGO with projects around the globe. The initiative was created with the primary goal of establishing marine protected areas in key tropical biodiversity zones in the Americas and the South Pacific, and with the secondary goal of providing both economic and ecological benefits to the communities living adjacent to these high-biodiversity zones.

2.4.4.3 Funding

The conservation initiative was funded primarily by a grant from an established family foundation, with further support (in the form of personnel costs) provided by the national governments of target countries in the Americas and the South Pacific. Funds from the foundation were earmarked for the program and restricted to spending in annual increments in the areas agreed to in the initial project proposal. The initiative was guided by an advisory board, and funds were time-bound: the grant would end after a 5-year period, regardless of outcomes.
2.4.4.4 Impacts & Outcomes

The interviewee identified multiple barriers to effective conservation that the funding mechanism created – among these, the decentralized conservation approach of the program contrasted with the centralized spending procedure necessitated by the funders. This created lags and inefficiency in hiring staff, paying contractors, and timing services.

More of a barrier was just that administratively, it’s a lot of places to work to handle the money and to get contracts in place for the scientific work. I might have put more of the burden of the contracting on the individual country programs as opposed to managing most of it from headquarters…but the challenge of that is, of course, that you’re then asking people to manage the money. But I think it would work better in terms of timing when different services were needed. You know, you can either contract because the money’s available and you’d better spend it before it goes away – as opposed to having it kept in a fund where you could access it later.

The interviewee reiterated that the insecurity of funding was a major barrier to creating effective and sustained conservation solutions:

There were studies of increased services, increased employment, improvements in livelihoods as well as improvements in the ecosystem itself. The onsite work indicated that communities not only benefited but began to support the establishment of these protected areas that they had opposed at first. So you could measure success by the change in attitude. A larger problem was: can you maintain it?...They had some success on a sustained basis…but it wasn’t clear where the funding would come from after the grant ran out.

2.4.5 CASE STUDY 5 – Type 3a

Initiative: Technology for Species Conservation

Funding Source: Family Foundation

Funding Mechanism: Restricted Grant, Biannual, Perpetual (no length restriction)
Amount: <US$100,000 budget

### 2.4.5.1 Congruence Testing Results

<table>
<thead>
<tr>
<th>Oversight</th>
<th>Ownership</th>
<th>Time Horizon</th>
<th>NGO’s Autonomy to Prioritize</th>
<th>NGO’s Freedom to Spend Funds</th>
<th>NGO’s Certainty about Funds</th>
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<tr>
<td>Donor</td>
<td>NGO</td>
<td>Immediate</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
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</table>

#### 2.4.5.2 Background

This conservation initiative was operated by a small, U.S.-based NGO and was intended to test the applicability of drone technology to species conservation and monitoring in Africa.

#### 2.4.5.3 Funding

Funding for the initiative came from a restricted grant provided by a family foundation, paid in a single lump sum by bank cheque and intended for spending over two years. The total amount funded was less than US$100,000, and maintenance of the grant required semi-annual reporting (a total of 4 reports: one every 6 months over 2 years) on conservation progress, but did not require expense or budgetary approvals. The grant also did not require consultation with any representatives of the funder; any group of funder-selected experts, or any external financial experts. Funds were renewable, but the administrative barriers to access prevented the program from requesting additional support.
2.4.5.4 Impacts & Outcomes

The funding mechanism (i.e. a bank cheque) was viewed as simple and straightforward by the interviewee, but the associated reporting requirements were seen primarily as a cost to the overall conservation effort.

I wouldn’t say it was so onerous that it stopped me doing the work, but I think it was unnecessary for them to ask for 6 month reports if they weren’t even going to reply. They could have said they were wanting a report or a phone call at the end of two years. In fact, I think the phone call would be a better mechanism…it would be the basis of a useful relationship rather than some anonymous thing. And I felt that with a lot of grants.

2.4.6 CASE STUDY 6 – Type 3b

Initiative: Anti-Poaching Intervention

Funding Source: Donations from High Net Worth Individuals (HNWI)

Funding Mechanism: Wire Transfer, Periodic, Perpetual (no length restriction)

Amount: US$100,000 – US$250,000

2.4.6.1 Congruence Testing Results

<table>
<thead>
<tr>
<th>Oversight</th>
<th>Ownership</th>
<th>Time Horizon</th>
<th>NGO’s Autonomy to Prioritize</th>
<th>NGO’s Freedom to Spend Funds</th>
<th>NGO’s Certainty about Funds</th>
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<tbody>
<tr>
<td>Donor</td>
<td>NGO</td>
<td>Extended</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

2.4.6.2 Background

This conservation initiative is operated by a small wildlife conservation NGO operating in the United States and Africa. It has the stated goal of using education and
on-the-ground enforcement and intervention to reduce the burden of poaching on
wildlife populations in Africa.

2.4.6.3 Funding

The initiative is funded partially by the personal wealth of the NGO founder.
Further funding comes from foundation grants and individual donations (<US$100,000),
and support in the form of personnel and access comes from in-country local law
enforcement agencies and landowner cooperative groups. Funding is primarily
disbursed as immediate, lump-sum cash transfers, either through bank cheques or wire
transfers. The funding received is renewable and not time-bound ("I don’t think we do
anything that’s a 2 or 3 year grant; I don’t think we even bother with stuff that has
limits like that.").

In the past, funding has not required consultation with an external advisory
board or external financial managers, but the interviewee indicated that this may be in
the process of changing as long-renewed foundation funds have raised requirements for
reporting and budget requests. The interviewee reported that in the past, these
requirements have relied primarily on “handshake agreements,” occasionally
augmented by general outcome reporting:

Nope, no real reporting. I think maybe we…these are all old school family
foundations from the middle of nowhere…we got our first request for
reporting that I have been aware of this year. So at the end of 2017, we’ll turn
in a report that’ll just be the [same] annual report that everyone gets. We don’t
do budgeting – like how much of your grant was used for X Y Z. We
could…but it would be made up if we did.
Past funding has also included crowdsourcing, but this has been terminated as a source of funds:

For the amount that we take in from [crowdfunding platforms], the administrative costs of reporting it basically makes it dumb to do that...they’re not flexible, there’s no way to report annually to those projects.

2.4.6.4 Impacts & Outcomes

The interviewee reported that the lump-sum, unrestricted cash transfers were a boon to the organization, particularly as they were critical to manage the high field costs associated with the type of work done:

Very few grants are interested in giving for truck maintenance, which is a significant part of our budget...it’s almost 20% of our budget, and...we do a lot of contract labor. Those are the things where we need unrestricted [funds] because no one wants to fund that kind of stuff. However, I think having so much unrestricted funding as we do...the problem is that...from an operational side, we end up being inefficient.

The interviewee further noted that inconsistent, ad hoc nature of funding and implementation was a barrier to establishing secure, long-term successes for the project:

The budgeting is...there is no method to budgeting, either, despite one consultant’s repeated pleas...it’s just not something that the leadership is interested in, and that means that the hand to mouth [funding situation] is just more pronounced. So looking at this coming year, I couldn’t tell you what projects we are or aren’t going to do, and what money we’re going to spend or not on this or that.
2.4.7 CASE STUDY 7 – Type 4a

Initiative: Anti-Wildlife Trafficking Awareness Campaign

Funding Source: Pay-to-Play Board Membership Dues

Funding Mechanism: Pooled Funds, Annual, Perpetual (no length restriction)

Amount: US$100,000 – US$250,000

2.4.7.1 Congruence Testing Results

<table>
<thead>
<tr>
<th>Oversight</th>
<th>Ownership</th>
<th>Time Horizon</th>
<th>NGO’s Autonomy to Prioritize Predicted vs. Reported</th>
<th>NGO’s Freedom to Spend Funds Predicted vs. Reported</th>
<th>NGO’s Certainty about Funds Predicted vs. Reported</th>
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<tbody>
<tr>
<td>Donor</td>
<td>Donor</td>
<td>Immediate</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
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</tbody>
</table>

2.4.7.2 Background

This conservation initiative was operated by a coalition of U.S.-based conservation organizations, animal welfare organizations, private sanctuaries, zoos, and aquaria that worked to raise awareness about the dangers of the illegal wildlife trade. Program activities included education and awareness campaigns, legislative advocacy, and support for anti-trafficking training for in-country professionals working in the wildlife sector.

2.4.7.3 Funding

The initiative was funded by a pay-to-play membership/partnership model, under which a variety of organizations could “buy in” to a seat on the advisory board, at
which time they would act as partners to direct the use of the pooled funds. In this way, members of the advisory board acted as donors who retained both control and ownership of the assets they brought to the pool. The funding minimum required to join the advisory board was less than US$20,000. Board members acted as expert advisors to the project, but consultation with other conservation experts was not required; consultation with external financial experts was also not required. The funds to support the program were infinitely renewable, but challenges with donor burnout placed a cap on its effective lifetime.

2.4.7.4 Impacts & Outcomes

As described by the interviewee, this funding mechanism altered outcomes by redirecting programmatic attention and, in some cases, lengthening the bureaucratic process necessary to make conservation decisions. The pay-to-play partnership model permitted the inclusion of a broader diversity of funders and advisors than was common for conservation initiatives, which allowed the group to draw on a broader diversity of funding resources – and to stabilize the program’s income over multiple years. However, this model also permitted ongoing control to be exercised by members of the board, which may have slowed action.

One of the things that was very interesting was the differences in opinion between the conservation organizations and the [non-conservation] organizations…That did result in some conflicts sometimes, and the group did its best to try to change verbiage to make the [non-conservation] folks more happy, but it wasn’t perfect…we did our best as a group to compromise and keep the group together, and keep that stable source of funding together. But
that was a potential drawback, was the diversity of the board and the participants.

2.4.8 CASE STUDY 8 – Type 4b

Initiative: Anti-Wildlife Trafficking Awareness Campaign

Funding Source: United States Government Agency

Funding Mechanism: Performance-Based Payment, Annual, Length Restricted (5 years)

Amount: US$5 million – US$10 million

2.4.8.1 Congruence Testing Results

<table>
<thead>
<tr>
<th>Oversight</th>
<th>Ownership</th>
<th>Time Horizon</th>
<th>NGO’s Autonomy to Prioritize</th>
<th>NGO’s Freedom to Spend Funds</th>
<th>NGO’s Certainty about Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donor</td>
<td>Donor</td>
<td>Extended</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

2.4.8.2 Background

This conservation initiative is operated jointly by two large conservation NGOs, with the goal of reducing trade in illegal wildlife & related products. Program activities include education and advocacy campaigns in both source countries and destination countries for wildlife products.

2.4.8.3 Funding

Funding for this program is provided largely by the United States government, under a performance-based grant program that requires quarterly reports and detailed budget requests that must be approved before funds are disbursed. Structured in this
way, the donor relinquishes only partial control or ownership of the committed funds. The program is not required to consult with external experts or a funder-nominated advisory board, nor are they required to consult with an external financial expert. The funds to support the program are time-bound, and support will end at 5 years, regardless of outcome.

2.4.8.4 Impacts & Outcomes

As reported by the interviewee, the high level of control exerted by the funding organization led to slower timelines for the project overall, including a 9-month lag between date when initial funds were committed and date when they were received. This, combined with quarterly reporting requirements and accounting procedures (that included restrictions on mingling or co-spending of funds), led to delays that were a concern for partners on the project.

Every three months, along with sending the financial reports, we also have to send a technical progress report that shows what the partners are doing and how they’re achieving their goals. We also need to create a work plan for what we’ll do the subsequent year and the proposed budget. That has to get sent off and approved... At the end of the financial year, you have to submit how much money you’ll need for the next year. I know there were concerns about the nine-month delay at the start through all of the partners; they felt a bit frustrated that they couldn’t just start and get the ball rolling, especially as it linked to previous work. As I mentioned earlier, there is also this delay between submitting your budget and it being approved. That can sometimes eat into the next financial year so you might not know how much funding you’ve got... You can have these grand plans but can’t actually do anything until the next year.

However, the interviewee also cited these processes as valuable means of ensuring accountability and enhancing outcomes:
As far as being watertight and accountable, I can’t fault it. But we didn’t realize how much time would be spent on the accounting...that has been a bit cumbersome, and has taken time away from actually doing the project, but I understand that it has to be done. So I guess it’s a bit of a necessary evil...because I think the danger is that if you just give someone an amount of money and let them run off with it, you might end up with all kinds of problems.

The interviewee was also careful to note that although their project had experienced delays in reaching some targets of success, that other factors – including shortstaffing and lack of training/capacity among on-the-ground staff – were at greater fault than the stringency of control exercised by the primary funder.
### Table 8. Summary of predicted vs. reported impacts

<table>
<thead>
<tr>
<th>Case #</th>
<th>Who is overseeing how funds are spent or disbursed?</th>
<th>Who has legal ownership of the funds?</th>
<th>Over what time horizon do transfers take place?</th>
<th>Impact: NGO’s Autonomy to Prioritize (Prioritization) Predicted vs. Reported</th>
<th>Impact: NGO’s Freedom to Spend Funds (Expenditure) Predicted vs. Reported</th>
<th>Impact: NGO’s Certainty about Funds (Funding Security) Predicted vs. Reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>4</td>
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<td>8</td>
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</tbody>
</table>
2.5 Discussion

Directly linking contract design to outcomes is a challenge, but identifying key variables (prioritization, expenditure, NGO perceptions of funding security) in a congruence testing framework has allowed us to draw inferences that may be useful for directing future research. This paper may therefore represent a first effort toward establishing best practices surrounding optimal contract design for funding and financing of global biodiversity conservation.

Under our framework, donors and NGOs implementing conservation initiatives act analogously to partner firms embarking on joint ventures, and attempt to use contractual safeguards (e.g. funding mechanisms) to reduce risk and ensure the best possible outcomes. However, mechanisms that are overly complex or inappropriately structured may result in worse conservation outcomes.

Overall, our framework did an excellent job of predicting most of the impacts reported by NGO interviewees on three proxy measures of conservation outcome: (i) the autonomy to prioritize where/how funds should be spent; (ii) the freedom to make expenditures as needed, and (iii) assurance of funding security for the required duration of the initiative. Nevertheless, we found four areas non-congruent with our anticipated outcomes. The effect of time-bounding (donor-set restrictions on the length of funded programs) appeared as one such unanticipated variable. Further points of non-congruence are discussed here:
Although an unrestricted, immediate cash transfer appears at first to be an ideal funding arrangement from the perspective of the NGO (as it eliminates relational risk and minimizes transaction influences on performance), the report of the interviewee in Case Study 1 challenges that assumption. The negative consequences of this funding mechanism were not anticipated by our framework, and were driven primarily by the uniquely large size of the transfer in question (>US$50 million), which overwhelmed institutional/organization infrastructure and exceeded management capacity, leading to inefficient spending and reduced performance.

We expected that the time schedule of periodic (rather than lump-sum) transfers would trigger anxiety in the NGO, reducing funding security. However, the NGO’s strategy of variation in supplementary sources of income (e.g. magazine sales, memberships) reduced the expected funding insecurity associated with the time schedule & horizon in this case study.

Our framework failed to predict the impact that strict time-bounding would have on relational risk as well as perceived security of funding, and thereby on outcomes. In this case, significant economic and cultural shifts were demanded by the donor as a goal of the project, but the NGO and stakeholder communities believed these could not be sustained without long-term funding inputs, which a five-year contractual time limit precluded.

Our framework also failed to anticipate the nuance of ‘funding security’ as highlighted in this case – although the time bounding raised performance risk and
reduced the overall perceived security for programmatic outcomes, the five years of funding were believed to be highly secure, and neither the time-bounding nor the periodic disbursement schedule impacted the perceived funding security.

The donor here used an entry barrier (extensive grant application process), contractual restrictions on the use of funds, an ongoing reporting requirement, as well as renewal application procedures as four forms of contractual safeguard intended to reduce performance risk. The rigor of this process was seen to raise relational risk, but our framework failed to correctly predict the responsive behavior of the NGO; rather than design compromise structures in an effort to meet relational expectations, the NGO responded in a resistant/rebellious manner, choosing to spend received funds as needed and terminate the relationship with the donor instead.

Likewise, for Case Study 6, our framework failed to predict the perceived autonomy (and willingness) of the NGO to spend as needed when funds were available—a willingness that may have been exacerbated by the insecurity of funds (‘spend it while you got it’) and the insecurity introduced by donor control. We also failed to predict the severely negative impact that donor control and an irregular disbursement schedule over an extended time horizon would have on funding security.

2.5.1 Future Directions

As conservation continues to improve in effectiveness and expand in scope, closer examination of the specific management & financial needs of conservation initiatives will become increasingly valuable. A next step for the findings of this paper
would be a larger-dataset congruence analysis, incorporating the emergent variable of time-boundedness.

Conservation donors and NGOs have adopted (intentionally or inadvertently) many of the common contract structures found in other disciplines or used for other philanthropic purposes. Understanding why and how this has occurred (using donor interviews and perspectives of funding mechanisms) will be a critical second step in improving our understanding of the impact of these structures.

Further, these common contract structures may not best meet the unique needs of conservation initiatives, and donors and NGO should look closely at the potential costs of non-optimal contract design. Quantifying these potential costs via structured surveys and audits would be provide deep insight and actionable information for researchers, donors and NGOs.

Last, undertaking a broader survey of conservation contracts using direct examination of contract documents themselves for comparison (rather than relying on experiential reports, as we have done here), could present an opportunity to closely trace the funding process and identify clearer links between mechanisms and outcomes.
Chapter 3. Boma Fortification is Cost-Effective at Reducing Predation of Livestock in a High-Predation Zone in the Western Mara Region, Kenya

Lions *Panthera leo* kill livestock in the pastoral steppe of East Africa. The subsequent lethal retaliation by livestock owners has helped reduce lion numbers by more than 80% and driven it from most of its historic range. This conflict is especially intense along the western edge of the Maasai Mara National Reserve in Kenya, where some of the densest lion and livestock populations in Africa overlap. We evaluated the effectiveness of implementation for one proposed solution – the Anne K. Taylor Fund’s subsidized construction of fortified, chain-link livestock fences (‘bomas’) – in reducing livestock loss to depredation. We collected 375 predation reports from 308 semi-structured household interviews and predation records. We used these data to study the impact of subsidised boma fortification on the depredation of cattle, sheep and goats. Of 179 fortified bomas, 67% suffered no losses over one year; of 60 unfortified bomas, only 15% had no losses over one year. Furthermore, losses of greater than five animals per year occurred at only 17% of fortified bomas, compared to 57% of unfortified bomas. The overall reduction in losses to predation at fortified bomas equated to savings of more than $1,200 USD per household per year.

3.1 Background

Human-wildlife conflict is a global threat to large mammals (Dickman 2010). In East Africa, conflict often arises in the form of livestock depredation that poses a

The lion *Panthera leo* is an iconic, charismatic and well-studied animal whose range once extended across the entirety of the African continent. Lions now occupy less than 30% of their former range, with many small remnant populations likely to be extinct by 2050 (Riggio et al. 2012).

Nowhere is the conflict between humans and lions more acute than in the area surrounding the Maasai Mara National Reserve. The Mara is in Narok County, home to more than three million head of livestock and 850,000 people, with 93% of them living in rural or semi-rural areas (Kenya Open Data 2014, Commission on Revenue Allocation 2014). This region is also a lion population stronghold (Figure 7), where between 2,870 and 7,126 lions occupy just over 35,000 km² (Blackburn et al. 2016). This area, though largely protected, places high numbers of lions adjacent to some of the highest densities of cattle in Africa (UN FAO 2005, Robinson et al. 2014), leading to conflict. Projections of lion population shifts and cattle density increase suggest that this conflict is likely to intensify (Kahi et al. 2006, Herrero et al. 2008, UN Secretariat 2012, Kenya Open Data 2014, Robinson et al. 2014).

Within the East African region, the greatest concentrations of cattle form in a semi-circle on the southern side of Lake Victoria, of which our study site on the western Mara comprises the northeastern-most portion (Figure 8). The western Mara possesses
both high cattle numbers and high lion numbers, with a resultant potential for livestock
depredation conflict greater than anywhere else in Africa.

Figure 7. Global cattle density, overlaid with known lion presence (Riggio et al., 2012)
across Africa.
Conflict between livestock and predators can be mitigated or exacerbated by the style of livestock husbandry, with some husbandry styles inherently incurring greater predation risk than others. In the western Mara, animals are herded out of the nighttime enclosure ('boma') in the mornings, and moved toward known grazing areas and water sources. Cattle are typically shepherded by either a paid herdsman, the male head of household ('mzee'), or a young, unmarried male member of the household ('moran'); however, children as young as seven years old may be tasked with shepherding sheep and goats. Household dogs may or may not accompany herders. In the evenings, livestock are returned to the boma and guarded by the fencing structure, the presence of dogs around the homestead, and the physical proximity of the home to the boma. This
style of husbandry produces limited daytime predation, as the presence and vigilance of
the herder acts as a deterrent. However, animals remain vulnerable to night-time
predation, and this can be exacerbated by poor fencing structures, such as traditional
acacia fences (Figure 9a), and lack of vigilance.

Over the past twelve years, those working to save lions have sought to de-
escalate the conflict by reducing the threat of night-time depredation with the
construction of predator-proof bomas (Figure 9; Ogada et al. 2003, Lichtenfeld et al. 2015,
Manoa & Mwaura 2016). The Anne K. Taylor Fund (AKTF) has operated its Boma
Fortification Program since 2009 (AKTF 2013). The programme provides materials and
labour support for the construction of wire-and-post livestock enclosures across the
western Mara. In this study, we report its efficacy in reducing reported livestock
depredation losses and make recommendations for its future role.
Figure 9. Contrasting Maasai boma styles: a) a traditional unfortified Maasai boma; b) a boma fortified in the Mara North by the Anne K. Taylor Fund using posts, chain link wire, galvanized wire, and immature thorny plants.

3.2 Action

From April 2013 to July 2015, we collected 375 in-person interviews about depredation experience from 308 Maasai households that owned bomas in two subsections (the Mara North Conservancy and the Trans-Mara region) of the western Mara region. Interviews were conducted using a multi-query approach (described below), and \( t \)-tests were used to test for differences between depredation at ‘fortified’
(i.e. chain-link fencing used to reinforce traditional construction) bomas and ‘unfortified’ or traditional (i.e. acacia thorn fencing) bomas (Figure 9).

The episodic nature of predation events and the limited infrastructure for reporting incidents in the sprawling landscape of the western Mara presented a challenge to quantify predation accurately. Our study relied on information collected through semi-structured, retrospective household interviews. The semi-structured interview approach was the most appropriate because our project sought to record perceptions, opinions, experiences and phenomena occurring across a varied population. Other methods of data collection, such as written surveys, were deemed inappropriate, as Narok County had a self-reported literacy rate of 46.2% for men and 34.5% for women in 2007 (Kenya Bureau of Statistics 2007).

Our interviews covered approximately 550 km² along the western edge of the Maasai Mara Natural Reserve in Narok South (Figure 8), an area with an estimated human population of 12,000 within a district whose known livestock population exceeds 2.1 million.

To ensure comparability between our data and other sets relating to predation, we measured our impact in boma-months (i.e. the number of months in which a boma was monitored). This is an approach used by Lichtenfeld et al. (2015), and has the benefit of simplifying comparison across differing monitoring programme lengths and extents.
3.2.1 Validity and Reliability of Interview Data

In qualitative research, reliability refers to the reproducibility of interview results, validity is how well the resultant data reflects a specific phenomenon, and triangulation refers to a process whereby multiple sources of data confirm each other’s accuracy (Bush 2007). The itinerant nature of predation and the limited infrastructure for official reporting make it difficult to accurately triangulate predation losses in the Mara. We therefore focused our efforts on improving the validity and reliability of our interview results.

We improved reliability by modifying the survey instrument in response to ambiguities in respondents’ answers to specific questions, as well as in response to specific problems, such as overlooked animal types. Having multiple interviewers helped to test the reliability of our questions by highlighting any ambiguities in the wording or presentation of the survey instrument.

Because our intention was to gather information on the fortification programme that might be generalizable to other field sites, we focused heavily on improving the validity of our surveys. To do so we (i) restricted our surveys to a 12-month retrospective; (ii) structured our queries in easily memorable time blocks (i.e. rainy seasons/dry seasons), and (iii) employed a repeat-query process that allowed us to approximate the likelihood that respondents were overstating their losses in general inquiries. This multi-query process consisted of the following approach:

Inquire about general estimates of predation loss (i.e. ‘How many cattle did you lose last
Ask respondents to estimate each loss of the current season (e.g. ‘How many animals did you lose this rainy season?’)

Ask respondents to estimate each loss of the previous season (e.g. ‘How many animals did you lose in the dry season?’)

Ask respondents to estimate each loss of the last season of the current type (e.g. ‘It is now the rainy season. How many animals did you lose last rainy season?’)

Ask respondents to detail each loss of the last season of the opposite type (e.g. ‘How many animals did you lose in the dry season before this last one?’)

Ask respondents to detail their problems with each predator, and how many animals they lost in the last year to the predator (e.g. ‘How many times have lions attacked your boma this rainy season? How many animals did they take? How about hyenas?’)

In this way, we gained two separate measures of self-reported predation estimates: (1) an estimate of loss; and (2) an accounting of losses. We were then able to compare the more general response to the more specific (and presumably more credible) accounting.

After completing the interview, we thanked participants and asked to visit any livestock structures within their landholding. We assessed the quality of the overall landholding on a 5-point Likert scale (Likert 1932); in later revisions of the survey instrument, we assessed quality for each individual livestock structure.

The protocols in 2013, 2014, and 2015 were different, so we present them separately. The experiences in 2013 informed our protocols for the second round of...
interviews. Our data collection methods were approved as exempt by the Duke Institutional Review Board (IRB Exemption: Protocol [B0371]), because of the very limited risk to participants. Participants in the household interviews provided verbal consent after having the process explained in both English and kiSwahili (and, when necessary, in Maa).

### 3.2.2 Household Interviews, Set 1 of 3 (2013)

The first phase of data collection was from 5 April to 15 July 2013 at various sites around the Mara Region of western Narok County. Sutton, Munyao, and Kamande collected 12-month retrospective interviews from 131 bomas, resulting in 1,572 boma-months of data. During this time, Munyao and Kamande were both employed by the AKTF.

We selected interviewees at random from within two known groups: those who had already received a boma fortification from the AKTF more than six months prior, and those who had not yet received a boma fortification, or whose bomas had been fortified less than six months ago.

Sutton, Munyao and Kamande separately conducted in-person interviews of an average duration of 65 minutes with residents of the Trans-Mara Community and the Mara North Conservancy. The interviews took place in or around the primary residence structure within each landholding. We conducted interviews preferentially with the senior male head-of-household. In the absence of the senior male (‘mzee’), interviews were conducted (in declining preference) with the senior female head-of-household.
(‘mama’); the eldest son; the senior male’s brother or other male relative; a senior employee responsible for the care of the cattle; or another relative (e.g. daughter) or friend/neighbour whom the head-of-household had designated to speak in his stead. We collected data only about the cattle owned by a single mzee at a single boma; adjacent herds from related households were not included, nor were secondary bomas located in other places.

Sutton, Munyao and Kamande did not interview the same households, raising the risk of between-interviewer variability as a threat to validity. To minimize this risk, all interviewers participated in one pre-interview training session and daily end-of-day data reviews during which any discrepancies in data collection (e.g. differently-worded questions; missing data; outlying numbers) were noted and discussed. If methodological errors were identified, the question or interview was removed.

We adaptively revised the survey instrument seven times during the first round of data collection in response to suggestions from interviewees, surveyors, and other project partners; or to fill gaps in data; or to uncover additional information to enhance understanding of emergent patterns. Our edits did not impact the core question phrasing or location information for questions related to predation data.

### 3.2.3 Household Interviews, Set 2 of 3 (2014)

From May to July 2014, Sutton, Munyao and Kamande conducted follow-up interviews with residents of the Mara North Conservancy who had not had boma fortifications in the previous year, but who had received boma fortifications between
July and December 2013. This meant that their fortified bomas had been constructed more than nine months before the current interview, but not had not yet been fortified at the time of the previous interview in 2013. We did this to provide longitudinal before-and-after data to augment the paired sampling (treatment versus control) data that we collected in this region in previously. The interview and boma assessment process was the same as for the previous year. From this data collection effort, we gathered 12-month retrospective interviews from 23 bomas, resulting in 276 boma-months of data.

3.2.4 Household Interviews, Set 3 of 3 (2015)

From July 2014 to July 2015, Downey and Munyao collected abbreviated interviews from 154 bomas, providing 1,962 boma-months of data. These interviews took place with boma owners who were either previous recipients or those who were scheduled to receive boma fortifications from the AKTF. These interviews covered the same area (the Trans-Mara region and the Mara North Conservancy) as Sutton, Munyao and Kamande in 2013, but the 2015 bomas had not been previously surveyed.

The interview and boma assessment process, including introductions and consent, followed the approaches developed in 2013 (outlined above) as closely as possible. As in previous rounds of interviews, these were preferentially conducted with the senior male head-of-the-household, at the site of the boma. However, when the head-of-the-household was absent, we attempted to reach them by phone and to conduct the interview that way, instead of deferring to family members.

These interviews were collected with an abbreviated version of the survey
instrument developed in 2013. Guided interviews were completed in less than five minutes, and focused on the boma’s stock and predation history, as well as its state of repair. Notably, this survey instrument did not ask for the ‘Accounted Losses’ data collected in 2013; it only collected ‘Estimated Losses’.

We interviewed boma owners opportunistically during installations of new bomas by AKTF or during routine inspections and maintenance visits to bomas that AKTF had previously fortified between 2008 and 2014. Fewer than ten had been previously interviewed by Sutton.

We collected information about the costs of boma construction from the purchase records of the AKTF. We collected information about the valuation of livestock from the Kenya Meat Commission (2014).

3.2.5 Data Preparation and Analysis

To draw the most useful information from our data, we combined interview results from the years 2013 – 2015. We visited a total of 308 bomas and made 462 inquiries, from which we collected 375 successful depredation interviews. We collected more interviews than bomas visited because our 2015 visits (of 154 bomas) made inquiry not only about residents’ current (this year) depredation experiences, but also about previous (past year) depredation experiences prior to fortification. This doubled the number of interview inquiries in 2015 from 154 to 308, and raised the total number of inquiries overall to 462. However, only 375 of these total inquiries resulted in the successful collection of an interview. Of these, a further 26 contained duplicate or
insufficient data, or were lost to a data storage failure, resulting in 349 cleared and de-duplicated depredation interviews. Six interviewees declined to report their losses, resulting in 343 final analysable depredation reports.

Because of differences in information gathered from the 2013/2014 interviews and the briefer 2015 interviews, we compared stock loss data between only two categories: those who had participated in the fortification programme (and thus possessed any form of chain link: ‘fortified’; n=179) and those who had not (and therefore possessed no chain link whatsoever: ‘unfortified’; n=164). This simplification to two categories allowed us to answer questions about potential demographic drivers behind participation in the AKTF fortification program, rather than the more complex question of individual fortification design. This also allowed us to treat each boma in each state as a complete unit of data, which thereby let us compare more readily across phases of monitoring, and to compare bomas longitudinally (i.e. if a boma owner fortified in the time between our interviews, he or she could have provided past information about the unfortified experience, as well as current information about the fortified experience).

To ensure that comparing data from different regions and different household types would not confound the validity of our conclusions, we collected demographic data during each household visit. These included descriptive household indicators (age of boma owner; length of residence at current boma; household economic sources; typical cattle herder) as well as proxies of household wealth (number of cattle owned;
number of sheep and goats owned; number of dogs owned; number of bomas owned). To ensure that boma fortification was not a proxy for wealth, we collected general data on the total number of animals owned at each boma, then compared averages between boma types.

We used $\chi^2$ tests to determine the significance of differences in demographic factors and stock losses between households who chose to fortify and those who did not. We followed this with a comparison of stock losses at the two fortification types only for bomas of known and comparable size, to account for the potential influence of herd size/group size on losses.

We carried out a cost-benefit analysis using stock loss reduction numbers from our boma interviews collected in 2013/2014 of our original three boma types: fully fortified, partially fortified, and unfortified. We defined fully fortified households as those who had performed complete fortification using chain-link fencing to reinforce multiple structures within the homestead; partially fortified households as those who had performed incomplete (50%) fortification using chain-link fencing; and unfortified households as those who had performed no fortification with chain-link. We used a standard discount rate of 12% (the 2015 bank rate at the Central Bank of Kenya), an exchange rate of 87.47 KSh to one US dollar, and an approximate boma lifespan of five years, with an annual maintenance cost of 5,000 KSh (these latter two measures were determined by AKTF records).
3.3 Consequences

3.3.1 Efficacy of Boma Fortification

We found that fortification using chain-link fencing, regardless of the quality of the construction or maintenance of that fencing, was an effective means of reducing significant and costly losses of livestock to depredation ($\chi^2$ test, $p < 0.001$, $n=343$).

In our study region between 2013-2015, we recorded 1,895 heads of livestock lost over 1,968 monitored boma-months at 164 traditional bomas, equivalent to a monthly loss rate of 0.96 animals. At 179 fortified bomas, 564 heads of livestock were lost over 1,611 monitored boma-months, equivalent to a monthly loss rate of 0.35 animals.

Despite the high predation pressure in the region, 67% of fortified bomas suffered no losses over one year; by contrast, only 15% of unfortified bomas experienced such a reprieve (Table 7). Only 17% of fortified bomas lost more than five animals in a year; by contrast, 57% of unfortified bomas lost this many animals (Table 7). These numbers were collected from 239 boma owners who reported not only their predation numbers to us, but also the number of stock they held overall ($n=239$).

The number of animals present in both boma types was broadly similar: 59% of fortified vs. 57% of unfortified bomas held up to 240 animals. Large bomas, holding more than 420 animals, were 13% of fortified bomas and 16% of unfortified bomas.
However, the number of cattle owned, and number of sheep and goats owned differed significantly between fortified and unfortified households ($\chi^2$ test, $p = 0.028$ and $p = 0.015$, respectively). This may indicate that herd size (and correlated wealth) plays a role in the decision to fortify, with larger herd sizes more common amongst households who chose to fortify.
Table 9. Number of households reporting varying levels of annual livestock losses to depredation in fortified and unfortified bomas containing different numbers of animals.

<table>
<thead>
<tr>
<th>NUMBER OF LIVESTOCK LOST</th>
<th>Zero</th>
<th>1 to 4 heads</th>
<th>5 to 9 heads</th>
<th>10 or greater</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unfortified</td>
<td>Fortified</td>
<td>Unfortified</td>
<td>Fortified</td>
</tr>
<tr>
<td>&lt; 60</td>
<td>2</td>
<td>18</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>60 to 119</td>
<td>2</td>
<td>16</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>120 to 179</td>
<td>0</td>
<td>20</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>180 to 239</td>
<td>3</td>
<td>21</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>240 to 299</td>
<td>1</td>
<td>8</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>300 to 359</td>
<td>1</td>
<td>14</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>360 to 419</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>420 - 479</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>&gt; 480</td>
<td>0</td>
<td>10</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>9</td>
<td>120</td>
<td>17</td>
<td>28</td>
</tr>
<tr>
<td>Percentage</td>
<td>15%</td>
<td>67%</td>
<td>28%</td>
<td>16%</td>
</tr>
</tbody>
</table>
3.3.2 Cost-Benefit Analysis: Modelling the Economic Costs of Livestock Loss to Depredation

In our original (2013/2014) categorization, we recorded 40 accounted losses to predation at our 22 fully fortified bomas. Because of breaks in our boma monitoring, we monitored each boma for an average of nine months, a total of 198 boma-months. This gave an average annual loss of 2.42 heads of livestock (0.20 animals per month) per boma household. Using the average market value of a cow, sheep or goat of US$450, US$80 and US$80 respectively (Kenya Meat Commission 2014) this amounted to an average loss per animal of US$203, and an average annual loss of US$492 per boma household.

We also recorded 386 accounted losses to predation at our 163 partially fortified bomas. Because of breaks in our boma monitoring, we monitored each boma for an average of nine months, and a total of 1,467 boma-months. This gave an average annual loss of 3.16 heads of livestock (0.26 animals per month), amounting to an average annual loss of US$641 per boma household.

Finally, we recorded 562 accounted losses to predation at our 61 unfortified bomas over a 12-month span, for a total of 732 boma-months. This gives an average annual loss of 9.21 heads of livestock (0.77 animals per month) per household, amounting to an annual loss of US$1,870.
3.3.3 Is Building a Boma Worth the Cost?

In 2013, the average resources needed to construct a fully-fortified boma were:

four rolls of chain-link (5,000 KSh); treated wood posts (eight at 900 KSh); high tensile wire (1180 feet at 2KSh / foot); doors (one at 2,000 KSh each); four steel corners (2,500 KSh each); miscellaneous amounts: cement, sand, and rocks (approximately 1,000 KSh total); one box of binding wire and 3 kg nails etc. (approximately 1,500 KSh total).

Additional costs include construction labour (two day labourers at 1,000 KSh per day each), welding labour (one skilled labourer at 4,800 KSh) and transportation from Nairobi (the materials for one fully-fortified boma require half a lorry at 50,000 KSh each). We calculated the total cost to build a fully fortified boma in the western Mara region to be approximately US$890.13 (77,860 KSh). The Eden Wildlife Trust and AKTF provided US$638.62 (55,860 KSh), leaving an average cost to Maasai livestock owners of US$251.51 (22,000 KSh).

In 2013, the resources needed to construct a partially fortified boma were, on average: four rolls of chain-link fencing (5,000 KSh each), one door (2,000 KSh each), 3 kg nails (180 KSh per kg = 540 KSh), found local materials (no cost), plus labour (two day labourers at 1,000 KSh per day each) and cost of chain link transportation from Nairobi (approximately a quarter of a lorry at 50,000 KSh each). We estimated the total cost to build an average partially fortified boma to be approximately US$446.32 (35,040 KSh). The Eden Wildlife Trust and AKTF provided approximately US$320.56 (28,040 KSh), leaving an average cost to Maasai livestock owners of US$125.76.
In 2013, the resources needed to construct an unfortified (traditional) boma were, on average: one day’s labour for a boma owner. The total cost to build an unfortified (traditional/acacia thorn) boma in the western Mara region was estimated to be approximately US$11.43 (1,000 KSh), and the expense was entirely borne by the livestock owner.

With these numbers, our analysis produces an estimated net present value of US$5,899.93 for owners of fully fortified bomas. With a per-boma cost of US$890.13, the project provides a return on total project investment of approximately 349%. A partially fortified boma results in an estimated net present value of US$5,332.83 for livestock owners, with a 778% return on project investment.

**3.4 Discussion**

Livestock depredation is a costly problem that jeopardizes both wildlife populations and human livelihoods. Fortified bomas protect livestock and prevent depredation, which in turn can reduce the number of retaliatory predator killings. These fortifications reduce danger while livestock are held within them, but additional measures are needed during livestock transit and grazing.

The predation incident reports we collected targeted loss to lions, but also loss to hyenas, leopards, wild dogs, honey badgers, cheetah and baboon. We found inconsistencies in identification of the predator in our reports – confusion persisted between the spotted cats (leopard and cheetah) that are named by coat pattern in Maa
(‘olmara’ and ‘olwarumara,’ respectively). Occasional there was confusion in
distinguishing the spotted cats from spotted hyenas (‘orokonoi’). We also witnessed
over-attribution of predation incidents to lions, a phenomenon that has been
documented previously in the literature as leading to higher rates of species removal
(Rust & Marker 2013). We therefore concluded that attempting to distinguish loss
incidents by the depredating species would be difficult and likely inaccurate. Instead,
we decided to use a generalized predation rate to give a general sense of the pressure
that livestock owners experience. This approach was consistent with previous reports of
predation rates elsewhere in the literature.

3.4.1 Anticipating and Studying Depredation Across Africa

The rates of use of improved husbandry practices, in combination with maps of
inherent landscape characteristics (as in Abade et al. 2014 & Kushnir et al. 2014), can help
identify ‘easy target’ areas for depredation. These maps and risk factors should be
integrated into part of an open-access tool for conservationists and local managers to use
in the field to proactively avert conflict before it can arise.

Such a tool would be made much more useful by consistent, accurate collection
of data relating to depredation in Africa. Without straining additional resources, wildlife
agencies and conservancies could act in two ways: (1) implement improved employee
training on the collection of accurate, timely depredation reports; and (2) provide a
platform for standardized reporting by mobile phone, which could make timely
reporting easier for livestock owners.
3.4.2 The Future of Fortification in Africa

Although fully fortified bomas in our study offered better protection to livestock (averting the loss of 0.74 more animals per year per boma household than partially fortified bomas), partial fortification still appeared to be a more cost-effective way to protect livestock. With a return on investment of 778%, partially fortified bomas are vastly more cost effective than fully fortified bomas (return on investment = 349%). This means that for the same price, nearly twice as many bomas can be partially fortified as fully fortified. In addition, it takes at least two days to construct a fully fortified boma versus less than one day to partially fortify a boma by wrapping an existing structure with chain-link fencing. Therefore, partial fortification can be completed with only a portion of the time (and without the additional skilled labour) it takes to fully fortify. They may also be easier to maintain, as the simpler construction and fewer parts make replacement or repair less complex.

Partial fortification may also be a more sustainable solution to the problem of wire supply. At present in our study area, all building materials are distributed and construction is controlled via a single, centralized supplier (AKTF). Although this results in more effective fully fortified bomas, this single-supplier model also makes the programme more vulnerable to failure, as the loss of this single supplier would undermine the entire process. But partial fortification requires fewer materials, and could also be achieved through a decentralized, multiple-supplier model. Indeed, focusing on partially fortifying bomas by simply making the baseline materials (wire,
nails) widely available in local shops would allow herders (or NGOs) to create effective fortifications with materials available from local shops. Since 2013, we have witnessed at least one shop in our region begin to stock and sell rolls of chain-link wire.

Resolving the complex issues of human-wildlife conflict and disrupting the predation-retaliation cycle will be key to ensuring the sustainable maintenance of local biodiversity and the successful protection of local economies. Centralized, high-quality boma fortification can be one powerful and effective element of a holistic approach to mitigating human-lion conflict in East Africa. However, its implementation relies on: (i) a long-term commitment by a stable organization that can subsidize the cost of materials, transport, and construction; (ii) a population with sufficient capital to ‘buy in’ to the program; and (iii) a local willingness to participate in construction and maintenance of such structures. In cases where these three preconditions are met, the approach detailed herein may provide guidance for conservation action elsewhere on the African continent. In cases where the first condition is not met, decentralized partial fortification may provide a more cost-effective and sustainable approach to protecting livestock and reducing depredation conflict.
Conclusion

This dissertation serves as an exploration of the human forces underlying successful biodiversity conservation projects around the world. These human factors are pervasive in the planning and execution of successful conservation projects, and are deserving of careful further study.

Scientists need accurate biological and ecological data to inform our efforts to preserve global biodiversity and halt the loss of species. However, we also desperately need data on the human dimensions of our conservation work; we must understand our own perspectives and beliefs; our training, management and leadership; and our financial and economic practices in order to effectively plan for conservation’s future.

This dissertation is an effort to bring these human dimensions of conservation forward, and to identify some major patterns in leadership, management, and finance of biodiversity conservation that could have implications around the globe.

In Scotland, we found that strong leadership, clear organizational structure, and supportive autonomy may contribute to successful outcomes in wildlife reintroduction programs. In the United States, we found that inappropriate funding mechanisms may lead to inefficient prioritization and spending in recipient conservation organizations. And in Kenya, we found that on-the-ground interventions are most valuable when they explicitly evaluate the cost-effectiveness and infrastructural sustainability of locally implemented solutions.
Through this dissertation and in my future work, I hope to make a useful contribution to the body of scientific literature; to advance conservation science toward greater efficacy; and to support the work of colleagues studying the human dimensions of conservation. As I stated in my introduction: there is no higher goal than the preservation of life, in all its beautiful and diverse forms in our natural world. It is my most fervent hope that the foregoing chapters of this dissertation reflect that.

INTERVIEW INTRODUCTION

Hello! I’m a doctoral candidate at Duke University, and I’m undertaking a study on financial mechanisms in conservation as part of my dissertation research. The goal of this research is to understand whether financial mechanism used to transfer contributions or investments to conservation can be linked to programmatic outcomes.

To try to get at this information, I’m going to ask you a few questions about one specific program that you’ve worked on. There will be 25 guiding questions, but you should feel free to diverge from those questions if you’d like to share information with me about something I haven’t asked.

You’ve already affirmed that you understood the informed consent statement, but I’d like to check again: Is this OK? Would you like to participate?

INFORMATION FOR THE RESEARCHER

<table>
<thead>
<tr>
<th>Date (day, month, year)</th>
<th>Survey no.</th>
<th>Respondent ID #</th>
<th>Interviewer Name</th>
<th>People present at start of interview (note here if anyone other than primary respondent is present)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Interviewee Name:

Current Affiliation:

Since when?

Previous Affiliation:

Please state or describe your profession:

How long have you worked in conservation? What has the experience been like?
I know that you’ve worked on a number of conservation projects, but today we’re going to talk about just one. I’d like you to think of a project you worked on or led, for which you had access to the financial planning and information – and for which an outcome has already been determined.

Project Name:

Project Dates:

Lead Organization: IRS Classification:

Project Sponsors:

Funding Source (if known):

Estimated budget of the project (in USD): Over what time period?

# of Staff (Full-time) on the project:
# of Staff (Part-time) on the project:
# of Volunteers on the project:

1. Did your project have a stated goal or mission statement? If so, what was it?

2. Was there a secondary or unstated purpose to your project? If so, do you feel comfortable sharing it with me?

3. Was it a time-bound project? Was a projected end date determined during the planning stage?
4. Was it a time-driven project? Was it undertaken because there was a matter of critical importance or that required a timely response?

5. Where was the project expected to take place?

6. Where did the idea for this project come from?

7. Did the originators of the idea end up executing the project?

**FUNDING FOR YOUR PROJECT – 25 minutes**

8. Where did the funding for this project come from?

9. How was funding disbursed to the project? Was it moved through the organization, or did it come to your project directly?

10. Was funding for your project kept separate from other streams of funding, or were funds mixed within the organization?

11. Did the funding you received come as the result of a sale – of products, goods, property, or services? This includes (but is not limited to) ecotourism, consulting services, or memberships.

12. Did the funding you received come as the result of a gift – including (but not limited to) grants, charitable donations, or bequests?

13. Was your funding a one-time deal, or was it renewable? If renewable – how many times, and after what period would it become renewable?

14. Was your funding an investment or loan? Did it require a return of funds equivalent to or greater than the original amount you received?

15. Was your funding part of a government program or scheme? If so, please describe it.
16. What requirements had to be met in order for you to receive your funding? Did those requirements have to be met one time, multiple times, or in perpetuity? Were you able to change these requirements after receiving the funding, or were they permanently attached?

17. Were you required to consult with, defer to, or otherwise collaborate with any specific organizations or individuals in order to receive your funding? If so, were you required to do so in perpetuity?

18. Was the expertise of specialized financial experts required for you to manage your funding?

19. Is there anything else relevant about the nature of your funding that I should be aware of?

FUNDING FOR YOUR PROJECT – 15 minutes

20. How was success defined for your project? Was your project considered a success?

21. Do you think the type of funding you received influenced your ability to conduct your project? If so, how? If not, why not?

22. Do you think the type of funding you received influenced the ability of others to conduct your project? If so, how? If not, why not?

23. Do you think the type of funding you received influenced the outcome of your project? If so, how? If not, why not?

24. What do you think the best type of funding is for conservation programs? Why?

25. Is there anything else you’d like to add about the experience of planning and funding your project?
26. Is there anyone else in your field who you think I should speak to?

Thank you for your time! If you have any further questions or comments, please don’t hesitate to contact me by phone or email.
Appendix B: Interview Protocol: Understanding Human-Carnivore Conflict in the Trans-Mara & Mara North Regions of Kenya (Chapter 3)

INTRODUCTION

Hello, we are from the Anne K. Taylor Fund, and we would like to talk to you about your boma and your experiences with wild animals. This information will help us to do a better job of protecting you and your boma from predators.

Now, we would like to ask you some questions about your boma and your experiences with wild animals. You may answer as many questions as you like, and you may stop at any time. There is no compensation for any of this information, nor is there any punishment if you decide not to participate.

Q1. Is this OK? Would you like to participate?

Q2. Has anyone from the Anne K. Taylor Fund ever come to talk to you about your boma before?

Q3. If so, what was your experience like when you met this person?

BASIC INFORMATION

<table>
<thead>
<tr>
<th>Date (day, month, year)</th>
<th>Survey no.</th>
<th>Interviewer s</th>
<th>Wire Present?</th>
<th>Condition of the Boma(s) – See Scorecard Below:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

Boma Scorecard:

(A) Enclosure
Wire Fencing in Excellent Condition, Good Posts & Planks
Wire Fencing in Good Condition, with All Posts or Planks present
Wire Fencing in Fair Condition, Missing Posts or Planks
Wire Fencing in Poor Condition, Broken Posts or Planks
Wire Fencing in Bad Condition, Bad Posts or Planks

(B) Door/Gate
Metal Door, with Door Slab
Wooden Door, with Door Slab
Wooden Door, no Door Slab
No Door; Archway Only
No Archway; Open Space

(C) Roof
Metal or Wire Roof
Thatched Roof
No Roof

(D) Bottom Border
Aluminum or Wire Bottom Border, Buried
Aluminum or Wire Border, Not Buried
No Border, Not Buried
Wire separated from Bottom

(E) Vegetation
Living Thorn Fence, No overhanging trees
Partial Living Thorn Fence, some overhang
No Living Thorn Fence, some overhanging trees
Many overhanging trees

---

109
<table>
<thead>
<tr>
<th>Name of Mzee</th>
<th>Boma GPS Locations:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cow: S: _ _ _ _ _ _ E: _ _ _ _ _ _</td>
</tr>
<tr>
<td>When did this boma get wire? (Year &amp; Month)</td>
<td>Goats: S: _ _ _ _ _ _ E: _ _ _ _ _ _</td>
</tr>
<tr>
<td></td>
<td>Sheep: S: _ _ _ _ _ _ E: _ _ _ _ _ _</td>
</tr>
<tr>
<td></td>
<td>Calves: S: _ _ _ _ _ _ E: _ _ _ _ _ _</td>
</tr>
</tbody>
</table>

### ABOUT THIS BOMA

<table>
<thead>
<tr>
<th>Q5. Interviewee Name</th>
<th>Q6. Age (years)</th>
<th>Q7. Age Group</th>
<th>Q8. Sex</th>
<th>Q9. Ethnic group</th>
<th>Q10. When settled at this boma</th>
<th>Q11. No. bomas owned</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

**Relationship to the mzee:**
- Son
- Wife
- Brother
- Neighbor
- Friend
- Self
- Other (Specify)

**Q12.** How many cattle/smallstock/etc. do you have at this boma right now? How many did you have at the beginning of last year? What has happened to them in the last year?

<table>
<thead>
<tr>
<th></th>
<th>Cattle</th>
<th>Smallstock</th>
<th>Donkeys</th>
<th>Dogs &amp; Cats</th>
<th>Chickens</th>
<th>Bees</th>
</tr>
</thead>
<tbody>
<tr>
<td># in 2014</td>
<td></td>
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<td></td>
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<tr>
<td># in 2013</td>
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<tr>
<td># Sold (Uliuza)</td>
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<tr>
<td># Slaughtered (Ulichinja)</td>
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</tr>
<tr>
<td># Given Away (Ulipeana)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td># Stolen (Kuibiwa)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td># Killed By Predators (Kuwawa na wanyama)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td># Died from Disease (Mgonjwa)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Other Loss (Specify) (Kwa kituigine yeyote)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Q13.** Who usually looks after your stock at this boma? (Laiyoni, morani, elders, self, wife, etc.)

<table>
<thead>
<tr>
<th>Cattle:</th>
<th>lainyoni</th>
<th>morani</th>
<th>elders</th>
<th>self</th>
</tr>
</thead>
<tbody>
<tr>
<td>other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Smallstock:</th>
<th>lainyoni</th>
<th>morani</th>
<th>elders</th>
<th>self</th>
</tr>
</thead>
<tbody>
<tr>
<td>other</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Donkeys:</th>
<th>lainyoni</th>
<th>morani</th>
<th>elders</th>
<th>self</th>
</tr>
</thead>
<tbody>
<tr>
<td>other</td>
<td></td>
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</tbody>
</table>

**Q14.** Who guards your animals at night?

<table>
<thead>
<tr>
<th>Cattle:</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smallstock:</td>
<td>N/A</td>
</tr>
<tr>
<td>Donkeys:</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Is there a guard dog INSIDE of the boma?**

<table>
<thead>
<tr>
<th>Cattle:</th>
<th>Yes</th>
<th>No</th>
<th>Sometimes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Donkey:</td>
<td></td>
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</tbody>
</table>
### Q15. In the last year, have you made any money from:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Yes/No</th>
<th>Ranking (e.g. #1, #2, #3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling/exchanging livestock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selling crops/vegetables/grain</td>
<td></td>
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<tr>
<td>Selling livestock products (e.g. milk, honey, skins)</td>
<td></td>
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<tr>
<td>Tourism</td>
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<tr>
<td>Landholding/Investments</td>
<td></td>
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<tr>
<td>Any Other Activity (Specify)</td>
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</tbody>
</table>

### Q16. IN THE LAST YEAR, have any of your dogs or livestock been attacked by the following animals:

#### Lion (Simba)
- When (year and month if possible)
- Season (dry/wet)
- In bush, or at boma?
- Time of day
- # of Livestock killed? # of Livestock injured?
- Was there a dog with the stock?
- Who was there? Who saw the attack?
- How many were there? Males or Females? How did they attack?
- What happened to the attacking animal?

#### Leopard (Chui)
- When (year and month if possible)
- Season (dry/wet)
- In bush, or at boma?
- Time of day
- # of Livestock killed? # of Livestock injured?
- Was there a dog with the stock?
- Who was there? Who saw the attack?
- How many were there? How did they attack?
- What happened to the attacking animal?
<table>
<thead>
<tr>
<th>Animal (Species)</th>
<th>When (year and month if possible)</th>
<th>Season (dry/wet)</th>
<th>In bush, or at boma?</th>
<th>Time of day</th>
<th># of Livestock killed?</th>
<th># of Livestock injured?</th>
<th>Was there a dog with the stock?</th>
<th>Who was there? Who saw the attack?</th>
<th>How many were there? How did they attack?</th>
<th>What happened to the attacking animal?</th>
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</thead>
<tbody>
<tr>
<td>Hyena (Fisi)</td>
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<tr>
<td>Jackal (Mbweha)</td>
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<tr>
<td>Baboon</td>
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<tr>
<td>Wild Dog (Mbwa mwitu)</td>
<td>When (year and month if possible)</td>
<td>Season (dry/wet)</td>
<td>In bush, or at boma?</td>
<td>Time of day</td>
<td># of Livestock killed?</td>
<td># of Livestock injured?</td>
<td>Was there a dog with the stock?</td>
<td>Who was there? Who saw the attack?</td>
<td>How many were there? How did they attack?</td>
<td>What happened to the attacking animal?</td>
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<tr>
<td>Honey Badger</td>
<td>When (year and month if possible)</td>
<td>Season (dry/wet)</td>
<td>In bush, or at boma?</td>
<td>Time of day</td>
<td># of Livestock killed?</td>
<td># of Livestock injured?</td>
<td>Was there a dog with the stock?</td>
<td>Who was there? Who saw the attack?</td>
<td>How many were there? How did they attack?</td>
<td>What happened to the attacking animal?</td>
</tr>
<tr>
<td>Eagles / Birds of Prey</td>
<td>When (year and month if possible)</td>
<td>Season (dry/wet)</td>
<td>In bush, or at boma?</td>
<td>Time of day</td>
<td># of Livestock killed?</td>
<td># of Livestock injured?</td>
<td>Was there a dog with the stock?</td>
<td>Who was there? Who saw the attack?</td>
<td>How many were there? How did they attack?</td>
<td>What happened to the attacking animal?</td>
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<tr>
<td>Cheetah (Duma)</td>
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<td><strong>When (year and month if possible)</strong></td>
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<tr>
<td><strong>Season (dry/wet)</strong></td>
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<tr>
<td><strong>In bush, or at boma?</strong></td>
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<td><strong>Time of day</strong></td>
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<tr>
<td><strong># of Livestock killed?</strong></td>
<td><strong># of Livestock injured?</strong></td>
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<tr>
<td><strong>Was there a dog with the stock?</strong></td>
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<tr>
<td><strong>Who was there? Who saw the attack?</strong></td>
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<tr>
<td><strong>How many were there? How did they attack?</strong></td>
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<tr>
<td><strong>What happened to the attacking animal?</strong></td>
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</tbody>
</table>

Q19. Have your dogs or livestock ever been attacked by any other animals that we did not mention?

### ALL ABOUT YOUR FAMILY

How many people live in this boma?

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th>Men</th>
<th>Teen Girls</th>
<th>Teen Boys</th>
<th>Girls</th>
<th>Boys</th>
<th>Babies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

Please describe (e.g. My mother, myself, my wife, and my three children live here.)

____________________________________________________________________________________

In the last year, has any person in this boma been injured or attacked by any animal? Please describe:

<table>
<thead>
<tr>
<th>Person’s Age/Gender (e.g. 27/F)</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Animal</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Place of attack (in bush/ around boma?)</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Time of Year (month or season)?</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Time of Day</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>What was the person doing?</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Person injured or killed?</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>What happened to the animal?</th>
<th></th>
</tr>
</thead>
</table>
In the last year, has any person in this boma become sick after being bitten or touched by an animal? Describe:

<table>
<thead>
<tr>
<th>Person’s Age/Gender (e.g. 27/F)</th>
<th>Animal</th>
<th>Type of illness</th>
<th>Time of Year (month or season)?</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

In the last year, has any person in this boma become sick after drinking milk or looking after cattle? Describe:

<table>
<thead>
<tr>
<th>Person’s Age/Gender (e.g. 27/F)</th>
<th>Animal</th>
<th>Type of illness</th>
<th>Time of Year (month or season)?</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

ALL ABOUT WILD ANIMALS

Q26. How long have you lived in this area? From the time you came until now, have any types of animals disappeared? Do you see any animals now that you never saw before?
Q27. Since you came to this boma, are there more or fewer of the following kinds of animals in this area?

<table>
<thead>
<tr>
<th>Animal</th>
<th>Increased</th>
<th>Decreased</th>
<th>Stayed the same</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leopard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheetah</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spotted Hyaena</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African Wild Dog</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jackal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Honey Badger/Ratel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snake</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Q22. Do people in the area around this boma ever have to use poisons or traps to control the numbers of predators here?

<table>
<thead>
<tr>
<th>Q22. Do people in the area around this boma ever have to use poisons or traps to control the numbers of predators here?</th>
<th>Yes/No</th>
<th>If yes, how? Poison, traps?</th>
<th>If no, why not?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q23. Have you ever killed a predator?</td>
<td>Yes/No</td>
<td>If yes, what kinds, how many, and when?</td>
<td></td>
</tr>
</tbody>
</table>

Q24. What do you think is the best way to protect your livestock from predators?

Q25. Would you be interested in wire for your boma? What about for your entire compound?

Q28. Which of these animals do you like the most? Which animals do you like the least? Why?

<table>
<thead>
<tr>
<th>Animal</th>
<th>Lion</th>
<th>Leopard</th>
<th>Cheetah</th>
<th>Spotted Hyaena</th>
<th>African Wild Dog</th>
<th>Jackal</th>
<th>Honey Badger</th>
</tr>
</thead>
</table>
Q29. Can I ask you to look at some pictures with me? Could you tell me if you’ve seen any of these animals?

<table>
<thead>
<tr>
<th>Identification</th>
<th>Don’t know animal</th>
<th>Doesn’t occur here</th>
<th>Which type/subspecies? Last time seen? Where? What sex/age (if known)? What was it doing?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right? Y/N</td>
<td>Species confuse d with</td>
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<tr>
<td>Porcupine</td>
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<tr>
<td>Hare</td>
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<tr>
<td>Bushbaby</td>
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<td>Vervet</td>
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<td>Baboon</td>
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<tr>
<td>Honey Badger</td>
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<tr>
<td>Polecat</td>
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<tr>
<td>Genet</td>
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<tr>
<td>Civet</td>
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<tr>
<td>Mongoose</td>
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<tr>
<td>Jackal</td>
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<tr>
<td>Bat-eared Fox</td>
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<tr>
<td>African Wild Dog</td>
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<tr>
<td>Aardwolf</td>
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<td></td>
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<tr>
<td>Striped Hyaena</td>
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<td></td>
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<tr>
<td>Spotted Hyaena</td>
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<td></td>
<td></td>
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<tr>
<td>Cheetah</td>
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<td></td>
</tr>
<tr>
<td>Leopard</td>
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<td></td>
<td></td>
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<tr>
<td>Serval</td>
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<td></td>
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<tr>
<td>Lion</td>
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<td></td>
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<tr>
<td>Caracal</td>
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<td></td>
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<tr>
<td>White rhinoceros</td>
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<tr>
<td>Zebra</td>
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<tr>
<td>Hippopotamus</td>
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<tr>
<td>Giraffe</td>
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<td>Warthog</td>
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<tr>
<td>Bush Pig</td>
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<tr>
<td>Giant Forest Hog</td>
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<tr>
<td>Aardvark</td>
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<tr>
<td>Wildebeest</td>
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<td>Eland</td>
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<tr>
<td>Cape Buffalo</td>
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<td></td>
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<tr>
<td>Elephant</td>
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</tbody>
</table>
References


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Biography

Alexandra Elizabeth Sutton is a doctoral candidate in the Nicholas School of the Environment at Duke University, where she has completed her research under Professor Stuart Pimm. Alexandra’s research focuses on the human dimensions of global biodiversity conservation – most especially on identifying best practices in conservation leadership, management, and funding/finance. She is also the founder and director of Kedge Conservation, LLC – an environmental consulting organization providing strategy advising to environmental NGOs in the US and Europe while working to improve economic literacy within rural communities of East and Southern Africa.

Alexandra is a native Baltimorean and alumna of the Bryn Mawr School for Girls ('03). She received her undergraduate degree from Howard University (Biology ’07) as an Environmental Biology Scholar, and her master of science from Texas A&M University (Wildlife & Fisheries Science ’09). She is also a former student of the Natural Resources Ecology Laboratory at Colorado State University (2009 – 2010), as well as an alum of the Ecological Society of America’s SEEDS program and the National Science Foundation’s MS PHDs program.

She is also a founding member of the Equity, Inclusion and Diversity Committee within the Society for Conservation Biology, and served for three years as a member of the Governing Board of the International Network for Next Generation Ecologists (INNGE). During her Ph.D., she has received fellowship support from the Explorers Club, Sigma Xi, and Duke University.