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

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Focus group discussion on human-crane interactions at Chipisa Village, Driefontein Grasslands

Cranes, communities and conservation: Exploring the linkages in the Driefontein Grasslands, Zimbabwe

Abstract

This chapter outlines major human actions that impact Wattled Cranes and their habitats, elaborating the underlying social causations behind the actions. Tenable conservation actions to ensure human-crane coexistence are presented. The actions are rooted in already existing community practices and tenable interventions given the social and biophysical context, acknowledging the role of local communities in addressing the threats to the species and its habitats, are presented.

3.1. Introduction

3.1.1. The Wattled Crane, a species in need of conservation

The most recent review of the status of African cranes by Beilfuss *et al*. (2007) revealed that the Wattled Crane *Bugeranus carunculatus* has declined across much of its range since the 1970s. Classified as Vulnerable on the IUCN Red List, the Wattled Crane is the most wetland-dependent of Africa's crane species (Meine and Archibald 1996). The species' global population ranges between 6,000 and 6,300 individuals, with Zambia supporting the largest population, estimated to be around 4,500 individuals (BirdLife International 2017). Although large populations thrive in major floodplains in Botswana and Zambia, there are small populations that depend on isolated wetlands in human-dominated landscapes in Angola, Mozambique, South Africa, Tanzania and Zimbabwe (Beilfuss *et al*. 2007; BirdLife International 2017).

In Zimbabwe, as in most other countries, data on the species' historical distribution is scant. However, aerial surveys conducted in the early 1980s confirmed the occurrence of flocks and breeding pairs at sites scattered in the country's central watershed (Mundy *et al*. 1984). The total population of Wattled Cranes in the early 1980s was estimated to be around 250 individuals (Irwin 1981) but by the mid-2000s, the number had declined to less than 200 individuals (Beilfuss *et al*. 2007). The species' range has also dwindled, and the largest population is now found in the Driefontein Grasslands, an area inhabited by rural communities resettled in 2002 under the land reform programme (Chirara 2011). Results of ground surveys conducted between 2000 and 2010 by BirdLife Zimbabwe, a bird conservation organisation, showed that the species' population in the Driefontein Grasslands has been declining (Chirara 2011). Results of the surveys are presented in Table 3.1.

Table 3.1. Results of Wattled Crane surveys conducted between 2000 and 2010 (Source: Chirara 2011)

Date of survey	Total number of cranes counted	Number of breeding pairs	Number of chicks	Number of juveniles
October 2000	123	16	3	7
August 2002	37			
April 2002	100			
August –September 2003	55	11		
September –October 2004	138	38		12
November 2005	87	30		9
September 2006	67			
November 2006	72	17		4
June 2007	70	16		4
September 2007	44	13	2	3
July 2008	27	9	2	1
November 2008	46	13		5
April 2009	34	11		5
November 2009	35	10		3
June 2010	37	10		1

The general perception among local birdwatchers, who have been instrumental in collecting crane sightings data since the colonial era, is that the species thrived in relatively undisturbed habitats for decades on commercial cattle ranches in the Driefontein Grasslands before 2000 (Chirara *pers. comm*. 2011; Rockingham-Gill[20] *pers. comm*.). This school of thought portrays human-induced threats emanating from the land reform programme, implemented by the government to redistribute to indigenous communities, as a process that will gradually push the species towards local extinction. In the *Roberts birds of Southern Africa,* Hockey *et al*. (2005) state that the land reform programme made the Zimbabwean Wattled Crane population the most threatened. Concern over the future of the species prompted BirdLife Zimbabwe to initiate a conservation programme in 2002 to sensitise

[20] David Rockingham-Gill is an avid birdwatcher and long-standing member of BirdLife Zimbabwe (formerly Rhodesian Ornithological Society). A former commercial farmer, he developed interest in birds in the 1950s. He has been coordinating waterbird counts across Zimbabwe since the 1980s. Cranes are some of the waterbirds that are counted by birdwatchers every year.

resettled farmers on the need to protect the species and its habitats. Key programme activities implemented included environmental education and conservation awareness targeting schools and the broader community, formation of community groups to assist in spreading crane conservation messages, and the establishment of consolidated community gardens in two villages to discourage the proliferation of scattered household-owned gardens in wetlands containing the species' breeding sites. The organisation also conducts annual crane surveys to determine breeding success and recruitment of chicks into flocks.

A review of BirdLife Zimbabwe's internal project documents (action plans, funding proposals, project reports) revealed that the initial design of its crane and wetland conservation programme was guided largely by expert opinions and theoretical assumptions on patterns and drivers of human-crane interactions. Given that there was no empirical study to gain insight into the social factors that influenced the survival of cranes and the integrity of wetlands before the design of the project, there was the need for the collection and analysis of data to generate contextual evidence upon which crane conservation action could be grounded. In this chapter, this specific objective is tackled in combination with a more general aim, the elucidation of a research approach that provides a strong connection between field realities and conservation action.

3.1.2. What to do - predetermined theories or context-specific learning?

Species and habitat conservation planning can be approached from two lines of reasoning. The first builds on conservation traditions that tend to be strongly paradigmatic or *theory-based*. Thus, we find fortress *vs* community-based conservation, ethics *vs* economics-based conservation (e.g., Payment for Ecosystem Services), socially pessimistic visions (e.g., Hardin 1968) *vs* socially optimistic visions (e.g. Ostrom 1990), etc., and the idea of political ecology that assumes that in the end, all root causes of species decline, and habitat loss are political. The advantage of theory-driven conservation work is that the researcher knows what to look for in problem analysis and the manager knows what to implement to address the problem. For instance, if the problem is people encroaching into habitats and harvesting resources in an unsustainable manner, then the answer is a "fortress". Or if the problem is a lack of economic incentives, the answer is payments. If the local people are unable to implement their good intentions, the answer is community empowerment.

Theory-driven environmental conservation approaches have weaknesses as exemplified by Vayda and Walters (1999) and Walters and Vayda (2009). They may blind the conservation researcher to what really is at stake and thereby mislead the conservation manager or project implementer. In response to this inherent pitfall, there is room to try out *evidence-based* approaches, which are more inductive and allow the researcher to take an open-minded look at local contexts and respond to them in a manner that is more detailed in space and more flexible over time. This resonates with calls for evidence-based conservation (Sutherland *et al*. 2015), whereby context-specific data is used to inform the design, implementation and evaluation of conservation initiatives, paving way for adaptive management. 'Adaptive management' is a term used to express that flexibility that allows continuous monitoring of field realities to resolve the multi-faceted and ever-changing environment-society dilemmas (Armitage *et al*. 2008).

This chapter presents an evidence-based approach, rooted in social causation analysis, focusing largely on the actors' experiences and perspectives, herein referred to as the *actor-based* approach. Actor-based approaches may result in more flexible and efficient conservation management, resilient in the face of uncertainty (Jepson *et al*. 2011; Pahl-Wostl *et al*. 2007). The flipside is that lacking strong theory guidance, it becomes unclear what data to gather data in the field. Should one be purely led by intuition, which may be just as blinding as theories? Vayda and Walters (1999) advocate for analytical techniques that give less precedence to *a priori* judgements, assumptions and theories. To make up for the lack of substantive theory (including prejudice), actor-based approaches require robust methodological frameworks to guide the data gathering and analysis. In the present chapter, one such framework is adopted, without claiming that this framework is in any way superior.

3.1.3. Need for an actor-based approach to developing solutions to challenges affecting cranes

There is a need for species- and habitat-oriented conservation actions informed by a comprehensive understanding of the human-crane interface in the Driefontein Grasslands. There is a dearth of knowledge on how Wattled Cranes populations fare under human-induced threats in rural landscapes, where social factors vary widely. As noted by Hulme and Murphree (1999) and Adams and Hutton (2007), a lack of attention to an array of social factors, community needs and aspirations that shape people's interactions with species and their habitats, makes conservation actions ineffective. This chapter seeks to provide empirical evidence supporting the need to direct efforts at the human dimensions in conservation planning in support of propositions by Manfredo and Dayer (2004) and Treves *et al*. (2006). To this end, and expanding on the basic research question in Chapter

1, the analyses of causal explanations of the human-crane interface in the Driefontein Grasslands were guided by the following research questions:

- What is the nature and periodicity of interactions between Wattled Cranes and people that have negative impacts on the species?
- What are the social causalities underlying the human-crane interactions?
- What are the implications of the findings for human-crane co-existence?

This next section of this chapter covers the biophysical, social-economic and institutional context in the Driefontein Grasslands. The methodological framework is then presented, followed by results of the actor-based analysis of direct and indirect human-crane interactions. Implications of key findings for crane conservation, focusing on opportunities identified to tackle cases of mortalities, low productivity and habitat loss through community involvement are elaborated. As part of the conclusion, insights for species conservation in human-dominated landscapes are presented.

3.2. Methods

3.2.1. Biophysical, social-economic and institutional context

A summary of contextual factors (biophysical characteristics, land use patterns, numbers of cranes environmental history, human settlement and demographic trends, current socio-economic practices) at the study sites summarised below. Some of this background information was obtained from unpublished crane survey results and conservation project reports compiled by BirdLife Zimbabwe. Data on environmental history, cultural history, livelihoods, land ownership, settlement patterns and community development patterns were also collected through interviews with community members and government officers responsible for land management, agriculture and environmental conservation. During field data collection, biophysical characteristics of landscapes around wetlands were observed and documented by the author.

The Driefontein Grasslands are located in central Zimbabwe, straddling the Masvingo, Mashonaland East and Midlands provincial boundaries (Central coordinates: 19° 23′ S, 30° 47′ E) (Fig 3.1). The landscape is characterised by undulating grasslands, seasonal and permanent wetlands (‘dambos’) and acacia and miombo forests (Childes and Mundy 2001). *Hyperrhenia* grass species dominate in the grasslands. In the wetlands, sedges, rushes and typha are common. Fast-draining Kalahari sands are found in the uplands, with greyish silty clays predominating in the wetland zones. The area experiences humid sub-tropical climate characterised by a wet season (November–March), followed by a dry season, which includes a mild winter season between May and August. Features signifying human footprint in the landscape include rural dwellings, small earth dams, agricultural fields in uplands and on wetland fringes and vegetable gardens on river sides. Management of natural resources is governed by state-based environmental regulations and customary institutions.

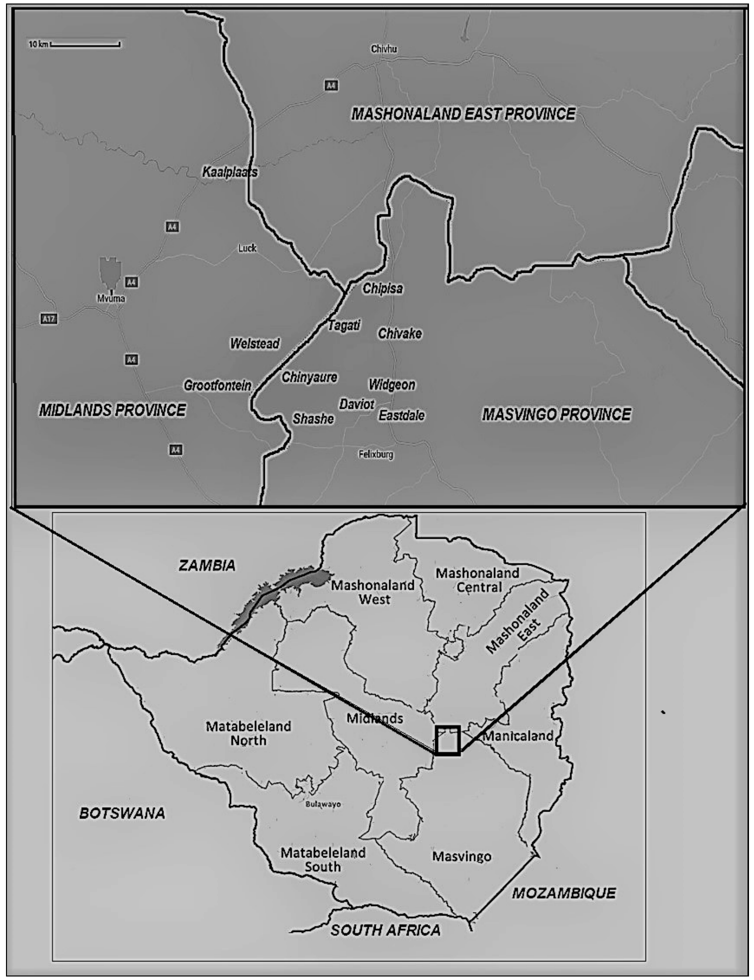

Fig 3.1. Provincial map of Zimbabwe showing the location of the Driefontein Grasslands and villages covered in this study (insert)

Up until 2002, cattle ranches managed by white commercial farmers dominated the landscapes. In that landscape, there are numerous impoundments and marshes used for livestock watering, where Wattled Cranes bred for decades. Land use and ownership patterns changed dramatically when the government-backed fast-track land reform was implemented during 2000–2002. This period saw the resettlement, in the area, of hundreds of black subsistence farmers from neighbouring communal lands and other parts of the district. Farmers produce grain and legume crops during the wet season in the uplands and mainly focus on wetland vegetable production during the dry season, which coincides with the Wattled Cranes' breeding cycle. Water from riverine wetlands, seeps and dams is used for irrigation and livestock watering. Cattle provide draught power and manure and are used as an investment that can be converted to cash when the need arises.

A large part of the study area falls under Ward 1 (local government administrative unit) of the Gutu Rural District Council. It is inhabited by Shona-speaking communities. Seven-member village committees are responsible for enforcing customary rules as well as ensuring that villagers adhere to government regulations. They are also responsible for land allocation and regulating the use of the common grazing areas (wetlands and grasslands) and forests. Streams, roads, paths and forest edges are accepted as landmarks that delineate areas falling under the jurisdiction of the various village committees. Though their work is often constrained by limited resources, extension officers provide technical support to communities on crop production, livestock management and the conservation of grasslands and wetlands. BirdLife Zimbabwe is the only non-governmental organisation that has played a role in sustainable natural resource management, focusing on birds, wetlands and grasslands.

The Driefontein Grasslands are one of Zimbabwe's twenty landscapes recognised as priority areas for bird conservation, Important Bird Areas (Fishpool and Evans 2001). The total mapped by BirdLife International and recognised as providing critical habitat for cranes extends over 20,000 hectares (BirdLife International 2017). It is also one of the few areas in the country where the Wattled Crane shares the same wetland habitats with Grey Crowned Crane *Balearica regulorum*. Riverine wetlands and aquatic zones on the edges of earth dams provide critical breeding habitats for both species. Though Wattled Cranes mainly feed on tubers and rhizomes of sedges and water lilies in wetlands, they also forage in grasslands and cereal stubble in the uplands. Based on unpublished data held by BirdLife Zimbabwe, over 50 wetlands where Wattled Crane pairs have bred since 1996 have been geo-referenced in the area. In the mid-1990s, 40 active nesting sites were counted in the area (Childes and Mundy 2001). However, by 2010, the number was reported to have declined to 25, largely attributed to habitat fragmentation following the resettlement programme (Chirara 2011).

In this chapter, the focal species is the Wattled Crane mainly because it is more sensitive to human disturbance than the Grey Crowned Crane and may even permanently abandon traditional ranges if its preferred habitats are extensively altered (BirdLife International 2017). Since both Wattled and Grey Crowned Cranes use the same wetlands for breeding, measures to prevent habitat degradation, to a great extent, would inherently benefit both species.

3.2.2. Methodological framework

In this study, the Action-in-Context (AiC) framework was used to analyse the human-crane interface. Based on Vayda's (1983) progressive contextualisation concept, the AiC framework was developed by De Groot (1992) as a methodology to analyse the social causal chains behind environmental problems. Its basic principle is that only actors (not social systems, markets or cultures) directly cause social change. Actors are generally defined as individuals, households, communities and organisations that have decision-making capacity and make decisions after considering a host of social, cultural, economic and political factors. Actors may be found at different causal distances from the problem, depending on the length of the causal chain.

AiC-based problem analysis starts with the identification of the problem and the action(s) causing the problem before one ventures into the wider context characterised by actors and underlying factors that influence the actors' decisions. The core of AiC can be presented as a simple triangular structure expressing that actors act the way they do because they have (1) options to act and (2) motivations to act, *cf.* Elster's (1999) 'opportunities' and 'desires' (Fig 3.2). Since motivations may be of any kind (economic, cultural, ethical), AiC represents a broad rational choice actor model.

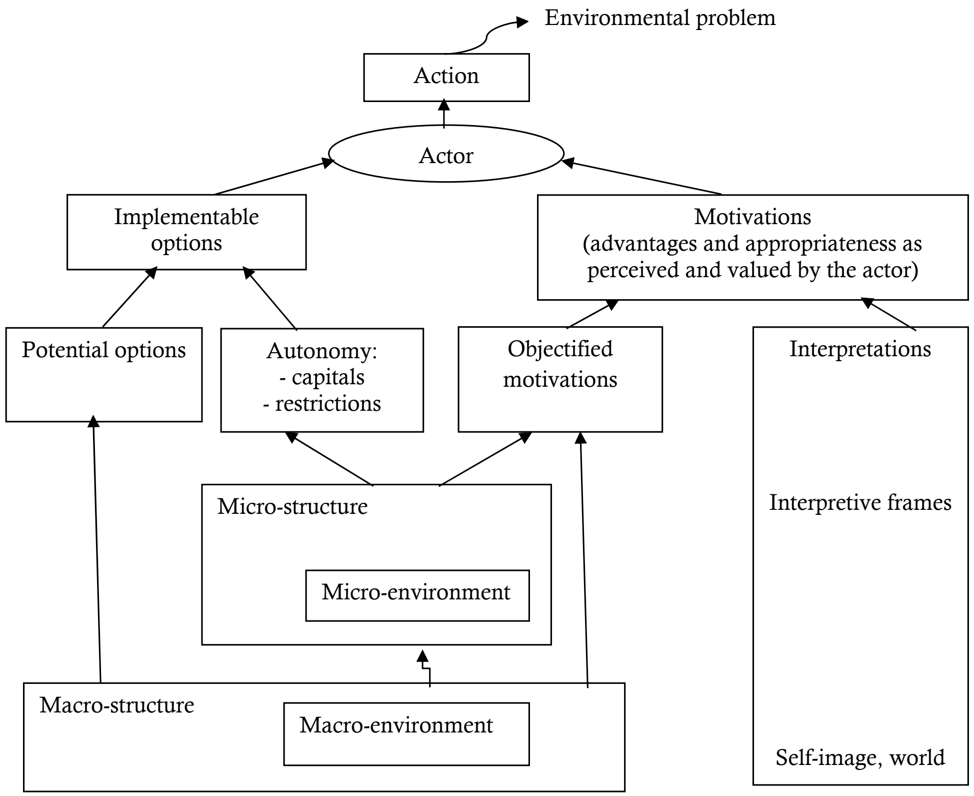

Fig 3.2. Action-in-Context deeper analysis scheme (Source: De Groot 1992)

The AiC provides a structure of 'deeper analysis', in which the options and motivations are broken down first into two elements each, as depicted in Figure 3.2. Actual options (i.e., courses of actions that the actor can readily take) are broken down into potential options and capacities. Capacities determine the difference between potential and actual options and are subdivided into financial capital, social capital and other positive components, *cf.* Bebbington (1999), plus negative components such as restrictions. Thus, if an actor were infinitely rich or powerful, all potential options would be actual options to this actor. Motivations are subdivided into objectified motivations comprising all easily quantifiable choice criteria such as money, hours or calories on the one side, and more cultural interpretations on the other, expressing, for instance, the values attached to the honour, virtues and social norms, etc. Shown in the schematic diagram is the bottom layer that connects these elements to microstructures (e.g., own groups) and macro structures (e.g., markets and society).

In AiC, actors can be connected to each other through 'actors fields'. Actors fields are defined as the causal influence of one actor on the options and/or motivations of another actor. For instance, if the problem is low yields due to poor soil fertility, the farmer is the 'primary actor'. Applying fertilizer is a potential option. If the price of fertilizer is among his motivations to apply it, a government subsidy on fertilizer then is a secondary action and the government establishing the subsidy is the secondary actor, which in turn has its own options and motivations to install the subsidy. If the IMF were to exert influence on the government to abolish all agricultural subsidies, the IMF would be a tertiary actor, again with its own options and motivations (e.g., economistic beliefs). AiC analysis is intimately linked to the design of interventions (policies, conservation, etc.). The actors field analysis generates the options of whom to work with ('target groups', e.g., farmers, government, IMF). The deeper analysis, in its turn, delivers the options for action, e.g., teach more potential options ('extension'), change capacities (micro-credit, 'empowerment'), change objectified motivations (taxes, subsidies, …), change interpretations (norms, appropriateness,). In our analysis here, the focus is on the primary actors and the first layer of the deeper analysis (Fig. 2), with secondary actors mentioned peripherally.

3.2.3. Collation of data on threats to cranes from secondary sources

Human activities in the Driefontein Grasslands that pose threats to Wattled Cranes were initially inventoried building on the species' behavioural responses to human activities summarised by Meine and Archibald (1996). Data on crane mortalities, unsuccessful breeding, nest abandonment, egg loss, habitat alteration and other human-crane conflicts in the Driefontein Grasslands were obtained from BirdLife Zimbabwe crane survey reports for the period 2001–2010. Results of the review of scientific literature and unpublished reports archived at BirdLife Zimbabwe and field observations were used to generate an array of factors that affected the breeding productivity and survival of the Wattled Crane population in the area. A conceptual diagram showing factors affecting cranes was then developed (see Fig 3.3) and used to guide data collection. A field verification exercise was subsequently undertaken through community consultation and personal observation in July 2011. Subsequent visits to the study area over the next three years (2012–2014) were used as opportunities to verify observations on threats to cranes and wetlands, and how they were linked to human actions.

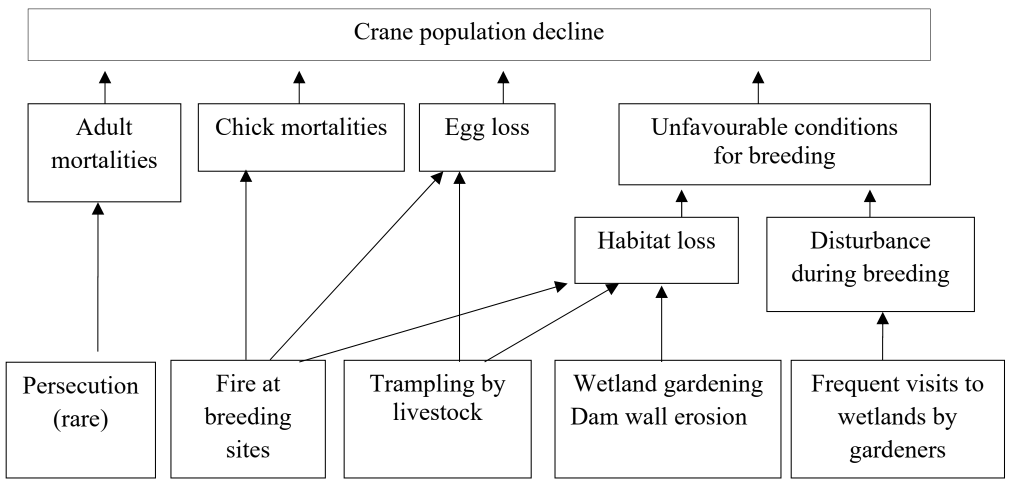

Fig 3.3. Conceptual diagram showing factors affecting cranes used to guide data collection

The factors in boxes in the bottom layer of Fig. 3.3 were used departure points to initiate discussions with respondents.

3.2.4. Field data collection

The bulk of data on human-crane interactions was collected in July 2011. The geographical focus was defined by 11 villages where breeding pairs and flocks had been observed during surveys undertaken since 2000. A purposive sampling approach was adopted to ensure the selection of respondents from villages where incidents of crane harassment and mortalities had been documented by BirdLife Zimbabwe and confirmed by the locals. The villages were Chinyaure, Widgeon, Shashe, Daviot, Eastdale, Chivake, Chipisa, Kaalplaats, Grootfontein, Tagati and Wellstead. In-depth interviews were conducted with all village chairpersons (n=11) and 22 village committee members. The criteria for selecting village committee members was that two members, a man and a woman, were to be randomly selected from each village. In total, 55 community members (22 adult women, 22 adult men, 11 youths) were interviewed. The adult community members were randomly selected, with a target of five people representing different households being chosen from each village. The average number of households per village was 21. Eight of the youths were members of Site Support Groups, teams of young volunteers that were promoting crane conservation with support from BirdLife Zimbabwe. The other three youths were selected because they had previously worked as guides when Zimbabwe Parks and Wildlife Management Authority was conducting crane surveys in the area. Five teachers, focal persons under BirdLife Zimbabwe's environmental education outreach at three secondary and two primary schools located in the study area, were interviewed. Also interviewed were four Agricultural Officers, two Land Officers, two Water Officers and two Environmental Officers and two District Administration Officers and three police officers. Two officers from the Zimbabwe Parks and Wildlife Management Authority and four BirdLife Zimbabwe officers that had previously been involved in crane surveys and awareness activities were interviewed so that they could give accounts of their personal observations of human-crane interactions. Six focus group discussions attended by 10 community members were held in each village. The villages were Chinyaure, Chipisa, Daviot, Grootfontein, Kaalplaats and Shashe. These were the villages where data gaps and issues that needed further investigation were identified after preliminary analyses.

A second round of relatively informal data collection took place in March 2012. This provided an opportunity to observe any impacts of threats documented during the previous year on nest sites. Site Support Group members voluntarily took part in the assessments, involving transect walks along wetlands and visits to crop fields and open grasslands where cranes foraged. Informal interviews, guided by questions posed during the detailed interviews in 2011, were held with 14 community members who were opportunistically encountered during the transect walks.

Interviews with respondents started with general questions about cranes or comments about people's perceptions and experiences with cranes, including threats they had observed. Guided by the AiC deeper analysis scheme, interviewees were then asked to explain the main activity causing the threat under consideration. The discussion would then be broadened to cover other actions and potential options that the community were not undertaking due to lack of capacity or restrictions (policies, standards, customary rules, legal requirements) imposed on them at village and district levels. Discussions on social, financial, political, human, cultural and natural capitals that either enabled or inhibited the adoption of specific options would then follow. Motivations for actions for actual and potential options were discussed in two phases. Quantifiable benefits and costs were discussed first, followed by an assessment of the interpretations (knowledge, norms, values, attitudes, aspirations and beliefs) that explained why certain decisions were made. Questions that were used as a guide in the semi-structured interviews are presented in Box 3.1.

Key questions posed during interviews are presented in Box 3.1.

Box 3.1. Key questions that were used to guide semi-structured interviews and group discussions

1. What human activities degraded wetlands containing crane habitats?
2. How does degradation of wetlands as a result of the activities occur?
3. How does the degradation of wetlands affect cranes (eggs, chicks, adults)?
4. Who are the people behind activities degrading the wetlands?
5. What local conditions, rules and standards govern human activities in wetlands?
6. What economic benefits do wetland users derive when performing activities degrading wetlands?
7. What are the other non-economic motivations for utilising and managing wetlands containing crane sites?
8. What are costs associated with utilising and managing wetlands?
9. What other activities could communities undertake to manage wetlands (that compromise or protect crane habitats?
10. What social, economic, cultural, institutional, political factors influence wetland management and crane survival?
11. Who else (beyond community boundaries) plays a part in deciding how wetlands are utilised and managed?
12. What are their motivations for influencing wetland management?

On average, interviews with individuals took between 60 and 90 minutes. Group discussions, which took up to two hours, were used to verify facts captured during interviews with individuals. In cases where questions were deemed to cause a feeling of incrimination, hypothetical scenarios were used to avoid offending respondents. Most interviews were conducted at the respondents' homesteads. Group discussions were followed by excursions to crane breeding and foraging sites to give discussants opportunities to highlight practical aspects of human-crane interaction mechanisms. Chinyaure, Daviot and Grootfontein group discussants visited wetland and dam sites where cranes breed. In Chinyaure, Shashe and Chipisa, group discussion participants undertook transect walks through a grazing area that had recently been burnt.

Respondents that could not accurately quantify costs and benefits in standard metric units were asked to express them in terms of perceived values or in the local unit of measurement (which were later converted into metric units). Data, captured in the form of short notes, descriptions of phenomena and real-life stories, past events were reviewed at the end of each working day by the researcher and his assistant to identify anomalies, data gaps and convergent ideas. Preliminary analysis of data elicited from primary actors provided insights on the underlying factors and was later used to identify the secondary and tertiary actors. Secondary and tertiary actors were interviewed following the AiC procedure, i.e., identifying selected options, potential options, capitals, restrictions, objectified motivations and interpretations.

During data collection and analysis, the progressive contextualisation process (identifying actors, options and motivations) was ended when there was a convergence of ideas on underlying factors and actors. In other cases, the analysis was stopped when the underlying factors were noted to be beyond the scope of a normal conservation programme or when the cause of certain behaviour was associated with cultural norms or political beliefs. Interview responses were progressively synthesised into AiC schemes during field data collection. The schemas were later refined as part of the inductive analytic processes to discern data patterns, themes and overall implications of the findings.

At each site, this preliminary analysis provided insight into issues that needed verification and further investigation, including divergent and unclear responses to questions presented in Box 3.1. These then became data gaps that were addressed through focus group discussions. An invitation to participate in group discussions was extended household representatives (randomly selected) that had been interviewed, ensuring that there was gender balance. To facilitate focused discussions, participants formed three groups and each group would tackle the questions formulated (by the author) to address the site-specific data gaps. After the discussion, each group shared its points with the rest of the participants. Data gathered through these group discussions was then used to complete the narratives of crane habitat loss, complementing what had been gathered through semi-structured interviews.

3.3. Results

This section gives a synthesis of the major elements of the human-crane interface, with one explicit AiC scheme on wetland gardening (Fig. 3.4) to illustrate the outputs of the AiC-based analysis. For clarity, we present the results based on our field-based classification of factors affecting cranes and their habitats listed below:

i. Disturbance to breeding pairs at sites near wetland gardens,
ii. Habitat fragmentation through wetland gardening,
iii. Community inaction on repair and maintenance of earth dams,
iv. Overgrazing and trampling of breeding sites by livestock, and
v. Ineffective fire management systems affecting crane chicks and nesting sites.

The number of Wattled Crane breeding sites in the study villages where the factors (threats to cranes and their habitats) listed above were prevalent are listed in Table 3.2. This data is based on field observations by the author. The total number of sites surveyed was 25.

Table 3.2. Number of sites where threats to cranes and their habitats were observed

	Threats				
Village	Human disturbance	Habitat fragmentation	Erosion of dam walls	Overgrazing and trampling	Uncontrolled fires
Chinyaure	2	2	1	0	3
Chipisa	1	0	3	1	1
Chivake	0	0	2	1	1
Daviot	2	2	0	1	2
Eastdale	2	2	2	0	2
Grootfontein	2	2	2	2	0
Kaalplaats	0	0	2	1	1
Shashe	2	2	0	0	0
Tagati	0	1	0	1	0
Welstead	0	0	1	2	3
Widgeon	2	2	1	3	1
Totals	**13**	**13**	**14**	**12**	**15**

3.3.1. Human disturbance due to wetland gardening

Wetland gardening affects the Wattled Crane in two ways. First, disturbance to breeding pairs occurs when villagers visit wetlands during the dry season to undertake gardening activities. Establishment of gardens near breeding sites leads to habitat fragmentation, discussed in detail in 3.3.2. As noted in Table 3.2, human disturbance was identified as a threat at 13 sites. Wetland farmers are therefore primary actors in breeding pair disturbance and habitat loss. Proximate factors that influence decision-making by households in the planning and execution of gardening activities are summarised in Fig 3.4. In making calculations to quantify costs and benefits, a standard 100 m^2 garden owned by most households, was considered.

Household members, mostly women and children, make three or four trips per week to gardens located close to breeding sites and spend, on average, two hours working in their gardens. This schedule is followed during the Wattled Cranes' nest-building, incubation and chick-rearing periods. Although adult community members are generally indifferent towards cranes, children are attracted to nest sites by the cranes' imposing size and movements. Respondents reported observing cranes leaving their nests when humans approached garden sites, proving that the gardens are located within the species' alert distance. This temporary nest desertion poses a predation exposure risk for eggs or newly hatched chicks. In Chinyaure and Grootfontein, where gardens are within 50 m of nests, respondents stated that when the number of people at garden sites increased, cranes generally stayed away from their nests for hours.

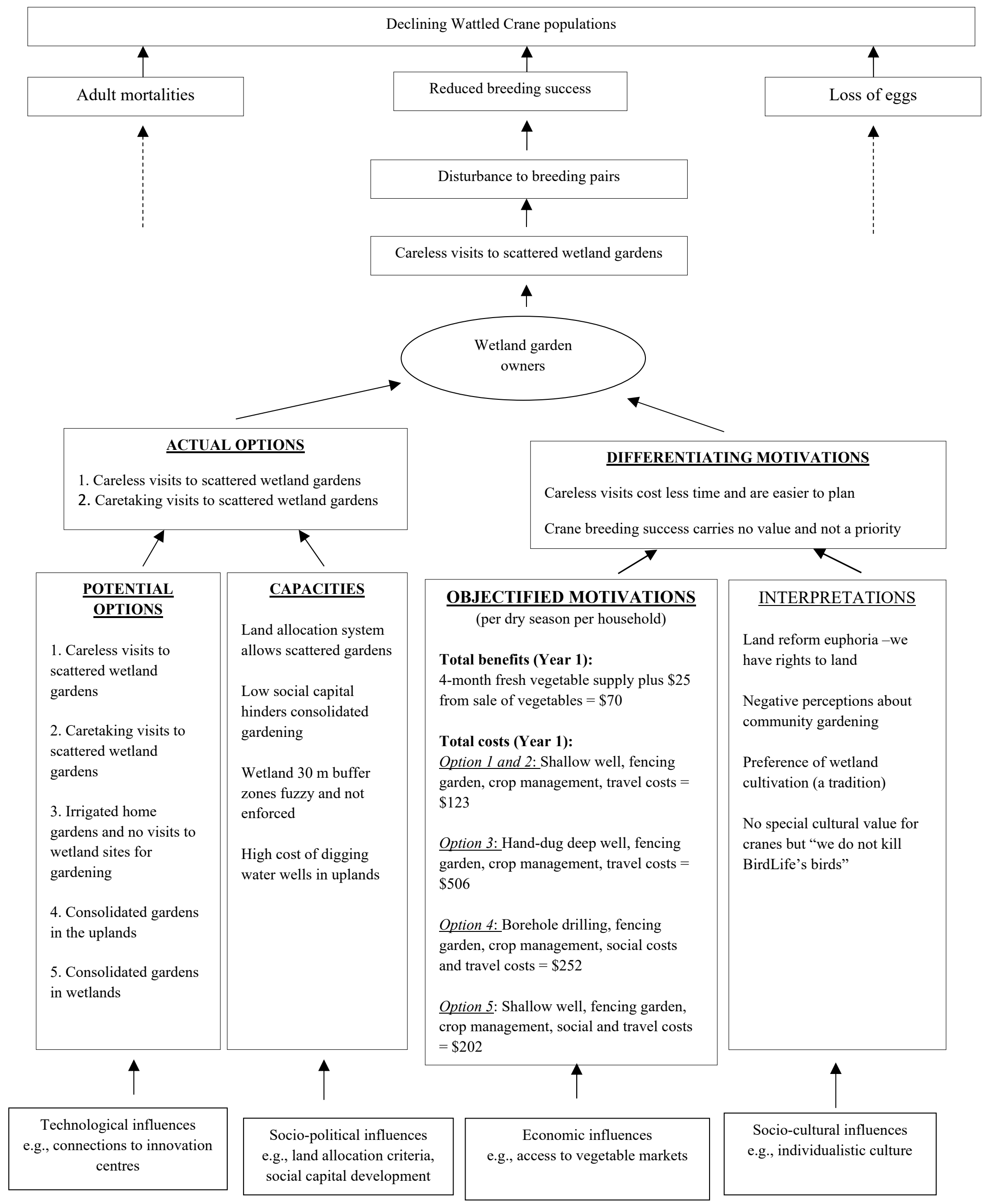

Fig 3.4. AiC deeper analysis diagram showing factors influencing gardening decision-making

The gardening season starts in June-July when flooding in wetlands eases and this coincides with the start of the breeding season of the Wattled Crane. Gardening activities end when the rainy season sets in October. Households do not follow regular gardening schedules. Protracted disturbance to breeding pairs is likely since households visit gardens at different times of the day and on any day of the week. The number of gardening hours depends on the task at hand, but it is common for children to mill around the gardens and sometimes take longer to complete tasks. Although households normally dig shallow wells within the fenced garden, it is also common practice to fetch water for irrigation directly from dams, ponds or streams, adding to crane disturbance.

Also covered in the discussion were community perceptions about the status of cranes in the area and attitudes towards cranes. Whilst the majority believed that cranes were declining, there were some sceptics. During a group discussion in Daviot village, one woman stated that she believed cranes were simply "constantly re-organising themselves since the villagers disturbed them all the time". When explaining community attitudes towards cranes, respondents repeatedly mentioned BirdLife Zimbabwe's crane conservation programme. Although cranes do not have a special role in the lives and culture of the community, cases of attacks and harassment of cranes are rare due to restraint rooted in the social ties between the community and BirdLife Zimbabwe officers that have grown over the past decade. Community members avoid harassing or killing cranes to avoid hurting the feelings of BirdLife Zimbabwe officers. It was common to hear them saying, "*hatiurayi shiri dzeveBirdLife*" (we do not kill BirdLife's birds). Some garden owners wanted to know about the practicability of relocating cranes to another area, where they would not be disturbed by people. Given the opportunity to express their views on their role in conserving cranes, some respondents tended to steer the discussion towards immediate and long-term benefits that would accrue to communities if they protected the species.

3.3.2. Habitat fragmentation through wetland gardening

Habitat fragmentation due to wetland farming was observed at 13 sites. Gardens are scattered around dams and on edges of streams in zones pegged by the Ministry of Lands and Rural Resettlement. No comprehensive assessment of possible impacts of gardening on the ecology and hydrology of wetlands was carried out before the zoning process. A loose guiding principle in the pegging process was that gardens were not to be located within 30 m of wetlands or streams. Vegetation structure around breeding sites is altered when scattered gardens are established on wetland fringes and dam edges.

To secure plots for gardening, households approach the village committee with their request. After being allocated land, they construct a stand-alone garden. Although in some areas, households can establish gardens in the uplands with high water tables, households are driven by presumptive advantages of locating gardens in wetlands. Under the prevailing land tenure system, households own wetland plots and only relinquish them when they decide to emigrate from the village. A household is entitled to one wetland plot. Logs, branches and bark from indigenous trees used for fencing are readily available and therefore households from all wealth classes can establish gardens.

Gardens tend to be located too close to wetland edges because the points from which measurements should be taken when delineating wetland buffers are not clearly defined. Though village committee members claimed to be aware of the physical features delineating gardening zones, an element of subjectivity in defining wetland boundaries was detected during discussions. Though it is common knowledge among community members that cultivating within 30 m of streams or wetlands is prohibited, seasonal water-level fluctuations and vegetation cover changes blur the wetland-grassland boundary. This explains why some gardens and fields for rain-fed crop production are located in seasonal wetlands. Environmental and agricultural extension officers, who are tasked with the responsibility of enforcing wetland conservation regulations, have limited knowledge and skills in wetland delineation.

Village committee members allocate land and are herewith identified to be important secondary actors. They do not get any financial benefits and simply execute their roles to fulfil socio-cultural obligations. Being a village committee member improves one's social status. Except in Wellstead and Grootfontein, village committee members in other villages believed that there were still large tracts of wetland that were unutilised land, open for allocation to prospective residents. Discussions on trends in requests for land over the years and the actual rate of conversion of wetlands to gardens revealed that dozens of households had been allocated wetland plots but were not utilising all their land. This explains the variations in the size of gardens and the patches of untilled land between some gardens.

Most gardens are private because it is a tradition to concentrate on household-based production. However, there are no restrictions that would hinder the establishment of community gardens in the wetland zones designated for gardening or in the uplands. The general perception among villagers, rooted in their experiences with cooperative gardening projects since the 1980s, was that such gardens could only be successfully initiated by an external agency, presumably an NGO or specific government programme facilitating group formation and providing inputs at the inception phase.

Mistrust, high initial social mobilisation and joint planning costs associated with community projects were cited as factors that discourage villagers to initiate community gardening projects. Respondents indicated that households would dedicate the same number of hours to gardening activities under the different gardening options. Walking to and from gardens located in wetlands accounts for 16 hours per season and an additional 9 hours would be added for joint work and group planning activities in the case of community gardens. Working in groups gives farmers greater bargaining power when applying for credit and inputs from lending institutions and government programmes but this appeared not to be a strong motivation for the establishment of community projects.

Results of basic cost-benefit analysis per household of the five types of gardens (presented as potential options in Fig 3.3) for the first year of establishing the garden are shown in Table 3.3. The calculations were based on contextual information provided by communities at the time of data collection. The information includes average shallow well depths, average borehole depths, crop maintenance practices, input costs, time allocated group project activities and average vegetable yields. The results show that establishing household gardens with shallow wells in wetlands is the cheapest option. Although having a garden at home significantly reduces the travel costs, the cost of digging a well in the uplands, normally done through hired labour, is costly for the household.

Table 3.3. Cost-benefit analysis for five types of gardens for the first year

	Options 1 and 2	Option 3	Option 4	Option 5
Costs (Zimbabwe Dollars[21]):				
Digging well (options 1, 2, 3 and 5) / borehole drilling costs (option 4)	2	400	60	2
Fencing materials (tree cutting for options 1, 2 and 3 and purchase of wire for options 4 and 5)	0	0	75	75
Fence erection (100m² for options 1, 2 and 3 and 2000m² community garden for options 4 and 5)	32	32	26	26
Average seed costs per season (Kale seeds = $1.20, Tomato = $1.20)	3	3	3	3
Pesticide (10g sachet of Aphid Kill)	3	3	3	3
Irrigation, crop-bed maintenance and harvesting (2hrs per day x 3 days per week x 14 weeks x $0.8/hr)	67	67	67	67
Planning and social mobilisation	0	0	10	10
Travel costs - walking to and fro the garden	16	1	8	16
Total cost per season	**123**	**506**	**252**	**202**
Benefits (Zimbabwe Dollars):				
Value of fresh vegetables consumed by household over 14 weeks	45	45	45	45
Income from sale of vegetables	25	25	25	25
Total benefit per season	**70**	**70**	**70**	**70**

Notes:
Option 1: 2m deep shallow well in garden, Option 3 = 30m hand-dug deep well in upland, Option 4 = 60m borehole in community garden in upland, Option 5 = 2m deep shallow well in community garden in wetland
Length of gardening season = 105 days
Cost of unskilled labour = $0.80 per hour
Standard size of household garden = 100m²
Standard size of community garden (membership: 20 households) = 2000m²
Total community gardening social mobilisation costs (12hours x $0.802) = $9.62
Average distance from homes to wetlands = 1.2km (takes 14min to walk)
Households consume $0.80 worth of vegetables four days per week for the entire gardening season
Same soil, crop and water management are assumed for the garden options

[21] At the time of data collection, the Zimbabwe was using the US dollar as its official currency

Agricultural and environmental officers provide technical support to households and village committees on land management issues and are therefore both secondary and tertiary actors. BirdLife Zimbabwe was noted to have played a significant role in influencing community attitudes and behaviour towards cranes and as such was identified as a secondary actor. The organisation provided fencing materials used to construct community gardens in Daviot and Shashe in 2004. These were set up as models that could be replicated in other villages to prevent the proliferation of stand-alone, household-managed gardens which exacerbate crane habitat loss. In other parts of the Gutu District, other non-governmental organisations fund joint livelihood projects and, as such, influence local perceptions about how community gardening projects should be initiated, funded and managed.

Despite having been the lead agency responsible for land allocation during the land reform exercise, the Ministry of Lands and Rural Resettlement is not involved in land use monitoring. Extension officers lamented the negative impact of the post-land reform economic downturn on the extension services as the meagre budgets allocated to their departments made it difficult for them to maintain regular contact with farmers and undertake regular land use monitoring. Limited knowledge and technical skills on ecosystem management were noted to have a negative influence on the performance of extension officers when dealing with wetland and grassland management. There was a consensus among respondents that any suggestions that have implications on wetland use and access would be viewed by the political leaders as attempts to reverse the gains of the land reform programme. This explains why extension officers often do not act against households that are tilling within the wetland buffers.

3.3.3. Community inaction on repair of dams used by cranes as breeding sites

Wetlands created by earth dams are critical for Wattled Crane breeding pairs. Dam wall erosion was identified as a phenomenon that affects the water holding capacity of the dams, and hence the vegetation around nesting sites. The dams were built for livestock watering during the era of private commercial cattle ranches, and erosion used to be minimised through the rotation of pastures. They are now open access resources prone to degradation. There were no community-initiated plans to monitor, maintain or repair dams even though the dams supply water for irrigation, construction and livestock. Physical signs of dam wall erosion were observed at 14 of 18 breeding sites associated with earth dams.

Respondents concurred that dam embankments are gradually being eroded due to cattle and humans using the raised embankments when crossing streams and wetlands. Cattle also trample the loose soil on the upstream and downstream sides of dam embankments. At most sites, sandy soil making up the embankments was noted to be prone to erosion when grass cover is reduced during the dry season. Total embankment failure was observed in Grootfontein and Chipisa. Reduced dam capacity due to structural defects as well as trampling of vegetation was reported by dam users in Kaalplaats, Grootfontein and Widgeon.

An average household abstracts approximately 50,000 litres of water from a dam to meet basic needs (irrigation, livestock watering, domestic uses) during the dry season. Knowledge on the steps that should be taken to address the problem of dam wall erosion varied, with some dam users indicating that they were not aware that proactive dam maintenance was necessary. Evidence of futile attempts by villagers to restore damaged embankments was observed in Chipisa, Chinyaure and Grootfontein. In all cases, individuals that repaired the dams failed to convince other community members to participate in the exercise and subsequently dropped the work. Probing to ascertain the government's role in dam maintenance revealed that national water agencies were detached from the community. Community members were not fully conversant with the roles of the agencies. As one agricultural extension said, "the government is yet to give full responsibility for maintenance of dams in former commercial farming areas to a specific agency".

Spatial distribution of dams and their location in relation to homesteads influences the level of dependence on the dam water among households. Respondents affirmed that the community had the capacity (labour and tools) to repair the dams without external support. They indicated that mobilising all villagers to collectively work together to repair eroded dam walls using locally available tools would take up to two days. Estimated time to fill up eroded parts of embankments with soil ranged from one to two days. Given that the rural district council is responsible for coordinating rural development projects, outcomes of previous attempts to engage the council in community projects were elicited. It turned out that water projects implemented by the district council in other areas were donor-funded but the donors' beneficiary selection criteria did not include households resettled under the land reform programme. The donors, mostly non-governmental organisations, were funded by western nations that had raised objections about the way the land reform programme was implemented. Villagers in the Driefontein Grasslands were therefore not eligible for donor support.

Key themes that emerged from the discussions were integrated into two underlying factors. First, as noted earlier, dams were critical common pool resources for villagers but there were no concrete indications of internal organising at community level to address dam wall erosion. In this regard, village committees were identified as important secondary actors. Second, maintenance of dams on former commercial farms was a grey area for the water sector and the government was yet to formally delegate the responsibility of maintaining the dams to a specific agency. Due to structural changes and shifts in mandates of government departments in the post-land reform era, some government agencies were presumed to oversee specific water management issues even though they were not actively involved. For instance, the Irrigation Department of the Ministry of Agriculture was presumed to be responsible for maintenance of all dams in former commercial farming areas. The District Irrigation Officer, like other extension officers, bemoaned the lack of vehicles for transportation to be able to reach out to communities and indicated that, on many occasions, he had to use his resources to make trips to different parts of the district. The department had not undertaken dam repair and maintenance work in any resettlement area in the district.

3.3.4. Overgrazing and trampling around breeding sites

Grazing practices and pasture management during the dry season that lead to overgrazing and trampling of crane breeding sites by livestock, a phenomenon reported at 12 sites during the period 2006–2010, were identified by consolidating personal experiences by livestock owners and herders. They reported that because common access grazing regimes prevail when pastures in the uplands are depleted, cattle frequent the low-lying wetland zones and grassed areas around watering points. They reported that below normal seasonal rainfall had, in the past, caused had early onset of the problem as signs of increased grazing pressure and trampling around dam sites were observed as early as June, a critical month in the breeding cycle of the Wattled Crane. This phenomenon was reported by herders in Widgeon, Grootfontein and Kaalplats.

A common observation among respondents was that overgrazing was an environmental problem ranked lowly by the communities. They attributed this to the general perception that there is abundant grazing land and as a result, they do not pay attention to patch-level vegetation changes. Livestock owners, therefore, do not restrict or monitor their livestock's movements during the day. No community meetings to deliberate on grazing matters were reported. At village level, matters related to livestock grazing during the dry season become topical when the village committee announces a date marking the start of the free-grazing period. The date, which normally falls in the first two weeks of May, is announced when all villagers have finished harvesting their summer crops in the uplands. This coincides with the start of the Wattled Crane breeding season. There were no mechanisms to replace, repair and maintain fences that were previously used by commercial cattle producers to facilitate rotational grazing. In Daviot, Widgeon, Shashe and Chinyaure, old fences were moved to demarcate grazing zones and to isolate crop fields. Although, to a notable extent, village-based informal regulations to avoid vandalising fences have been effective, overall, the current fencing patterns do not restrict the movement of livestock through areas that contain crane breeding sites.

The majority of respondents complained that the Livestock Production Department did not offer technical advice on grazing management. The Livestock Production Department's one-officer-per-district policy was cited as a major impediment to effective extension service as the officers are overwhelmed and do not have the capacity to cover the entire district. The officers were said to be only active in animal disease control programmes as it was a national priority. A sizeable number of households were previously members of community grazing schemes before the land reform programme but hinted that they had not initiated such projects in the Driefontein Grasslands as pastures were abundant, as opposed to the perennially overgrazed pastures they had had in their old villages.

3.3.5. Ineffective fire management systems affecting crane chicks and nesting sites

Records supplied by BirdLife Zimbabwe confirmed that 16 breeding sites had been affected by uncontrolled fire during the period 2003–2010. Most of these fires had mainly been started by the resettled farmers when clearing grassed patches before they establish new gardens or dryland fields. Other common causes of fire included careless dumping of hot ashes around homesteads and careless use of fire by community members when extracting honey from beehives. Suspected cases of hunters that started fires to clear grasses to be able to spot animals easily were reported and so were fires started by naughty children. When they settled in the area, communities did not maintain the firebreaks that existed before 2002 and as a result, when a fire breaks out, it spreads unchecked across grasslands and seasonal wetlands. Apart from posing a risk to the crane nesting sites located in seasonal wetlands, fire could also lead to mortalities of unfledged chicks. Cases of fire incidents that affected crane breeding sites were confirmed in Chinyaure, Widgeon, Eastdale and Chivake. Most fires that had devastated wetlands had occurred between August and October but incidents of fires in June and July were reported.

All villages resort to reactive firefighting. Although village committees always devise strategies to extinguish fires, detection and firefighting team mobilisation times vary and, in most cases, collective action to extinguish fires only starts when fire has spread extensively. Average time costs associated with the current fire management systems are presented in Table 3.3. Despite it being common knowledge that if a fire starts in one village, it invariably spreads to other villages, no formal community meetings are held to enhance collaboration when fighting fires. The maximum distance that the community members are willing to walk to take part in firefighting is 3 km. All the same, some informal communication channels within and between villages exist. This explains why almost all causes and origins of fires always become public knowledge. Respondents bemoaned the social complexities associated with acting against individuals that started fires in their villages. They feared retribution and risked having sour relations with friends and neighbours if they reported the culprits to the authorities.

Table 3.4. Average time costs associated with current fire management systems

<table>
<tr><th colspan="2">Activity</th><th>Time (minutes)</th></tr>
<tr><td colspan="2">Time to mobilise village members to form firefighting teams</td><td>30</td></tr>
<tr><td colspan="2">Time to walk from homestead to area affected by fire</td><td>5–30</td></tr>
<tr><td rowspan="3">Time taken to extinguish fire based on experiential knowledge (for a team of 20 people)</td><td>When fire is observed within 30 minutes after breaking out</td><td>60</td></tr>
<tr><td>Moderate fire</td><td>120</td></tr>
<tr><td>When fire has spread extensively</td><td>180 or longer</td></tr>
</table>

Roads, tracks and seasonal streams, physical features that could potentially act as firebreaks, have on several occasions not been effective in stopping fires. Although no formal cross-village meetings to deliberate on fire management issues are held, village-level norms and structures to facilitate firefighting exist. As the village chairperson of Chinyaure explained, "a fire outbreak is like a funeral because every adult is compelled to act regardless of their personal circumstances and commitments". There is a social norm that binds every community member over the age of 14 years to take part in firefighting when the need arises. Asked about the triggers of community action in the event of a fire, the response was that whenever they observed smoke in wetlands or grasslands, villagers check and if the fire is unattended, they mobilise each other. General landscapes that should be protected against fire, are known to the community. Cited among the infrastructure and resources that the community protects against fire were gardens, grazing areas and any structures near homesteads constructed with combustible materials. Also known were specific patches within grassland and wetland landscapes that, if threatened by fire, would instantly trigger action by the household from a specific section of the village. For instance, villagers in Chinyaure indicated that they would act if fires spreading from the Widgeon side crossed over the Shashe stream since most of their gardens are located on the edges of the stream. On a positive note, through BirdLife Zimbabwe's outreach, community members in Chinyaure, Daviot and Widgeon were increasingly making it a priority to prevent fires from spreading to wetlands containing crane breeding sites. This pro-crane conservation development was led by Site Support Group members, village-based teams formed by BirdLife Zimbabwe to champion crane and wetland conservation.

Potential ways in which the community could act to address the problem of ineffective fire management systems were discussed. Topical among the suggestions put forward by respondents were (a) development of community-based fire management systems (social networks, controlled burns, fire guards), (b) imposition of stricter measures to penalise community members responsible for starting fires, and (c) engaging the rural district authorities to focus their attention on local-level capacity building. The options were discussed to scrutinize the opportunities and challenges of strengthening common property resource management systems.

The biggest setback, according to the majority of respondents, is that penalties for causing fires are seldom enforced by the responsible authorities, the police and the district authorities. Village committees and the rural district council were identified as secondary actors here. Rural district council by-laws stipulate that individuals that start fires should pay is $2 for every hectare burnt. According to the Agricultural Extension Supervisor, fires affected between 5,000 and 10,000 hectares every year. Respondents concurred that even if the by-laws were to be strictly enforced, the amounts to be paid by culprits would be higher than the average annual income for the majority of villagers.

Hence, system of fines is considered by the community as one of many by-laws that exist on only paper and not enforceable. Even though village committees carry out informal investigations to determine the origins of fires, they have no mandate to apprehend or fine the culprits. They resort to reporting the cases to the police and the rural district council.

3.4. Implications for human-crane coexistence

This study sheds light on the interactions between cranes and humans in a landscape where the human footprint became increasingly pronounced following a government-backed resettlement programme. Spatial and temporal human-crane interaction patterns evolved as the resettled communities adopted crop and livestock farming routines, utilised water from man-made dams and developed systems for managing shared natural resources such as wetlands and grazing lands. Positive attitudes towards cranes also emerged as community members interacted and built social ties with BirdLife Zimbabwe's crane conservation project facilitators.

Studies on human-wildlife interactions reveal processes through which threats to species and habitats manifest themselves, generating insights for strategic entry points for developing appropriate conservation solutions (Dickman 2010; Redpath *et al*. 2013). To develop effective solutions, it is also important to look beyond human-wildlife interface to factor in human-human interactions and ensuing relationships that aid or constraint species survival (Madden 2004; Marchini 2014). This study fulfilled these two foundational conservation planning requirements. Findings of human-wildlife interactions have been used successfully used to develop threat reduction pathways, including social and ecological conditions necessary for human-wildlife coexistence (Madden 2004; Carter *et al*. 2012). Building on these broad methodological considerations, it is possible to discern the implications for the coexistence of Wattled Cranes and local communities in the Driefontein Grasslands from the findings presented in the previous section. These implications, framed as generic conservation approaches and interventions that prevent local extinction of Wattled Cranes in the face of human-induced threats, are presented in this section.

When framing tenable conservation interventions, it is important to note that long-term survival of Wattled Cranes in the Driefontein Grasslands hinges on local communities accommodating species in space and across temporal patterns, while taking action to address threats identified in this study. It is therefore important to explore practical mechanisms through which human-crane coexistence could be achieved. Options for achieving human-wildlife coexistence by applying principles of "land-sharing" with and "land-sparing" for species of conservation concern have been proposed (Kremen 2015; Shackelford *et al*. (2015). Although such land management practices, planned with wildlife in mind, may contribute to the maintenance of suitable habitats for the target species, they need to be complemented by a positive species protection ethic among local communities, a key contributor to effective conservation outcomes (Paterson 2006; Hare *et al*. 2018). Accordingly, a holistic conservation solution to the host of threats affecting cranes in the Driefontein Grasslands would therefore involve the integration of land management systems that factor in the ecological requirements of Wattled Cranes blended with the promotion of positive values and attitudes to ensure that the species is protected when breeding, foraging and roosting. As the study findings show, current land management systems do not include strong elements of crane breeding habitat protection which is required to ensure the long-term survival of the species in the area. This highlights the need to define practical crane-focused conservation actions implementable at farm and site levels, bearing in mind that actions have to be acceptable to local communities.

The need to integrate knowledge drawn from ecology and social sciences when resolving conflict associated with human-wildlife interactions is recognised globally (e.g., Hill 2004; Riley 2007; White and Ward 2011). This has given rise to conservation approaches that factor in community practices, values, norms and perceptions in the quest to ensure the survival of species and maintenance of habitats (Reyers *et al*. 2010; Bennett *et al*. 2018). Actor-based analyses used in this study led to the identification of socio-psychological factors, such as land use preferences, entitlements, responsibilities and returns concerning the management of wetland resources. Understanding the interplay between local institutional arrangements and livelihood strategies and resultant influence on natural resource management is critical (Hulme and Murphree 1999; Fabricius 2007). Implications for human-crane coexistence presented below were conceptualised acknowledging that the need to integrate the ecological requirements of cranes and livelihood practices of the local communities.

Understanding broad range of motivations for conservation action by individuals, households and community groups is a key aspect of contemporary conservation (Kabii and Horwitz 2006; Dearborn and Kark 2009). As argued by Haggith *et al*. (2003) and Zafirovski (2003), human behaviours that have implications on environmental conservation should be analysed from both economic and non-economic perspectives. This study shows that though the quest to meet basic household needs is a key determinant in household decision-making, socio-cultural and socio-political structures and processes also have a profound influence. Therefore, a portfolio of interventions addressing a full range of livelihood-related, cognitive, cultural and institutional factors should be developed to secure long-term community involvement in conservation action. This recommendation is in line with the concept of creating refuges for the long-term survival of cranes in human-dominated landscapes, by not just creating physical space for the species but cultural space as well, building the species into the communities' narratives of sense of place and belonging (Miller 2005; Hausman *et al*. 2015).

The need for identifying entry points to help the conservation facilitator and communities to develop a common ground has been highlighted in contemporary conservation planning (Foli *et al*. 2014; Weeks *et al*. 2014). This study revealed entry points that could be leveraged to develop a network of patches that provide suitable breeding habitat for cranes, involving local communities in the process. They include inherent land allocation and wetland management practices that leave space used by cranes for breeding and positive attitudes that emerged as outcomes of a crane conservation awareness programme. As noted by Colding and Folke (1997) and McNeely and Schroth (2006), inherent community beliefs and practices that contribute to habitat protection and species survival, rooted in customary systems or state-enforced policies, can be used to demonstrate the feasibility of human-wildlife coexistence. In the case at hand, a land allocation system that inadvertently leaves distinct wetland patches unconverted offers hope for the species. Although cranes are already using the patches for breeding, there is a need to intentionally incorporate the ecological requirements of cranes in farm- and village land use planning, even if it means doing so informally initially. Advocating for wetland management systems that solely give precedence to crane requirements at the expense of livelihoods would be analogous to promoting fortress conservation, which has been noted to be problematic as it alienates local communities (Hulme and Murphree 1999; Berkes 2007). It is therefore worthwhile to negotiate and facilitate the incorporation of crane conservation matters into village land use plans and strengthen inherent pro-crane conservation practices such as the prioritisation of wetlands as zones that require protection in the event of a fire outbreak. From a resource governance perspective, social control mechanisms enforced by village committees seem to be strong enough and implicitly suppress haphazard encroachment into parts of wetlands that are important for cranes. Given that areas earmarked for gardening and grazing are already defined, a window of opportunity to influence future land use patterns exists for the benefit of cranes, building on landscape management mechanisms that have evolved since the communities were resettled in the area. Mapping current and projected land use patterns, involving local community leadership structures, about active and potential crane breeding sites could provide insights on wetlands that should be managed with the intention to secure crane breeding sites.

Community attitudes towards cranes that reflect positive neutrality ("*we do not harm cranes, but they would be better off if relocated to another place*") and altruism ("*we do not harm BirdLife's birds*") are the second entry point. These positive attitudes evolved through interactions with conservation facilitators and the community which, in turn, contributed to the emergence of a common understanding around the need to protect cranes. Such human-human relationships are a necessary condition for the success of conservation projects facilitated by governmental and non-governmental organisations (Madden 2004; Nyhus 2016). This points to the need for the facilitators (in this case BirdLife Zimbabwe staff) to remain relevant, reputable and socially connected to the community. The emergence of positive attitudes towards cranes, spurred by BirdLife Zimbabwe initiatives also highlights the feasibility of building attachment to species and shared symbolic values of landscapes and habitats thereof. These cognitive outcomes could be strengthened through educative and celebratory events that entrench a sense of pride, common identity as custodians of cranes and enjoyable collective memories for the communities. Such events could either coincide with specific phases in the Wattled Cranes' breeding and flocking cycles or be tied to specific conservation successes such as the successful fledging of chicks. It is also logical to have simple rewarding techniques (e.g., certificates of appreciation; prizes; educational trips for children; festivals to celebrate cranes) to acknowledge individuals and groups that champion pro-crane conservation behaviour. These approaches, which lead to collective inspiration of communities, have been used to protect threatened species in human-dominated landscapes (e.g., Bowen-Jones and Entwistle 2002; Van der Ploeg *et al*. 2011; DeWan *et al*. 2013).

Having defined two entry points, the next step is to focus on defining ways to addressing factors contributing to the degradation of crane habitats. In this regard, one pertinent issue that warrants attention is the lack of social capital to address common environmental problems. Although evidence of social capital in village-based fire management was documented, communities were not united in action to address dam wall erosion. Although they attached the same socioeconomic values to dams, the initiative to take collective responsibility to repair the eroded walls or put in place mitigating measures in anticipation of possible erosion was lacking. Evidence of conservation projects, facilitated by non-governmental organisations, successfully triggering social capital building processes at community level leading to positive livelihoods and conservation outcomes, have been documented (Lansig 2009; Nath *et al*. 2010). The thrust of such processes is on creating platforms for communities to appreciate benefits that accrue from collective action in natural resource management. In the Driefontein Grasslands, it would entail working with the communities to demonstrate the success of community-driven solutions to local environmental problems (self-efficacy) while at the same time opening new communication lines among relevant actors identified during the analysis. Acceptability and effectiveness of ecosystem restoration projects are both enhanced if the initiatives are designed to tangibly restore declining ecosystem services that are collectively valued by local stakeholders (Clewell and Aronson 2005; Aronson *et al*. 2006). To address dam wall erosion, it is important to facilitate unity and common purpose among local communities (bonding social capital) and create platforms for connecting communities to relevant service providers (bridging social capital).

Given that some of the threats to cranes documented in this study can be attributed to common practices by individuals and households from different villages, it is important to place the community (cluster of villages) as the broad social unit around which conservation interventions are planned. However, experiences from some field projects have shown that greater conservation impact is attained through intentional targeting of specific primary actors behind threats to species and habitats (Hermans 2008; Jepson *et al*. 2011). In this case, engaging individuals, households and sub-groups within the community behind threats identified through the actor-based analysis is imperative. Engaging the right actors provides a sound basis to linking actions to threat reduction, making conservation impacts trackable, generating evidence-based lessons. Already, two community gardening projects established in Daviot and Shashe are widely cited by the communities as their desirable options for balancing livelihoods and conservation. This acknowledgement of compatibility between specific livelihood interventions and conservation actions could form the basis of species and habitat stewardship ethic which spurs communities to exercise restraint to avoid harm to species and avoid practices that degrade habitats collectively (Roach *et al*. 2006; Raymond *et al*. 2016). It would also be logical to consider targeting specific clusters of households to address specific threats that emanate from their collective use of wetland resources (e.g., households using one dam site). Active involvement of primary actors to enable them to appreciate and track the linkages between their collective environmental actions and species conservation is critical in line with emerging community-based monitoring principles (Conrad and Hilchey 2011; Sheil *et al*. 2015). To this end, community-based monitoring of simple but specific conservation impact indicators such as nesting success, chick survival and fledging success could be promoted.

Competition between cranes and humans for space in wetlands will remain a challenge in the Driefontein Grasslands, as the demand for arable escalates due to human population increase. While it makes sense to invest in conservation interventions that leave or maintain suitable habitats for cranes as elaborated earlier, it is worthwhile to promote innovation in land use and water utilisation to chart new pathways for securing crane habitats. Actor-based analyses revealed that households make decisions on wetland gardening after considering the availability of raw materials, labour requirements and market-related factors. Unfortunately, the decisions they make regarding wetland utilisation have negative impacts on cranes and their habitats. This points to the need to explore innovative technological solutions to not only reduce pressure on the wetlands but reduced excursions into wetland areas. Technological innovations to improve water use efficiency are a practical option that farmers could adopt. Cost-benefit analyses of four gardening options showed that switching to homestead gardens would translate into increased disposable time for households. Although the initial cost would be high, if drip irrigation technologies were introduced in homestead gardens, for instance, the annual operational costs of gardening would be significantly reduced. The process of introducing such technologies would inherently entail changing mindsets about gardening (social innovation) for local communities to realise a wide spectrum of livelihoods currently overdriven by traditional practices and beliefs. Such innovative approaches that contribute to improved resource use efficiency, increased productivity and reduced human footprint on ecosystems as a response to environmental change are gaining prominence globally (Kitzes *et al*. 2008; Scherr and McNeely 2007). These innovations would need to be promoted across the landscapes where cranes are found through the promotion of participatory social learning and experimentation.

The conservation interventions proposed above are, by no means, exhaustive. They illustrate the general gist of actions that typically emanate from the actor-based approach. The proposed actor enjoyment approaches provide platforms for building on incremental site- or village level successes in a cost-effective manner and creating room for external project facilitators and communities to adapt, build trust and develop common long-term visions for creating a multifunctional landscape that meets the needs of communities and secures the future of cranes. This is in line with recommendations by Zanen and De Groot (1991), Bouwen and Tailleu (2004) and Armitage *et al*. (2008) for enhancing participation and shared learning in natural resource management in rural communities.

3.5. Conclusions

Since the early 2000s, when the Driefontein Grasslands were targeted for resettlement, patterns of direct and indirect interactions between Wattled Cranes and people have evolved. The interactions have spatial and temporal dimensions that are mainly influenced by livelihood practices (gardening and livestock rearing routines), conservation values and attitudes towards species (liked BirdLife Zimbabwe's conservation outreach) and local resource management institutions (rooted in customary and political systems). Evidently, species is not associated with any negative phenomena that may create negative attitudes among local communities. However, the species' survival is impinged upon by poor land management practices (unregulated grazing), negative environmental behaviour (setting fires recklessly) and community inaction (no dam maintenance and rehabilitation) that contributes to habitat degradation during the nesting and chick-rearing stages.

This chapter presents an integrated conservation research and planning approach, the first to be applied in a landscape that supports nationally significant Wattled Crane populations, to gain a better contextual understanding of the social causation chains behind threats to the species and its habitats. The methodological approach provides a platform for stakeholders (primary actors and relevant agencies) to define key tenets of conservation interventions, building on existing social capital and acknowledging the role of government agencies and other external organisations. The findings demonstrate that gaps in conservation programmes and, by extension, actions that may not be properly aligned with the required threat reduction processes for effective species and habitat conservation can be identified through the approach. The chapter also highlights some of the methodological disconnects that may arise if species and habitat conservation planning are solely rooted in theory-based approaches without taking due cognisance of the local context. The findings point to the need for framing conservation actions in such a way that they are linked to processes for reducing threats to species and habitats, leveraging inherent opportunities in local institutional frameworks and communities' conservation attitudes. As this study demonstrates, all these insights for evidence-based conservation planning can be drawn from rich narratives provided by primary and secondary actors.

One central methodological contribution of this study is that it confirms that isolating each interface mechanism exposes a broad spectrum of opportunities, requirements, costs, expectations, risks and constraints, thereby giving project planners and implementers a rich picture that informs the design of a community-based crane and wetland conservation programme. Taking into consideration the need to prioritise practical actions to reduce threats to cranes and wetlands and acknowledging the need to integrate human dimensions into the conservation interventions, five strategic thematic areas that could form the basis upon which community-based conservation action should be based can be discerned. They are: (1) strengthening attitudes towards cranes and values attached to wetlands, (2) supporting inherent local resource management institutions that are positively contributing to the maintenance of wetlands as suitable crane habitats, (3) facilitating collective actions to maintain ecosystem services provided by wetlands for sustaining livelihoods and habitats, (4) promoting appropriate technologies and practices to reduce community reliance on wetland-based crop production and (5) creating platforms for shared learning among local communities and supportive agencies for ownership and sustainability of conservation interventions.

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