Social dimensions of crane and wetland conservation in African rural landscapes: insights from Kenya, Uganda and Zimbabwe

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1

Introduction

Abstract

This chapter posits the Grey Crowned Crane *Balearica regulorum* and the Wattled Crane *Bugeranus carunculatus*, the focal species in this thesis, in the local extinction narrative. It provides an overview of the biology, ecology and conservation status of the two species. It presents an overview of the overall methodological approaches adopted during the research, with specific reference to the integration of social and ecological science in environmental problem analysis and species and habitat conservation planning. Building on the species background and conservation needs, a justification for this thesis and the methodological approaches adopted are presented. A timeline describing the field data collection periods and the thesis structure are also presented.

1.1. Species decline as a global environmental problem

The decline of animal populations in areas that constitute their traditional geographic ranges is a growing global environmental problem (Gardenfors *et al*. 2001; Gaston and Fuller 2007; Pimm *et al*. 2014). If action is not taken to address the causes of the decline, the disappearance of species in defined geographical regions (local extinction) may occur (Harrison 1991; Gaston 2005; Brook *et al*. 2008). Local extinction of animal species has been conceptualised as part of the global problem of biodiversity loss (Pimm *et al*. 1995; Rands *et al*. 2010). Biodiversity loss manifests itself in the form of reduction in plant and animal species diversity and degradation of ecosystems, leading to a reduction in ecosystems' capacity to provide viable wildlife habitats (Orlove and Brush 1996; Trimble *et al.* 2014; Ceausu *et al.* 2015). There is mounting scientific evidence confirming that globally most of the species declines and extensive habitat loss are driven by anthropogenic factors

(Lande 1998; Pimm *et al*. 2014). Therefore, the escalating risk of local extinction of species driven by human activities, under the umbrella of biodiversity loss, calls for research that integrates social and ecological sciences for informed conservation planning (Brechin *et al*. 2002; Gjersten and Barrett 2004; Trimble *et al*. 2014).

1.1.1. Introducing two African crane species facing local extinction

Concern over the likelihood of local extinction of some bird species in Africa became a topical conservation issue at the turn of the century (Fishpool *et al.* 2001, Brooks and Thompson 2001). In the Gruidae (crane) family, two species have been documented as having declined over the past four decades, the Grey Crowned Crane *Balearica regulorum* and the Wattled Crane *Bugeranus carunculatus* (Meine and Archibald 1996; Beilfuss *et al*. 2007; Harris and Mirande 2013). Both species primarily depend on wetlands for breeding. Globally, wetlands are now classified as threatened ecosystems due to the decline in the areal extent and ecological integrity of wetlands (Junk 2002; Davidson 2014). The Grey Crowned Crane is listed as Endangered on the IUCN Red List of Threatened Species of 2018 (hereafter referred to as the IUCN Red List) (BirdLife International 2017a). The Wattled Crane is classified as Vulnerable on the IUCN Red List (BirdLife International 2017a). Based on a species status review conducted in 2012, the Grey Crowned Cranes declined by 80% over 45 years, mainly as a result of habitat loss and removal of birds and eggs from the wild for domestication and illegal trade (BirdLife International 2017a). The Wattled Crane is threatened by habitat loss caused by the alteration of hydrological regimes and vegetation structure of wetlands (Beilfuss *et al*. 2007; BirdLife International 2017b). A downward trend is projected for both Grey Crowned and Wattled Cranes against a backdrop of an escalation of human-induced threats to the species such as drainage and fragmentation of wetlands through agriculture (BirdLife International 2017a, b).

Since the 1980s, African cranes have increasingly attracted the attention of researchers, naturalists, birdwatchers and conservationists (Urban 1988; Meine and Archibald 1996; Harris and Mirande 2013). Results from surveys conducted since then have provided insights into national population sizes and distribution in the species' range countries and informed decisions on areas that were targeted under early crane conservation projects (Beilfuss *et al*. 1996; Beilfuss *et al*. 2007). By the mid-1990s, Grey Crowned and Wattled Cranes had already become focal species of conservation projects in some biogeographical regions within their range (Meine and Archibald 1996). In recent years, cranes have increasingly become flagship species for wetland conservation, providing entry and rallying points for integrated conservation and livelihood projects (Meine and Archibald 1996; Beilfuss *et al*. 2007). This integrated approach was adopted because degradation of wetlands does not only lead to crane habitat loss but also contributes to the loss of ecosystem services that are critical for local communities' food security and income generation (Meine and Archibald 1996; Beilfuss *et al*. 2007).

There are 15 crane species in the world (Harris and Mirande 2013). Six species occur in Africa, namely the Black Crowned Crane *Balearica pavonina*, Blue Crane *Anthropoides paradiseus*, Grey Crowned Crane *Balearica regulorum*, Demoiselle Crane *Anthropoides virgo*, Eurasian Crane *Grus* and the Wattled Crane *Grus carunculatus* (Beilfuss *et al*. 2007*).* Except for the Demoiselle and Eurasian Cranes, the other four species are considered non-migratory (Meine and Archibald 1996). The non-migratory species occur in defined regions and landscapes across the content, although intra- and inter-seasonal movements within the landscapes occur, mainly influenced by variations in food and water availability (Meine and Archibald 1996).

1.1.3. Biology, ecology and distribution of Grey Crowned Cranes

There are two sub-species of the Grey Crowned Cranes, namely *Balearica regulorum* sub-species *gibbericeps* (found in East Africa) and the *Balearica regulorum* sub-species *regulorum* (found in Southern Africa) (Morrison 2015). The Zambezi River is generally considered the geographical boundary separating the two regions in which the two sub-species occur (Morrison 2015).

Photo 1.1: A pair of Grey Crowned Cranes (*Photo credit: Takashi Muramatsu*)

Grey Crowned Cranes utilise mixed wetland-grassland habitats (Meine and Archibald 1996). They breed in shallow wetlands, associated with floodplains, riverbanks and edges of small dams (Pomeroy 1987; Urban 1988). There is evidence that the species can tolerate and adapt to transformed landscapes and cases of successful breeding events have recorded in fragmented wetland patches, including rice fields (Pomeroy 1987; Olupot *et al.* 2009; Morrison 2015). They forage in wetlands, open grasslands, fallow fields, fields where crops have been harvested and newly ploughed fields (Morrison 2015). Their diet comprises grass seeds, small toads and frogs, insects and cereal crop seeds, among others (Muheebwa-Muhoozi 2001; Morrison 2015). They roost either in trees or on the ground near wetlands. Like other crane species, Grey Crowned Cranes form pairs and bond for life and pairs can raise between one and four chicks per year (Meine and Archibald 1996). They start breeding at four or five years of age and their lifespan ranges between 15 and 20 years (Meine and Archibald 1996).

Confirmed through surveys conducted since 2000, East Africa is the stronghold of the Grey Crowned Crane (Beilfuss *et al.* 2007; Morrison 2015). The global distribution of core populations of the species is shown in Fig 1.1. The global population of the species ranges between 26,500 and 33,500 individuals (Morrison 2015). The largest populations are found in Kenya (10,000–12,500 individuals) and Uganda (5,000–8,000 individuals) (BirdLife International 2017a). In the two countries, the species now depends on remnants of wetlands that used to support more than double the current population of the species half a century ago (Pomeroy *pers. comm.* [1]). As shown in Table 1.1., other countries that support sizeable populations are Zambia and South Africa. It is estimated that 200–700 individuals are found in Zimbabwe (Morrison 2015).

[1] Derek Pomeroy is a retired professor of ornithology. He has lived in Uganda and Kenya since the mid-1960s. Apart from conducting pioneering crane surveys to determine the population status and distribution in Kenya and Uganda, he has supervised academic research projects on the biology and ecology of the species since the late 1970s.

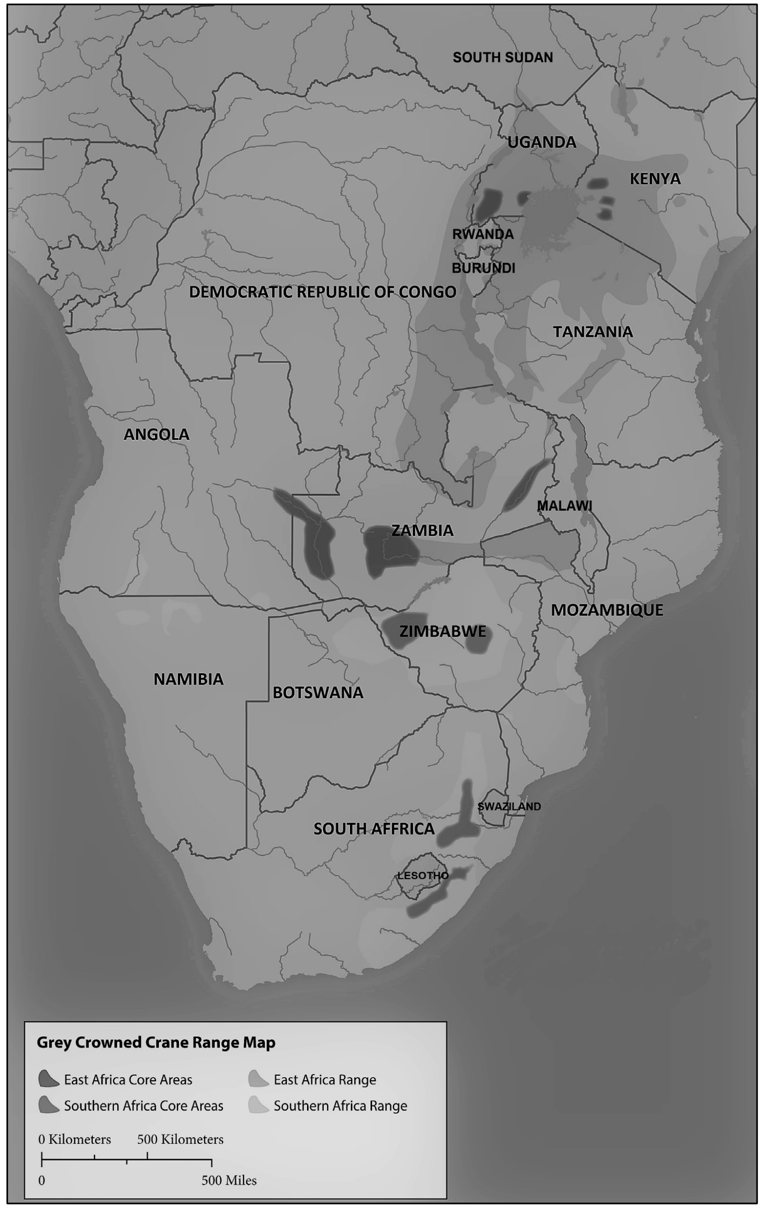

Fig 1.1. Distribution of Grey Crowned Crane populations (Source: Morrison 2015)

Estimates of Grey Crowned Crane populations by country, based on a review conducted in 2013 under the auspices of the African Eurasian Migratory Waterbird Agreement (AEWA), are presented in Table 1.1.

Table 1.1. Estimated populations of the Grey Crowned Crane within its range (Source: Morrison 2015)

Country	**1985 (Urban 1988)**	**2014**
East African Grey Crowned Crane		
Angola	100	0–100
Burundi	<600	10–100
DRC	5,000	300–1,000
Kenya	35,000	10,000–12,500
Malawi	100's	0–100
Northern Mozambique	1,000's	50–100
Rwanda	<1,000	50–500
South Sudan	0	0–10
Tanzania	Low 1,000's	600–1,000
Uganda	35,000	6,500–8,000
Zambia	1,000's	2,000 – 2,500
East African sub-species total	***>90,000***	***19,500 – 26,000***
Southern African Grey Crowned Crane		
Botswana	100	<20
Southern Mozambique	1,000's	>250
Namibia	100	<20
South Africa	Low 1,000's	6,500
Zimbabwe	Several 1,000's	200–700
Southern African sub-species total	***10,000***	***7,000–7,500***
TOTAL	**>100,000**	**26,500–33,500**

1.1.4. Biology, ecology and distribution of Wattled Cranes

The Wattled Crane (*Bugeranus carunculatus*) is the largest and most wetland-dependent of all African cranes (International Crane Foundation 2017).

Photo 1.2: A pair of Wattled Cranes (*Photo credit: Ian N White*)

Wattled Crane breeding pairs are known to defend their territories, which range between 0.25 km^2 and 1.8 km^2 in size (McCann and Benn 2006). The territories comprise an area around nests and surrounding space used for foraging and chick-rearing (Meine and Archibald 1996). They breed in permanently inundated wetlands (often on small islands) covered with short grass, mostly sedges, away from predators (Johnsgard 1983). In Southern Africa, apart from using wetland patches located in large floodplains, they also utilise seasonal wetlands (dambos) and vegetated fringes of small dams for breeding (Meine and Archibald 1996). Although their main food consists of tubers and rhizomes of aquatic plants, mostly sedges and water lilies, found in shallow waters, they also feed on aquatic insects, snails and frogs (Urban 1988). They lay two eggs but, in most cases, they only raise one chick as they tend to abandon the second egg once the first egg has hatched (Meine and Archibald 1996). During the non-breeding season, they form flocks, which facilitates pair formation for young individuals. They start reproducing at the age of seven years and may live up to 30 years (Johnsgard 1983).

Besides the large populations found in floodplains in Botswana, Zambia and Mozambique, small populations occur in scattered wetland systems in Southern African countries, with another isolated population found in Ethiopia (Fig 1.2). A typical example of such small populations is found in Zimbabwe, where an estimated 250 Wattled Cranes occurred in the wild in the late 1980s (Mundy 1989; Mundy *et al*. 2001). The population has declined to less than 200 birds (Beilfuss *et al*. 2007), with over 85% of the population now found in the Driefontein Grasslands, located in the central region of the country, where they share the same habitat with the Grey Crowned Crane (Chirara 2011; Fakarayi 2016).

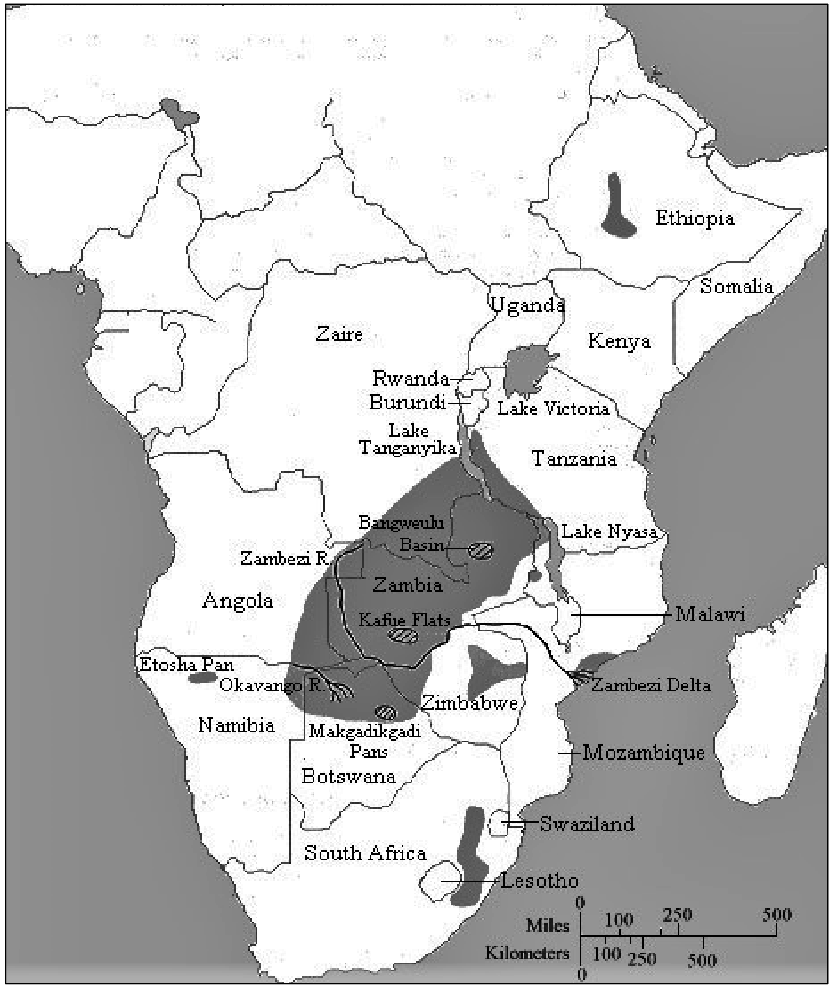

Fig 1.2. Map of Africa showing the distribution of Wattled Crane (Source: Meine and Archibald 1996)

The last global status review of the Wattled Crane was conducted in 2004 and trends in the species' populations since the 1980s are shown in Table 1.2.

Table 1.2. Trends in Wattled Crane populations (Source: Beilfuss *et al*. 2007)

	1985	**1994**	**2004**
Angola	500	500?	<200
Botswana	200	1,400–3,500	1,400
DRC	Several 100s	100s	<300
Ethiopia	100	100s	<200
Malawi	250	50	<20
Mozambique	150	2,500–2,800	350
Namibia	300	200–300	60
South Africa	Several 100s	250–300	250
Tanzania	Several 100s	100s	500
Zambia	11,000	7,000–8,000	<4,500
Zimbabwe	Few 100s	250	200
Total	**13,000–15 000**	**13,000–15,000**	**<8,000**

1.1.5. Human activities as drivers of the decline of cranes

Factors contributing to the decline of Grey Crowned Cranes are linked to human activities (Meine and Archibald 1996; Harris and Mirande 2013; Morrison 2015). This is particularly the case for populations found in rural landscapes within the species' range in East and Southern Africa (Morrison 2015; Pomeroy *pers comm*). In these landscapes, habitat loss, a major contributor to reduced productivity, is driven by various activities undertaken by local communities to meet their livelihood needs, mainly the transformation of wetlands for agriculture and harvesting of wetland plant resources (Harris and Mirande 2013). The species' occurrence in agricultural production landscapes exposes them to persistent disturbance during the breeding season as community members conduct their farming activities, spending extended periods within the vicinity of breeding sites (Morrison 2015). Though this interaction in space and time does not always lead to conflict, cases of mortalities due to poisoning and direct attacks have been reported (Muheebwa-Muhoozi 2004; Olupot *et al*. 2009; Morrison 2015). The ecological requirements of the species are not prioritised in rural land use planning in most range countries, creating a leeway for degradation and fragmentation of crane habitats (Olupot *et al*. 2009; Chirara 2011; Harris and Mirande 2013). Removal of eggs and chicks from the wild for food, domestication and trade has been reported as a major threat to Grey Crowned Cranes in some parts of East Africa (Morrison 2015).

Wattled Cranes are sensitive to human disturbance, especially during the breeding season (BirdLife International 2017b). Breeding pairs may abandon their nests or breeding territories if they are disturbed persistently (Meine and Archibald 1996; McCann and Benn 2006). Although the majority of the Wattled Crane populations are found in protected areas in Southern Africa, mostly in Botswana and Zambia, they are not immune to human-induced threats. Prevalence of threats to Wattled Cranes (egg removal, hunting of adult birds, nest disturbance) potentially linked to local communities traversing into the protected areas, associated with major floodplains in Botswana, Mozambique and Zambia were reported by Beilfuss *et al*. (2003). Land use on privately-owned farmlands and the commons influence the quality, size and availability of habitats for small and isolated populations found in rural landscapes (Fakarayi *et al*. 2016). Apart from human disturbance, the other threats that have been recorded in these agricultural landscapes include modification of wetlands through damming and drainage (Meine and Archibald 1996; McCann and Benn 2006), overgrazing of nesting areas and trampling of nests by livestock (Morrison and van der Spuy 2012; Fakarayi *et al*. 2016), uncontrolled fires destroying nests (Meine and Archibald 1996; Chirara 2011) and the removal of eggs and chicks from the wild for trade (Morrison and van der Spuy 2012).

1.2. Approaches for understanding and addressing species decline

1.2.1. Multidisciplinary approaches to address species decline

Up until the 1970s, assessment of threats to species in landscapes that defined their geographical range primarily involved gathering and analysing biological and ecological knowledge about species and habitats (Soulé 1985; Mascia *et al*. 2003; Drew and Henne 2006). The evolution of conservation biology as a discipline saw the increasing recognition and application of social science principles in threat and habitat assessment to generate knowledge required for conservation planning (Nyhus *et al*. 2002; Drew and Henne 2006). This prompted the wide application of analytical approaches that involve the integration of social and ecological factors in the assessment of direct causes and underlying drivers of species decline, habitat loss and ecosystem degradation (Jacobson and McDuff 1998; Manfredo and Dayer 2004; Walters and Vayda 2009). These analytical approaches are being adopted in recognition of the influence of human and social factors such as environmental perceptions, knowledge and values on species survival and habitat integrity (St John *et al*. 2010; Brooks *et al.* 2013; Villamor *et al*. 2014). These factors, in turn, influence patch- and landscape management decisions and actions that impact species' breeding success, foraging requirements, safety and long-term survival (Lande 1998; Fisher *et al*. 2006; DeFries *et al*. 2007).

1.2.2. Untangling the complexity of social and ecological interactions

The complexity of connections and interactions between social and ecological factors associated with species decline is acknowledged in literature (Hoffman 2004; Bryan *et al*. 2010). The interactions have spatial and temporal dimensions as well as feedback mechanisms that must be understood if efforts to mitigate the problem are to be successful (Tallis and Kareiva 2006; Moran 2010). To untangle the complexity, various frameworks that can be used to conceptualise and analyse direct causes and underlying drivers of species decline have been developed (e.g., Williams *et al*. 2008; Maxim *et al*. 2009). These frameworks are also used to define linkages between human activities behind threats to species and how conservation actions led to threat reduction and ultimately long-term survival of animal populations (Salafsky and Margoluis 1999; Parrish *et al*. 2003).

In most cases, factors contributing to species decline are nested in broader causal chains behind environmental problems extending beyond farm boundaries, watersheds and administrative regions (Poiani *et al*. 2000; Fischer *et al*. 2008). This calls for the recognition of connections between site- and broader landscape-level problems in environmental problem analyses. This also enables the identification of people behind actions (actors), factors that influence the actors' decisions and actions, thereby portraying an array of social causal chains behind an environmental problem, as exemplified by Vayda (1983), De Groot (1992; 1998) and Walters and Vayda (2009). In this regard, species and habitats targeted for conservation can be conceptualised as components within a social-ecological system comprising human communities, natural landscapes, modified landscapes and built infrastructure, among others (Liu 2001; Redman *et al*. 2004).

1.2.3. Balancing human needs and species requirements in human-dominated landscapes

Species conservation projects designed to balance livelihood needs of communities and ecological requirements of species gained recognition in recent years (DeFries *et al*. 2004; Trimble and Aarde 2014). This is linked to the global shift from fortress conservation (state-led, top-down and people-exclusive approaches) to community-based conservation (decentralised, bottom-up and people-centred approaches) (Hackel 1998; Adams and Hulme 2001; Brooks *et al*. 2013). Irrespective of whether the community-based approaches are applied around protected areas or in human-dominated rural landscapes, local communities are placed at the centre in the design, implementation and evaluation of conservation actions, providing platforms for local decision-making and collective action to address threats to species and habitats (Hulme and Murphree 1999; Ruiz-Mallen *et al*. 2015). Species protection and habitat management in human-dominated landscapes entail managing conflicts between wildlife and humans, acknowledging the economic trade-offs associated with creating or maintaining space for wildlife in landscapes used for primary production such as agriculture, fisheries and forestry (DeFries *et al*. 2007; Morrison 2015).

1.2.4. Focus on social dimensions in the evaluation of conservation projects

Acknowledging that they are actors behind threats to species and taking cognisance of their potential role in interventions to address species decline, local communities are recognised as both subjects and participants in the evaluation of conservation initiatives (Waylen *et al*. 2009; Brooks *et al*. 2013). They interact with species and habitats targeted for conservation when they utilise soil, plant and water resources to sustain their livelihoods (Salafsky and Wollenberg 2000; Nepal and Spiteri 2011). The interaction patterns in space and across time scales and impacts on the species are influenced by local resource access, utilisation and management institutions (Colding *et al*. 2003; Persha *et al*. 2011) and local communites' environmental values and attitudes (Mehta and Heinen 2001; Decaro and Stokes 2008).

The success of conservation projects implemented in landscapes inhabited by humans does not only entail achieving the desired threat reduction and species survival goals. It involves taking stock of changes in the socio-economic well-being of communities, success in building local institutions supportive of conservation goals and attainment of pro-conservation attitudes and behaviour among communities in an integrated way (Pejchar *et al*. 2007; Woodhouse *et al*. 2015). These factors, which connect human communities to species and habitats targeted for conservation, are referred to as the social dimensions of conservation (Mascia *et al*. 2003; Knight *et al*. 2010). Social dimensions of conservation also encompass a host of other factors that influence human decisions and actions, including economic motivations (Kabii and Horwitz 2006), moral and ethical standards, legal requirements and learning processes (Brechin *et al*. 2002), rights and traditions (Miller *et al*. 2012), and shared beliefs and pride (Jenks *et al*. 2010). Research to understand the social dimensions of conservation is an entry point for promoting socially acceptable conservation programmes in a wide range of settings (Knight *et al*. 2010). Understanding social dimensions paves way for informed conservation planning, which may involve identifying ways in which local actions to reduce threats to species and habitats can be integrated into local communities' environmental plans, resource use regimes and collective action processes (Salafsky *et al*. 2001; Brooks *et al*. 2013). The level of support and buy-in from community leadership, local administrative authorities and environmental agencies influences the acceptability and sustainability of conservation initiatives and are therefore critical aspects of the social dimensions of conservation (Dixon 2008; Chen *et al*. 2012).

1.3. Relevance of the study

1.3.1. Contextualising the social dimensions of crane conservation

The decline of African crane populations is an environmental phenomenon that warrants investigation. It is critical to conduct research that generates conservation solutions applicable and adaptable in a wide range of social and ecological contexts. If the solutions are to be effective in addressing the decline, the research should focus on the social dimensions of crane conservation. Acknowledging the approaches and trends in conservation planning presented in the previous section, the research could generate empirical evidence on the nature, proximate causes, underlying drivers and impacts of human-crane interactions. This would then enable the systematic and focused design conservation of interventions taking into consideration the various facets of human-crane interactions, including conflict situations. Development of conservation actions informed by findings from assessments of human-wildlife conflicts is increasingly being popularised globally (Bell 1995; Treves *et al*. 2009; Redpath *et al*. 2013). The effectiveness of crane conservation interventions could be enhanced if they are nested in national, regional and global species and habitat conservation frameworks (Steiner *et al*. 2003; Brooks *et al*. 2006).

A significant proportion of landscapes that contain crane breeding and foraging sites lie outside formally protected areas. Most of the landscapes have, in recent decades, undergone transformation due to human activities, most agriculture (Meine and Archibald 1996; Morrison 2015). In East and Southern Africa, cranes interact with humans in undisturbed wetlands, cultivated wetland fringes and agricultural fields located in the uplands (Meine and Archibald 1996). The interactions occur in mosaics comprising grazing areas, crop fields and upland zones where plants and non-timber products are harvested (Beilfuss *et al*. 1996; Muheebwa-Muhoozi 2004; Olupot *et al*. 2009). In most rural landscapes in East and Southern Africa, access to land and associated resources is governed by local rules and national environmental policies (Hulme and Murphree 1999; Nelson and Agrawal 2008). This implies that human-crane interactions in these rural landscapes are influenced by local and national resource management institutions. Whereas the interactions take place at farm or patch level, it is important to consider social and ecological processes that operate at higher geographical scales within watersheds of wetlands and administrative regions. When human-animal interactions are influenced by an array of social and ecological factors operating at different scales, it becomes imperative to adopt threat assessment and conservation planning tools that integrate social science and ecology (Chazdon *et al.* 2009; Dickman 2010; Ban *et al.* 2013).

1.3.2. Justification for selected study sites

This thesis focuses on the social dimensions of crane conservation in rural landscapes in Kenya, Uganda and Zimbabwe. Six landscapes located within the geographical distributions of the two crane species in question, Grey Crowned and Wattled Cranes were selected as the study sites. When this study was conceptualised in 2011, these landscapes were already recognised as core areas supporting globally significant crane populations. They were initially mapped and coded as priority areas for crane conservation during a workshop on African cranes held in August 1993 (Beilfuss *et al.* 1996). Staff from in-country conservation organisations and academics that had conducted surveys and other crane-related research activities in Africa provided the bulk of the data used in the mapping and prioritisation process. Since then, knowledge on the status and distribution of cranes has improved as surveys were held as part of crane conservation projects. Kenya, Uganda and Zimbabwe were examples of countries where such ground-breaking projects were implemented.

The target landscapes were all inhabited by rural communities and had no formal protected area status. This made them suitable sites for conducting social dimensions research, with local communities as the subjects. One of the objectives of the study was to evaluate field approaches and conservation impacts of crane conservation projects implemented at the study sites. Kenya, Uganda and Zimbabwe were therefore chosen as the focal countries recognising that it is where pioneering community-based crane conservation projects had been implemented. Although the figures shown in Tables 1.1 and 1.2 confirm that there were other core areas in other countries, they were not covered in this study mainly because including them would make data collection unsurmountable given the high time and financial requirements for extensive field work. Although the landscapes share a common attribute in that they are inhabited by communities whose livelihoods revolve around crop and livestock farming, the social, cultural, biophysical contexts differ. Focusing on the selected landscapes therefore would make it possible to explore the social dimensions of crane conservation under different social, geographical and eco-hydrological contexts. The wetlands used by cranes in the landscapes varied in terms of type, ecological characteristics, functions and size, making it possible to conduct cross-site comparisons of social dimensions of crane conservation.

1.3.3. Practical relevance of this study

This study was motivated by the need for evidence-based design of crane conservation programmes, building on findings from analyses of human-crane interactions and evaluation of community-based conservation projects. It was a response to a call for comprehensive social dimensions research to generate knowledge to strengthen the African Crane Conservation Programme, a joint initiative between the International Crane Foundation (www.savingcranes.org) and the Endangered Wildlife Trust (www.ewt.org.za). As the leading organisations promoting the development of national crane conservation programmes in Africa, they valued the incorporation of a social science dimension to species conservation action planning. Although some studies had been conducted to draw linkages between threats to cranes and human activities in Kenya, Uganda and Zimbabwe they were not strongly grounded in environmental social science theories. This study was, therefore, necessary to address gaps in knowledge on social dimensions of crane conservation, focusing on countries that supported globally significant populations of cranes. Given that the International Crane Foundation / Endangered Wildlife Trust Partnership and some in-country environmental organisations were already investing funds into site-focused conservation projects, there was the need to determine the effectiveness of field approaches used and overall impacts of the projects on cranes, wetlands and human communities. Such evaluative studies would shed light on the feasibility and effectiveness of community-based conservation approaches that were rooted in local community decision-making and collective actions.

1.4. Research questions addressed

The main goal of this research was to develop a general conceptual conservation model for the conservation of cranes and wetlands applicable in human-dominated landscapes in Africa. This was achieved through the integration of knowledge on patterns and drivers of human-crane interactions and promising developments (bright spots) from the evaluation of site-based crane conservation projects implemented in Kenya, Uganda and Zimbabwe. To achieve the goal, each chapter addresses specific questions on the social dimensions of crane and wetland conservation in rural landscapes in the three countries. The questions are as follows:

1. What are the causal linkages between wetland-based livelihoods, local communities' decision-making frameworks and underlying drivers of Grey Crowned Crane habitat loss in Kenya, Uganda and Zimbabwe? (Chapter 2)

2. How do socio-economic, institutional, cognitive and biophysical factors influence interactions between Wattled Cranes and people in the Driefontein Grasslands, Zimbabwe? What conservation actions can be discerned from an actor-based analysis of human-crane interactions? (Chapter 3)

3. How effective is community-led conservation in the quest to save cranes and secure their habitats, based on project experiences in western Kenya? What lessons for conservation planning can be drawn from the analysis of social processes associated with community-led conservation? (Chapter 4)

4 . How can local institutions be developed and nurtured to protect cranes and secure their habitats? How effective are the local institutions, based on project experiences from southwestern Uganda? (Chapter 5)

5. What lessons can be drawn from the analysis of human-crane interactions and evaluation of crane conservation projects implemented in Kenya, Uganda and Zimbabwe? How can the lessons be integrated to inform conservation planning to save crane populations in human-dominated landscapes? (Chapter 6)

To address these questions systematically and effectively, two methodological frameworks are used. Both offer a set of inter-related concepts that guide the researcher towards a coherent set of phenomena to describe through the field work, such as 'primary actors', 'secondary actors', 'motivations', 'action arenas', 'collective actions' and 'institutional outcomes'. The first framework is the Action-in-Context (AiC) (De Groot 1992), used to analyse social causation chains in problem analysis. It was therefore selected for the research presented in Chapters 2 and 3. The other framework is called Institutional Analysis and Development (IAD) (Ostrom 2011), designed for institutional description and evaluation. It was specifically used in Chapter 5. In Chapter 4, the framework used for the analysis of human-human interactions designed to achieve conservation outcomes has been left more implicit but is anchored in social processes. More information on the frameworks can be found in the specific chapters.

1.5. Fieldwork periods

A significant volume of secondary data was gathered through a review of project reports (unpublished), policy documents and technical reports. Review of these secondary data sources as part of country-level strategic conservation planning was part of my job responsibilities as a coordinator of a regional crane conservation programme between November 2008 and December 2017. The programme's focal countries included Kenya, Uganda and Zimbabwe. The programme was funded and supported technically by the International Crane Foundation/Endangered Wildlife Trust Partnership. My position as a coordinator enabled me to gain access to various unpublished data and project reports compiled by national organisations involved in crane conservation in the three countries. The organisations were: Kipsaina Crane and Wetland Conservation Group (Kenya), Nature Uganda (Uganda) (www: http://www.natureuganda.org) and BirdLife Zimbabwe (Zimbabwe) (www.blz.co.zw). While fulfilling my formal job responsibilities, I had opportunities to visit the crane conservation project sites (defined as study sites in this thesis) where I interacted with government officers, community leaders and wetland users who are cited as respondents in this thesis. These interactions provided me with opportunities to gather complementary data which I used to verify and substantiate primary data collected during the formal data collection periods presented below.

Gathering of primary data required dedicated field work periods during which field observations, as well as individual and group interviews with local people and officials, could be undertaken. Table 1.2 summarizes the periods, major activities undertaken, and the chapters in which the results are presented. All in all, the total period spent in the field amounted to 9.25 months.

Table 1.3 The field work periods, activities undertaken and relevant chapters

Period	Country	Major activities	Chapters
1st week of January – 3rd week of February 2011	Kenya Uganda Zimbabwe	Preliminary assessment of ecological characteristics, social contexts and institutional arrangements at the study sites (required to have a good understanding of the sites to enable me to finalise the research proposal)	Chapters 2 and 3
July 2011	Zimbabwe	Data collection on interactions between cranes and people (interviews and field observations)	Chapters 2 and 3
October 2011	Uganda	Data collection on interactions between cranes and people (interviews and field observations)	Chapter 2
November 2011	Kenya	Data collection on interactions between cranes and people (interviews and field observations)	Chapter 2
March 2012 (2 weeks)	Zimbabwe	Data verification exercise, following up on issues and gaps identified after preliminary analysis of human-crane interactions (interviews and field observations)	Chapter 3
October 2012	Kenya	Preliminary data collection on project thematic focus, mapping the geographical focal area and profiling of target community groups (required for framing research questions)	Chapter 4
Mid-September – mid-October 2013	Uganda	Data collection on institutional development (interviews and field observations)	Chapter 5
Mid-October 2013 – mid-November	Kenya	Data collection on social processes (interviews and field observations)	Chapter 4
Last week of April – Mid- May 2014	Zimbabwe	Routine work visit but used to cross-check data collected in earlier years	Chapters 3 and 6
October 2015	Kenya, Uganda	Routine work visit but used to cross-check data collected in earlier years	Chapters 4, 5 and 6

1.6. Thesis structure

This thesis is an output of research conducted in three laps. First, social causal chains behind threats to cranes and wetlands were analysed. Second, social and institutional processes and associated conservation outcomes under site-focused conservation projects were evaluated. A conceptual conservation model for crane and wetland conservation was developed by integrating knowledge generated through the human-crane interface analysis and the promising field conservation approaches discerned from projects implemented since the early 2000s at the study sites. The outputs of the research are presented in five chapters, structured as follows.

Chapter 1 introduces and contextualises the environmental problem that necessitated this research (the decline of cranes in rural landscapes in Africa). It highlights the importance of understanding the nature and interactions between social and ecological factors in assessing the decline of cranes and the development of conservation solutions. Chapter 2 focuses on one of the major causes of the decline of cranes in rural landscapes, habitat loss, in Kenya, Uganda and Zimbabwe. Chapter 3 contributes to an improved understanding of how socio-economic, institutional, cognitive and biophysical factors influence interactions between Wattled Cranes and humans in a landscape that supports the great majority of Zimbabwe's Wattled Cranes, the Driefontein Grasslands. Chapter 4 draws lessons on the effectiveness of community-led conservation approaches through an evaluation of a renowned initiative in Kenya that has been operational for over 25 years, the Kipsaina Crane and Wetland Conservation Project. Chapter 5 presents the results of an evaluation of the institutional development process and the ensuing environmental conservation impacts at three sites in Uganda where conservation projects were initiated in 2002. Chapter 6 is a synthesis of key findings from the preceding chapters, addressing the question of what works for crane and wetland conservation in rural landscapes in East and Southern Africa.

All chapters were structured in such a way that they could be turned into scientific papers for submission to international journals at a later stage. They, therefore, have their site descriptions, methodology sections and list of references. This leads to an unavoidable slight degree of repetition but also makes them coherently readable as stand-alone contributions.

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