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

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Title: Social dimensions of crane and wetland conservation in African rural landscapes: insights from Kenya, Uganda and Zimbabwe
Issue date: 2021-07-15

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Drainage and agricultural encroachment are threats to crane habitats at Kingwal Swamp

Narratives of Grey Crowned Crane habitat loss in Kenya, Uganda and Zimbabwe

Abstract

This chapter provides a largely qualitative overview of how social factors influence wetland management decision-making, drawing linkages between human actions and ecological changes associated with crane habitat loss. Habitat loss, mainly caused by agricultural encroachment into wetlands used by cranes, is a major contributing factor in the decline of the species' breeding success. Through the narratives of habitat loss at six study sites, the chapter explores major issues affecting cranes in various social and ecological contexts. The chapter is a background for the more detailed chapters that follow.

2.1. Introduction

2.1.1. The Grey Crowned Crane: A species in decline

The Grey Crowned Crane *Balearica regulorum* is classified as Endangered on the IUCN Red List. It has declined by as much as 79 % since the 1960s and is regarded as the fastest declining crane species in the world, with loss of its breeding habitat (hereafter referred to as crane habitat loss) being cited in literature as a major cause of the decline across its range (Morrison 2015). As is the case with most cranes globally, low wetland utilisation pressure made it possible for Grey Crowned Crane to breed and thrive in the past in African landscapes (Harris 1994). However, human activities, over the years, caused the decline of the ecological integrity of wetlands across the species' range which covers much of Eastern and Southern Africa, with Kenya and Uganda defining the northern limits. Beilfuss *et al.* (2007) estimated a 50 % decline over a 20-year period in East Africa, mainly in the species' strongholds, Kenya and Uganda. Information about the species' recent population trends in Zimbabwe, which supports the third largest population in southern Africa (Morrison 2015) is scant. However, emerging evidence confirms that land use change from commercial cattle ranching to subsistence mixed farming, a result of the land reform programme implemented by the Zimbabwean government between 2000 and 2002, impacted negatively on the ecological integrity of wetlands thereby compromising the condition of crane habitats (Chirara 2011; Fakarayi *et al*. 2015).

Grey Crowned Cranes (hereafter referred to as cranes) depend on wetlands for breeding (Meine and Archibald 1996). Agriculture-induced wetland fragmentation, drainage and removal of native vegetation have a detrimental effect on the species' productivity as they reduce the quality and size of breeding habitats (Meine and Archibald 1996; Beilfuss *et al*. 2007; Harris and Mirande 2013). Habitat loss emanating from reduction in vegetation cover increases the risk of disturbance for breeding pairs and makes eggs and chicks vulnerable to trampling and predation (Harris and Mirande 2013). Wetland degradation that leads to habitat loss is mainly caused by agricultural encroachment, overgrazing, removal of wetland plants and the introduction of alien plants (Meine and Archibald 1996; Morrison 2015). These actions are rooted in land use decisions by wetland user communities and wetland management regulations enforced by state environmental agencies. In this regard, wetland users and government agencies can be described as actors because their decisions and actions affect the ecosystems, habitats and species. They operate in an environment (decision context) defined by socio-cultural factors, resource governance regimes, economic conditions and conservation policies and programmes (Jones 1999; Fabricius 2007).

2.1.2. The quest for evidence-based knowledge for informed conservation planning

Local communities' experiential knowledge and site-specific studies are critical in research aimed at furthering the understanding of the dynamics of land transformation, which affects both ecological and social components of ecosystems (Redman *et al*. 2004; Castillo *et al*. 2018). There is also a growing realisation that the analysis of contextual factors for conservation planning should go beyond the consideration of proximate factors affecting species and habitats to include analysis of values and motivations for environmental attitudes and behaviour change (Brooks *et al*. 2013; St John *et al*. 2014). Multi-disciplinary approaches that allow integration of social science, humanities, ecological economics, landscape ecology and other disciplines are used in contemporary environmental problem analyses (Machlis 1992; Liu 2001; Walters and Vayda 2009). By adopting such approaches and selecting robust methodological tools, researchers can collect and analyse qualitative and quantitative data to gain a holistic insight into the broader context of local conservation challenges in a rapid and cost-effective manner.

Analysing factors influencing wetland users' (primary actors) decisions in their local context and other actors and factors operating outside the wetland users' immediate social and geographical sphere of influence is critical in understanding social drivers and dynamics of habitat loss (Norton *et al*. 2013; Dorresteijn *et al*. 2015). This, in turn, provides a basis for evidence-based conservation planning (Pullin and Knight 2003; Sutherland *et al*. 2004; Pullin and Knight 2009), an approach that has been gaining recognition since the early 2000s. In line with this contemporary conservation approach, it is important to analyse direct causes and underlying drivers of the decline to generate evidence that could be used to inform conservation planning.

Recent rapid habitat assessments undertaken by individuals that have coordinated pioneering crane conservation projects have revealed the escalation of habitat loss in Kenya (Wanjala[2] *pers. comm*; Pomeroy *pers. comm*) and Uganda (Muheebwa-Muhoozi[3] *pers. comm*; Pomeroy *pers. comm*). The same trend have also been observed in Zimbabwe (Fakarayi[4] *pers. comm*). Common phenomena observed by these country-based crane conservationists are threats to crane habitats emanating from wetland-based livelihoods. Despite these worrying observations, no comprehensive study has been undertaken to draw linkages between wetland-based livelihoods, local decision-making contexts and ecological factors behind crane habitat loss. Contemporary knowledge on social drivers of crane habitat loss is based on broad-based extrapolation drawn from ecological, as opposed to environmental social science-based, research conducted at some crane sites in the past (e.g., Pomeroy 1987; Gichuki 1993; Beilfuss *et al*. 1996). Narratives of the interface between people and wetlands have been published in wetland survey reports, livelihood assessment reports and policy documents (e.g., Richardson 1993; Odada *et al.* 2004; Turyahabwe *et al*. 2015). In the absence of empirically generated knowledge on social causation of environmental degradation, land use planners and conservationists tend to rely on generalised interpretations for drivers and patterns of environmental phenomena described by Jones (1999) and Walters and Vayda (2009) as meta-narratives. Limited understanding of the local context is an obstacle to effective leveraging of local opportunities for effective management and conservation of resources (Walters and Vayda 2009). Against this background, the present chapter presents specific cases of crane habitat loss in Kenya, Uganda and Zimbabwe, to lay a foundation for evidence-based conservation planning.

This chapter presents a cross-national comparison of linkages between wetland-based livelihoods, actors' decision-making and underlying drivers of crane habitat loss. This is achieved through characteristic narratives which were elicited through semi-structured interviews, field observations by the researcher and review of secondary data. The narratives also inspire more formal and detailed analyses presented in subsequent chapters. In that vein, the chapter serves as a relatively introduction to the chapters. Its secondary purpose is to add to the international stock of stories of land use and biodiversity change and their underlying drivers, informing the science of land use change and linkages to biodiversity loss (e.g., Rudel and Roper 1997; Geist and Lambin 2002; McKinney *et al*. 2009.

[2] Maurice Wanjala is a community leader who formed a community-based group to address threats to cranes and wetlands in 1990. He has conducted extensive surveys to determine the distribution of and trends in the Grey Crowned Crane population in western Kenya since 1990.

[3] Jimmy Muheebwa-Muhoozi is a Conservation Biologist. He studied the ecology and distribution of the Grey Crowned Cranes as part of his MSc research project. He initiated projects aimed at conserving Grey Crowned Cranes in Uganda in the early 2000s. He has been a leading figure in crane conservation and has monitored cranes since 1998.

[4] Togarasei Fakarayi is Wildlife Management Scientist. He has worked for BirdLife Zimbabwe, a national conservation organisation, as a Crane Conservation Officer since 2004. Apart from conducting annual crane surveys, he conducted his MSc research in one of the key Grey Crowned Crane areas in Zimbabwe, focusing on crane habitat assessments and human-crane interactions.

2.1.3. Research framework and questions

Various methodologies used to characterise and analyse social drivers of environmental change were reviewed to assess their applicability in analysing drivers of crane habitat loss. The Action-in-Context (AiC) framework developed by de Groot (1992, 1998) was ultimately selected on the strength of its capacity to integrate multi-disciplinary data for holistic problem analysis. It also enables the researcher to explicitly define the social context in which the problem occurs and establish linkages between the contextual factors, underlying drivers of problems and tenable options for addressing the problems. The AiC framework was used during field data collection in six wetland landscapes containing crane breeding sites in Kenya, Uganda and Zimbabwe. More details about the framework are presented in the next section.

The AiC Framework was used to generate narratives of crane habitat loss, taking one or more key direct factor(s) contributing to crane habitat loss at each site as the departure points for the detailed analysis. The narratives then trace and shed light on the causal linkages behind these factors, with the subsequent qualitative elicitation of the implications for crane habitat conservation. Thus, building on the basic research question formulated in Chapter 1, this chapter addresses the following specific research questions:

- What historical developments contributed to current actions currently affecting the structure and functions of wetlands?
- What are the observable manifestations of key factor(s) affecting crane habitats at the study sites?
- What are the causal human actions and actors directly behind these factors?
- How do the underlying contextual drivers (local and external) influence actors' decision-making?
- What are the commonalities and differences in these drivers of crane habitat loss across the sites?
- What are the emergent implications of these findings for crane habitat conservation planning?

2.1.4. Structure of the chapter

In the next section, a description of the study sites, background information on biophysical characteristics of the landscapes containing study sites, sites' environmental history, common land uses, natural resource governance and socio-economic contexts are summarised. Key elements of the AiC methodological framework and field data collection methods are then outlined. In the results section, site-specific narratives of crane habitat loss are presented. In the discussion section, commonalities and differences in drivers of crane habitat loss across the six study sites are presented, regarding implications for crane and wetland conservation being made. In conclusion, tenable habitat conservation options and entry points for specific interventions in the context of prevailing policies, land tenure systems, local wetland management institutions, market forces and community environmental behaviours, are elaborated.

2.2. Methods

2.2.1. Study sites

The study sites have diverse environmental histories and biophysical characteristics. The study communities have varied cultural histories and are characterised by a mix of socio-economic systems, land tenure and natural resource governance regimes. Primary data were collected from communities bordering wetland landscapes that contain crane breeding sites in Kenya, Uganda and Zimbabwe. Since some of the secondary actors were not based in the communities in question, the author had to travel and interview them at their homes and offices during the data collection process. The landscapes and the countries in which they are located (in brackets) are: Driefontein Grasslands (Zimbabwe), Kaku, Mitooma and Nyamuriro (Uganda) and Kimondi-Kingwal and Saiwa (Kenya). The landscapes contain globally-recognised habitats for breeding crane pairs and flocks (Morrison 2015).

Study sites' biophysical characteristics, land use patterns, crane population status and human population density are presented in Table 2.1. Summaries of contextual factors (environmental history, human settlement and demographic trends, current socio-economic practices) at the study sites are summarised below. Contextual information on wetland sizes, central coordinates of sites and wetland characteristics were obtained from unpublished crane survey results and conservation project reports compiled by organisations that were coordinating crane conservation projects in their respective countries (BirdLife Zimbabwe, Kipsaina Crane and Wetland Conservation Group and Nature Uganda). Data on environmental history, cultural history, livelihoods, land ownership, settlement patterns and community development patterns were collected through interviews with community leaders and elderly members of the community. During field data collection, biophysical characteristics of landscapes around wetlands were observed and documented by the author.

Fig 2.1. Map of Africa showing the regions in which the study areas (black stars) are located in Kenya, Uganda and Zimbabwe

(Adapted from: United Nations 2015)

Both Kenyan sites lie in landscapes that underwent extensive transformation after the country attained independence in 1963. Around *Saiwa*, during the colonial era and for a decade after independence, land use was predominantly commercial maize, wheat and barley farming by European settlers and some indigenous farmers. Resettlement policies enacted in the early 1970s made it possible for families from other regions of the country to move into the area, leading to the emergence of multi-ethnic villages. Subsequently, villagers started clearing indigenous riverine forests on wetland edges for agriculture. Wetland edges were gradually turned into privately owned farms, with some remnant patches becoming common access grazing zones. Currently, households practise rain-fed crop production and cattle rearing. Crop production takes place in upland fields and household food gardens are found on wetland fringes and riverbanks. The area falls under what is now recognised as one of Kenya's main maize production zones.

The *Kimondi-Kingwal* wetland was managed as a common access resource under customary regulations by the Nandi people up until the 1970s. Thereafter, local communities subdivided the wetland's floodplain into dairy and crop production plots, with human settlements being established in the upland areas. Farmers grow cereals (maize and sorghum) and graze dairy cows, sheep and goats on the plots located on wetland edges. Apart from the privately-owned fenced plots, small patches where open access communal grazing regimes prevail are also prevalent. Despite the human-induced transformation, the wetland still contains patches where relics of past wetland vegetation are visible.

In Uganda, the focus was on three wetlands situated in the country's south-western region. The wetlands are a source of water for domestic use and crop production, in addition to providing pastures and papyrus for craft making, construction and fuel. *Kaku* is the main source of water for over 250 households from nearby villages and the town of Kyazanga. Up until the 1960s, its catchment area was sparsely populated as it receives less rainfall about the surrounding areas hence it did not attract new settlers at first. However, family groups, mostly from the southwest and central parts of Uganda settled in the area in the 1960s. The wetland is managed as a common access resource, which allows people from outside the wetland's geographical catchment to graze their livestock around the site during the dry season. Fishing is a major livelihood activity.

Nyamuriro is located in a densely populated area with a history of intensive agriculture on steep-sided hillslopes documented as far back as the 1960s (Carswell 2002). It is a source of livelihood for over 500 households that depend on it for crop production, water supply and provision of papyrus used for fuel and as raw materials for making crafts (baskets, mats, trays, ropes) and construction of roofs, ceilings and fences. Current threats to the wetlands are rooted in the rapid human population growth between the 1970 and 1990s which caused the demand for arable land and papyrus to escalate. Since the wetland is bordered by steep-sided hillslopes that are inherently marginal for agriculture, locals have been forced to encroach onto the wetland over the years. Human settlements are located on the hillslopes where indigenous hardwood forests were cleared. Irish potato production on reclaimed sections of the wetlands is a major source of income for the community.

At *Mitooma,* conversion of wetlands into crop fields peaked in the 1970s as the demand for land increased. This led to the emergence of a mixed crop-livestock farming system on privately-owned agricultural plots as households privatised wetland sections that previously been managed as commons. Goats and cattle are now grazed on these plots. Most households grow bananas as a cash and food crop. Human settlements are scattered on small hills interspersed by a network of riverine wetlands. In recent years, eucalyptus plantations have become a dominant feature in the landscape.

In *Driefontein*, the focus was on wetlands that form part of a network of rivers and streams that traverse the mainly grassland landscape. Commercial cattle ranching was the predominant land use before the fast-track land reform programme implemented in 2000. Subsistence crop and livestock farming were introduced when hundreds of families were resettled in the area between 2001 and 2002. Farmers grow vegetables and cereal crops (maize and wheat) and graze their livestock in communal pastures on wetland edges and grasslands in the uplands. Customary rules enforced by village committees and government-baked environmental regulations enforced by locally-based officers, define the natural resource governance systems. Households own arable land but share communal grazing areas. Residential areas are located in the uplands.

Table 2.1: Study sites' biophysical characteristics, land use patterns, crane population status and human population density

Country	**Kenya**		**Uganda**			**Zimbabwe**
Wetland	Kimondi-Kingwal	Saiwa	Kaku	Nyamuriro	Mitooma	Driefontein
District / County	Nandi	Trans Nzoia	Lwengo	Kabale	Mitooma	Gutu
Coordinates	0° 16′ N, 35° 9′ E	1° 5′ N, 35° 6′ E	0° 24′ S, 31° 21′ E	1° 12′ S, 29° 43′ E	0° 37′ S, 30° 03′ E	19° 23′ S, 30° 47′ E
Rainfall patterns	Bimodal	Bimodal	Bimodal	Bimodal	Bimodal	Unimodal
Annual rainfall amounts (mm)	1600[5]	1100[6]	840[7]	1200[8]	1230[9]	850[10]
Description	12 km long riverine wetland bordered by an expansive floodplain (size of wetland = 5.5 km^2)	Riverine wetland extending over 8 km dominated by bulrush sedges (size of wetland = 0.95 km^2)	Pan-shaped wetland comprising sections covered by open water, papyrus and other sedges (size of wetland = 2.4 km^2)	High altitude valley-bottom peatland fed by water from steep-sided hillslopes (size of wetland = 3.6 km^2)	Extensive system of papyrus-dominated wetlands associated with streams (size of wetland = 0.8 km^2)	Seasonal wetlands ('dambos') and earth dams (size of wetland = 6.6 km^2)
Main land use within 300 m of wetland edge	Private and communal grazing, vegetable gardening, maize production	Maize production, communal grazing and vegetable gardening	Vegetable gardening, wet season crop production (beans and maize)	Crop production (Irish potato rotated with beans and maize)	Private grazing, eucalyptus plantations, vegetable gardening, crop production (beans and maize)	Communal grazing and vegetable gardening
Catchment characteristics (<2 km of wetland edge)	Seasonally inundated floodplain, gently sloping cultivated fields	Gently sloping cultivated fields and patches of indigenous forests and eucalyptus plantations	Gently sloping cultivated fields, banana plantations	Steep-sided cultivated hill slopes and human settlements	Hilly cultivated landscapes, eucalyptus and banana plantations	Seasonally-wet grasslands, gently sloping cultivated fields
Use of site by cranes	25 nest sites in sedge-covered areas along the river system	15 nest sites in sedge-covered areas along the river system	6 nest sites in sedge covered areas on the edges of the wetland	6 nest sites in sections not converted to crop fields along the river system	8 nest sites in wetlands located on household-owned plots	5 nest sites on river and dam edges
Human population density (inhabitants/ km^2)	310[11]	397[12]	240[13]	401[14]	357[15]	29[16]

[5] Data from Infonet-Biovision (2018)
[6] Data from Infonet-Biovision (2018)
[7] Data from Nsubuga et al. (2014)
[8] Data from Nsubuga et al. (2014)
[9] Data from Nsubuga et al. (2014)
[10] Data from Department of Meteorological Services (1984)

[11] Data from Citypopulation (https://www.citypopulation.de/en/kenya/admin/rift_valley/29__nandi/)
[12] Data from Citypopulation (https://www.citypopulation.de/en/kenya/admin/rift_valley/26__trans_nzoia/)
[13] Data from Citypopulation (https://www.citypopulation.de/en/uganda/central/admin/105__lwengo/)
[14] Data from Citypopulation (https://www.citypopulation.de/en/uganda/admin/western/009__kabale/)
[15] Data from Citypopulation (https://www.citypopulation.de/en/uganda/admin/western/106__mitooma/)
[16] Data from Citypopulation (https://www.citypopulation.de/php/zimbabwe-admin.php?adm2id=804)

2.2.2. Methodological framework

The Action-in-Context (AiC) framework was used to guide field data collection and analysis. Developed by De Groot (1992) as a tool for analysing the social causal chains behind environmental problems, the AiC is based on the progressive contextualisation concept (Vayda 1983). The AiC framework focuses on environmental actors (individuals, households, communities and organisations) and their decision-making criteria. It acknowledges that decisions are made after consideration of social, cultural, economic and political factors. AiC-based problem analysis starts with the identification of action(s) behind the problem before one considers the wider context characterised by actors and underlying factors that influence the actors' decisions. The core of AiC can be presented as a triangular structure (Fig 1), showing that actors act in the way they do because they have (1) options to select and (2) motivations to act.

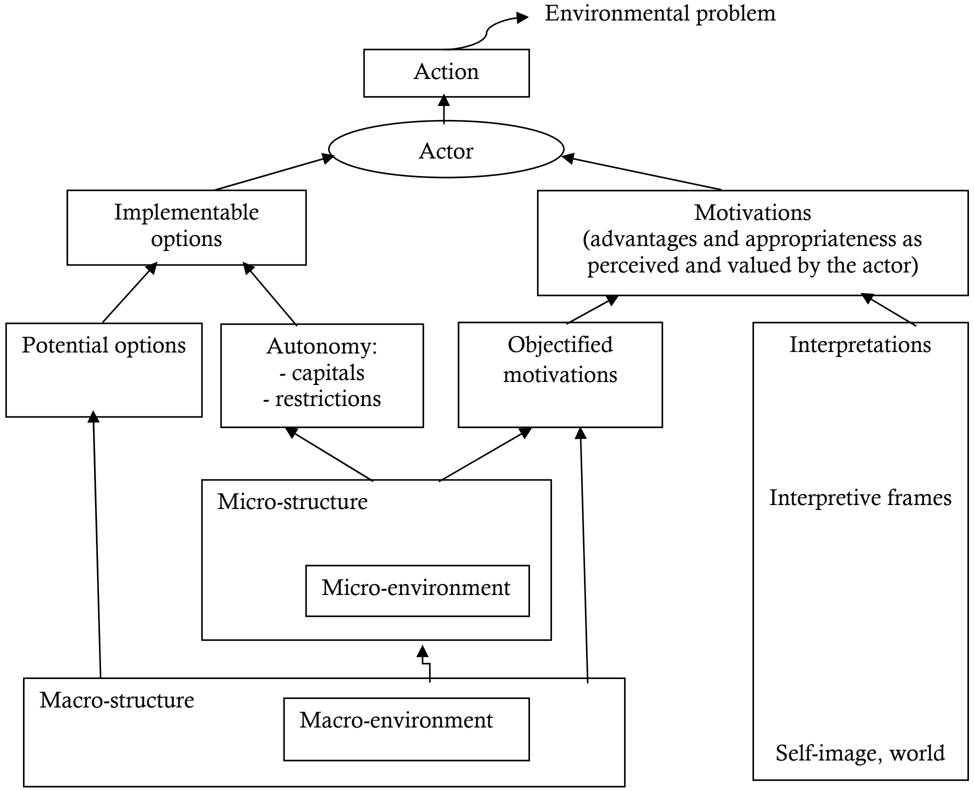

Fig 2.2. Action-in-Context deeper analysis scheme (Source: De Groot 1992)

The framework provides a structure of 'deeper analysis', in which the options and motivations are broken down first into two elements each, as shown in Figure 1. Implementable options (i.e., courses of actions taken by actors) are broken down into potential options and the autonomy. Autonomy includes environmental conditions, human capitals and capacities that aid or constraint the actor's decisions. Motivations are subdivided into objectified motivations comprising quantifiable benefits (e.g., income, food), cultural interpretations and cognitive considerations (norms, values, beliefs, etc). These, in turn, may be connected to technical, empowerment, regulatory, economic and cultural policy options. Shown in Figure 1 is the bottom layer that connects these elements to institutional microstructures (own social groups and networks) and macro structures (markets and society). In AiC, actors can also be connected to each other through 'actors' fields. Actors fields are defined as chains of the causal influence of one actor on the options and/or motivations of another actor (e.g., governments influencing farmers, international agencies influencing governments). The proximate actors are called 'primary actors' and the actors influencing these are called 'secondary', 'tertiary' and so on. In this chapter, the focus is on proximate issues, i.e., primary actors and the first layer of the deeper analysis (Fig 2.2), but reference is made to secondary and tertiary actors if their influences are easily discernible and relevant.

2.2.3. Field data collection

Reconnaissance trips to all study sites were conducted in January and February 2011 to gain preliminary insight into the local context (social structures, land use patterns and environmental governance systems) and how the contextual factors influenced human-crane interactions. The bulk of the data presented in this chapter were collected between July and November 2011. In Zimbabwe, data collection took place in July 2011 and Kenya and Uganda, it was undertaken in October and November 2011, respectively. Although comprehensive data collection took place in 2011, subsequent trips (five in total) to the sites between 2012 and 2014 provided opportunities to verify data collected and identify phenomena that might not have been captured.

Data collection methods included semi-structured interviews, group discussions and researcher observations. The total number of respondents involved in semi-structured interviews and group discussion participants are presented in Table 2.2. In total, 187 individuals were interviewed in the three countries (ranging from 24% up to 32% of the total households in the catchment areas), and 168 individuals were involved in group discussions (group size ranging from 15 up to 44 people). In

Zimbabwe, interviews were conducted in the local language, Shona, the author's first language. Local translators were hired in Kenya and Uganda to cater for non-English speakers although a significant proportion of respondents understood English.

Table 2.2. Number of respondents involved in semi-structured interviews and group discussions

Site	Number of respondents involved in semi-structured interviews and group discussions	Total number of households in the catchment of the wetland under consideration, percentage of households involved in semi-structured interviews
Kimondi-Kingwal	Crop and livestock producers (18), Community elders /leaders (3), Environmental Officers (2), County administrators (2), Milk buyers (3) Group discussion participants (44)	67 (31,3%)
Saiwa	Chief (1), Village leaders (2), Wetland plot holders (22), Environmental Officers (2), Forestry Officer (1), Wildlife Officers (2) Group discussion participants (22)	106 (23,6%)
Kaku	Wetland plot holders (10), Wetland Management Committee members (4), Fishermen (5), Livestock herders (10), Environmental Officers (3), County leaders (2), Nature Uganda Project Assistant (1) Group discussion participants (30)	94 (30,9%)
Nyamuriro	Potato growers (22), Wetland Management Committee members (4), Cooperative society leaders (6), Environmental Officer (1), Agricultural Officer (1), Nature Uganda Project Assistant (1) Group discussion participants (33)	122 (26,2%)
Mitooma	Crop and livestock producers (10), Plantation owners (14), Forestry Officer (1), Environmental Officer (1), Nature Uganda Project Assistant (1), Group discussion participants (15)	76 (31,6%)
Driefontein	Wetland plot holders (19), Village committee members (5), Agricultural Officer (3), Environmental Officer (1), Councillor (1), District Administrator (1) District Lands Officer (1), BirdLife Zimbabwe Project Assistant (1), Group discussion participants (24)	96 (26,8%)

Primary actors involved in semi-structured interviews and group discussions were selected from the wetlands' social catchments, loosely defined as clusters of households that derived socio-economic benefits from the focal wetlands. Delineation of social catchments was done with input from community leaders at all sites. The aim was to interview household heads as they make and ratify decisions at household level. However, it was common for household heads to consult other family members during interviews. At each study site, group discussions were organised and used as platforms to verify facts captured during interviews with individual respondents. Although invitations to participate in group discussions were made open to all wetland users, specific households that were known to use the wetlands for specific purposes were intentionally asked to attend. This approach was used at all study sites. Information on households that used wetland resources and the different uses was availed by community leaders and key informants (agricultural and environmental officers and community project leaders).

Semi-structured interviews involved posing questions framed to enable elicitation of data on actors, active options, potential actions, autonomy, motivations and interpretations (key elements of the AiC framework). Key questions that were used to guide semi-structured interviews and group discussions are presented Box 2.1. Interviews started with easy-going questions about the history and importance of wetlands and interactions between people and cranes. Questions formulated to cover key elements of the AiC deeper analysis scheme (See Box 2.1) were then posed to interviewees so that they could explain the human activities, hydrological processes and social drivers of wetland fragmentation and degradation. The focus of the interviews would then be broadened to include other practices 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. Questions on social, financial, political, human, cultural and natural capitals that either enabled or inhibited the adoption of specific options would then follow. Data on motivations for actions for actual and potential options were elicited in two phases. Questions on quantifiable benefits and costs were posed first, followed by discussions on the interpretations (norms, values, aspirations and beliefs) explaining why certain wetland management decisions were made. Semi-structured interviews took 30 – 45 minutes and group discussions took two hours.

Box 2.1. Key questions that were used to guide semi-structured interviews and group discussions

1. What is the history of human activities degrading 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 are the secondary actors, defined as wetland management decision-makers operating beyond community boundaries?
12. What are motivations of these secondary actors for influencing wetland management decision-making?

Data captured during the interviews with primary actors were reviewed at the end of each working day to identify commonalities and anomalies in responses as well as the underlying factors. Individuals or institutions that influenced decisions and actions made by primary actors were also identified. These secondary actors were interviewed following the AiC procedure, i.e., identifying selected options, potential options, capitals, restrictions, objectified motivations and interpretations. Interview responses were then synthesised into AiC schemes as part of the inductive analytic processes to discern data patterns, themes and 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 2.1. These then became data gaps that were addressed through group discussions. Group discussions took place during workshops (one per site) that brought together households that were open to household representatives that had been interviewed and other community members. To facilitate focused discussions during the workshops, participants formed three groups and each group would tackle the questions (all primarily drawn from the main questions presented in Box 2.1) 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. Responses from semi-structured interviews, enriched through data gathered through group discussions, primarily provided answers to Questions 1–9 in Box 2.1. This was the basis upon which the AiC schema for each habitat loss process.

Transect walks through the wetlands enabled the main author to observe ecological and hydrological phenomena cited during interviews. Physical evidence of wetland degradation were captured photographically for subsequent pictorial analyses to gain a deeper understanding of the nature and scale of the degradation.

An initial list of threats to wetlands, based on field observations, was compiled after the first reconnaissance trips to all study sites in 2011. The threats were broadly defined as human activities that impacted negatively on the wetland's biophysical characteristics (e.g., vegetation structure and composition) as elaborated by Fennesy *et al*. (2007) and Beth *et al*. (2006). This approach was premised on the acknowledgement that such alterations of wetland characteristics affect both surface- and groundwater hydrology of wetlands (Stromberg and Richter 1996, Yu and Ehrenfeld 2010), which can lead to a reduction in wetland's capacity to provide wildlife habitats (Zedler and Kercher 2004). These negative impacts of the change of wetland characteristics have been documented as common threats to cranes (Meine and Archibald 1996). In this vein, assessment of threats to wetlands, which inherently have repercussions on crane habitats, was primarily based on the identification of human- and livestock-induced changes to vegetation structure and composition and water retention and flow patterns.

During the reconnaissance trips, hotspots where signs of wetland degradation were observed (by the author) were marked on topographical maps of the sites. During subsequent formal data collection periods, wetland sections identified as hotspots were revisited and assessed to collect pictorial evidence of wetland degradation. A basic categorical scale (High, Low, Absent) for prevalence of threats to crane habitats was developed. Spatial criteria generally used to describe prevalence include how widespread the threats was (size of wetland area affected by the threat relative to the total area of the study site) and prevalence within the mapped focal wetland area (e.g., number of alien invasive trees within the focal wetland or number of fields affected). The categorisation was therefore on a per-study site basis, to rank the threats based on their prevalence around the site in question. This made it possible to identify the key human actions contributing to crane habitat loss and analyse the proximate issues (observable signs of habitat degradation) at the site and discern the social causation chain behind the issues.

2.2.4 Review of environmental policies

The entry point for addressing the third (contextual) research question was to review relevant environmental management policies to gain an understanding of how wetland management and associated conservation of biodiversity are articulated in policy documents. Key documents reviewed include the National Environmental Management Act of 2002 (Government of Zimbabwe 2002), Environmental Management and Coordination Act of 1999 (Government of Kenya 1999) and the National Wetlands Policy of 1995 (Government of Uganda 1995). During interviews with policy actors such as the Agricultural and Environmental Officers in Zimbabwe, Environmental Officers in Kenya and Wetland Officers in Uganda (see Table 2.2), policy implementation processes, challenges encountered and possible solutions to implementation bottlenecks were elicited. Application (and lack thereof) of environmental policies and other regulations in community-level wetland management were also explored during interviews with local community leaders. This provided a structured way to obtain answers to Questions 10–12 in Box 2.1.

2.3. Results

Human actions (factors) contributing to crane habitat loss at the study sites are numerous, as this and the subsequent chapters show. However, the critical ones can be grouped into six categories: ditching to drain water from agricultural fields, wetland edge cultivation, introduction of alien invasive species such as eucalyptus trees, overgrazing and trampling by livestock, overharvesting of wetland plants, and persistent human presence in wetlands. The critical ones per site were selected mainly because they featured prominently in discussions with the respondents, who included experienced crane conservation practitioners and local champions that had contextual knowledge about trends in crane breeding success and patterns in the utilisation of wetlands for breeding by cranes. The authors' ecological insight on factors worth in-depth investigation, grounded in field observations and informed by the general threat criteria outlined 2.2.3, also informed the selection of threats covered in detail in this chapter.

The narratives presented in this section take one or more of these factors as points of departure, without trivialising the ones that appeared minor at the time this research was conducted. In each case, the selected factor(s) are locally critical although they are not the only ones prevalent at the sites in question. However, the selection is intentionally meant to avoid lengthy narratives but fulfil the chapter's introductory aim (Section 2.1.2) to uncover characteristic social causation, and more comprehensive information is given in the chapters that follow.

In the following sub-sections, narratives of crane habitat loss at the six study sites are presented. The bulk of the data presented in this section was drawn from semi-structured interviews and group discussions, involving local communities who are the primary actors. Where the data presented is based on researcher observations, it is clearly stated. Where data emanated from interviews with non-local community respondents or informants, mention of the individuals' positions or their organization is made.

Table 2.3. Selected factors causing crane habitat loss at the six study sites

	Factors identified as highly prevalent at the sites
Kimondi-Kingwal	Ditching to drain water from agricultural fields Wetland edge cultivation Overgrazing and trampling by livestock
Saiwa	Wetland edge cultivation
Kaku	Wetland edge cultivation Overgrazing and trampling by livestock Persistent human presence in wetlands
Nyamuriro	Ditching to drain water from agricultural fields Wetland edge cultivation
Mitooma	Wetland edge cultivation, Introduction of alien invasive trees Overgrazing and trampling by livestock
Driefontein	Wetland edge cultivation

2.3.1. Ditching on household-managed plots at Kimondi-Kingwal

According to three village elders interviewed, up until the 1960s, the Kimondi-Kingwal wetland used to be flooded for the greater part of the year, except during drought years. Open access livestock grazing arrangements prevailed on the vast floodplain. Human population density was low and so was the demand for wetland resources. Due to waterlogged conditions in the wetland, crops were grown in the uplands. Low utilisation pressure and inaccessibility of some sections of the wetland meant that breeding habitats of cranes remained relatively undisturbed. However, as the population increased, the demand for arable land also increased, triggering a gradual agricultural encroachment that saw families extending their plots from the upland zones into the floodplain, a phenomenon that affected the entire stretch of the wetland.

The establishment of agricultural plots in the floodplain and current land ownership systems are rooted in post-independence land policies and absence of regulations to curb agricultural encroachment onto the wetland. Agricultural encroachment escalated and reached a peak in the 1980s, with farmers digging ditches (average size: 50 cm wide, 30 cm deep) to drain surface and underground water all year round to maintain soil moisture levels conducive for establishing pastures and enable crop survival. A network of dozens of ditches channels water to the river that meanders through the floodplain. A mosaic of fenced and unfenced plots, varying in size from vegetable gardens (400 m^2) to large pastures (5000 m^2), now covers much of the floodplain. The plots are mostly used for livestock (cattle and sheep) grazing though some plot holders also grow maize, millet and leaf vegetables. Interspersed between these plots are unconverted grassed sections that are used for grazing and provide wetland plants for crafts and construction. Restriction of livestock to fenced plots causes overgrazing and trampling of wetlands. Due to the extensive network of ditches, the flooding regimes of the unconverted sections of the wetland have been altered. The long-term negative impact of the persistent drainage was visible at some plots assessed as part of field data collection. In these plots, there were signs of long-term lowering of the water table, confirmed by community members, and change in grass species composition.

Plot holders belong to various socio-economic categories. They range from wealthy households that employ workers to carry out all farming tasks to comparatively poor households that cannot afford fences whose plots become communal grazing zones during the dry season. Crops grown (maize, millet and leaf vegetables) are mainly for domestic consumption. Milk is marketed in the villages and at the nearby town of Eldoret. On average, a household that owns one cow can generate up to $300[17] from the sale of fresh milk annually. Sheep are slaughtered for household consumption or sold at $120 each.

A salient phenomenon of the wetland is the presence of grass-covered wetland patches, some as small as 50 m^2, that provide refuge for crane pairs during the breeding season. These are located on the household-owned plots and on wetland fringes that are managed as commons. The current tenure system gives the plot holders quasi-private ownership rights over land as fenced plots are inaccessible to outsiders and their livestock. Despite the prevalence of uncultivated patches covered with wetland vegetation, information provided by Agricultural Officers and village leaders revealed that almost all land in the floodplain had been taken up by individual households. Some households, however, had not converted their land into crop fields because they owned other productive land in the uplands.

Most community members belong to the Nandi tribe who consider the Grey Crowned Crane a revered species. They believe that if a person kills a crane, flocks will come to mourn the dead crane and by so doing, curse the person responsible and his family. Reverence of the species is a positive phenomenon as respondents confirmed that the community, even young children, always exercised restraint when they encounter cranes, be it in wetlands or uplands. The Nandi have a history of intolerance towards outsiders, including government officers that do not belong to their tribe. The belief that they cast evil spells on outsiders when provoked is widespread in western Kenya. This was confirmed through interviews with environmental and agricultural officers who indicated that at times, they are not free to implement government programmes and enforce environmental regulations for fear of being victimised by the community. The government, through Kenya Wildlife Service, has only shown an interest, feeble though, in the conservation of the wetland because of the occurrence of the Sitatunga *Tragelaphus spekii* at the site. However, Kenya Wildlife Service's activities have not gone beyond public awareness on the need to conserve the wetland and highlighting its potential as a potential eco-tourism site. Despite the wetland providing habitats to 25 breeding pairs (see Table 2.1), no species and habitat conservation efforts by Kenya Wildlife Service were reported by local communities.

[17] All income and costs presented in this chapter are expressed in US dollars for standardization, at the prevailing rate when the data was collected

2.3.2. Wetland edge cultivation at Saiwa

Agricultural encroachment, which involves the removal of wetland vegetation and soil tillage, is the major cause of the reduction in the extent and quality of crane habitats at Saiwa. Households involved in wetland-edge cultivation take advantage of the recession of surface and ground water levels during the dry season to clear wetland vegetation, till the land and plant crops. They grow maize and leaf vegetables on wetland edges. Although normally the floodwater levels follow seasonal rainfall patterns, allowing farmers to grow crops on wetland edges when moisture levels are conducive, extreme scenarios (droughts and above-normal rainfall) were reported by respondents. The annual cycle of grass removal and tillage leaves the sections of the wetland edges devoid of vegetation that cranes require to nest and hide their chicks. There is a tendency by farmers to expand the area under cultivation into wetland zones during drought years. With the width of the grass-covered area having been reduced by up 50% at some points along the wetland according to the leader of the Kipsaina Crane and Wetland Conservation Group, fast-flowing floodwaters erode the loosened soil in cultivated plots and occasionally submerge crane nests.

There are three categories of actors responsible for wetland-edge cultivation. The largest group comprises households that acquired arable land around Saiwa, either through direct purchase after Kenya's independence or inheritance from their parents. The second group comprises outsiders that reside in neighbouring villages and business centres, who rent plots annually. They pay up to $135 per hectare per annum to the plot holders. The third group, locally referred to as squatters, failed to secure arable land in the uplands in the 1970s. The squatters have, for decades, resorted to wetland edge cultivation because they cannot afford to buy upland fields. Most community members regard the central parts of Saiwa as an open access resource that provides communal benefits such as grazing space, reeds for crafts and clay for brick-moulding. However, households in the first category have *de facto* ownership rights to wetland edges adjacent to their upland plots. This allows them to fence off sections of the wetland edge, thereby preventing other villagers from accessing their land. The sizes of the plots on wetland edges vary widely. The average yield of maize from the plots, based on estimates given by the 22 plot holders interviewed is 135 kg[18], enough food to sustain a 5-member household for 3–4 months.

[18] This was calculated since plot holders estimated that their harvests ranged from one bag (90kg Kenyan standard) to two bags (180kg).

A crane and wetland conservation outreach by the Kipsaina Crane and Wetland Conservation Group, a local community-based organisation, has positively influenced community attitudes and behaviour towards cranes over the years. This is particularly evident in Kipsaina village where the group succeeded in persuading wetland users (15 households) that had dug ditches, removed wetland vegetation and cultivated sections of a 1.7 km stretch along the wetland, to stop the practices. Village-based regulations introduced through the project helped curb encroachment, with no new cases of encroachment having been reported since 1997. The leader of the group used his social influence as a respected community development facilitator and opinion leader to promote the new wetland conservation ethic. The community took heed of his passionate conservation messaging. Attempts to introduce similar regulations in adjacent villages to protect other sections of the wetland failed. This was attributed to the fact that the group was not providing viable alternatives to wetland cultivation. The project implementers also had limited authority to impose sanctions for non-compliance and did not receive support from state environmental agencies or local county authorities. National agencies responsible for wetland conservation have not played a significant role in the initiative over the decades apart from occasional public acknowledgement of the group's work during environmental events. Despite the group's decades-long efforts to promote wetland conservation, The issue of the squatters was viewed by most respondents as a long-term problem that the community had no solution to and had to live with.

2.3.3. Multi-dimensional causes of habitat loss at Kaku

The situation at Kaku wetland represents a case of several proximate factors driving crane habitat loss. As stated in Table 2.2, threats to crane habitats at this wetland are multi-dimensional. High demand for arable land has, over the years, resulted in extensive conversion of land in the catchment to agricultural fields. The only remaining communal land, accessed by all livestock owners, is found on the fringes of the wetland. The area receives marginal rainfall and utilisation pressure on the wetland increases during the dry season as hundreds of cattle depend on the wetland when water becomes scarce in areas further away from the wetland. Incidents of droughts and late onset of the rains that had resulted in increased grazing pressure on and trampling of wetland edges were reported. Livestock herders from outside the wetland's immediate social catchment sometimes keep their livestock in the area for weeks until pastures in their areas improve. The locals tolerate the outsiders and view it as a customary arrangement that has been perpetuated over generations.

Human disturbance to breeding pairs emanates from three livelihood activities: fishing, wetland edge cultivation and grass harvesting. The wetland attracts fishers from the local villages, while others come from areas beyond the catchment boundaries. They use canoes to traverse the wetland in search of open water zones where they can cast their nets. On any day, there could be over 20 fishers, while human traffic on the wetland edges is common as traders and fishers transact on designated points on the edges of the wetland. Fish business is lucrative by local community standards. Annual income from the sale of fish ranges from $40 to $180 for inexperienced and seasoned fisherfolk respectively. The community harvests papyrus for crafts and construction from various sections of the wetland. Often, plant harvesters use canoes to navigate their way to the sections where the best stands of papyrus are found. Agricultural encroachment, which was reported to have escalated in the 1980s, is a common feature around the wetland. On some plots, vegetables (cabbage and tomatoes) are grown all year round, irrigated with water drawn from the wetland, while some plots are mainly used for rain-fed maize and bean production. The vegetables are sold to locals and travellers at Kyazanga. Vegetable traders owning 100m^2 garden makes between $25 and $55 annually from the sale of their produce. The persistent presence of fishers, fish buyers, crop growers and plant harvesters is a source of disturbance to breeding pairs.

In 2009, in recognition of the importance of Kaku wetland as a site crucial for biodiversity and community well-being, Nature Uganda facilitated a consultative process to develop a management plan for the wetland. The process, ratified by county authorities, the Wetlands Management Department and community leaders resulted in roles and required actions by different stakeholders to sustain the ecosystem services provided by the wetland being defined. However, the plan was yet to be implemented at the time of this research. Delayed implementation was said to be linked to lack of capacity (technical and legal) on the part of the Wetlands Management Department to finalize the necessary paperwork required to pave way for the official gazettement of the plan to pave way for its implementation. Owing to multiple resources that the wetland provides, with a potential to generate revenue by imposing levies on (especially fishers), management of Kaku was increasingly becoming a thorny issue among local administrative authorities and the state agencies responsible for environmental management, wildlife conservation and fisheries. The source of the conflict is the supposed overlap in mandates and authority among these local institutions and national agencies. These contestations indicated an exercise of undue authority by state actors, while disregarding the conservation requirements as stated in the National Wetland Policy. If implemented, three provisions of the plan, regular biodiversity monitoring, land use land zoning and regulated access, would translate into conservation results beneficial to crane habitats.

2.3.4. Vegetation clearance and furrowing for intensive crop production at Nyamuriro

Approximately 80 % of the Nyamuriro wetland's floodplain, previously covered with *papyrus*, *miscanthus* and *typha*, has been converted into arable land. The land, on either side of a river that runs through the floodplain, is intensively cultivated under a farming system dominated by Irish potato production, in rotation with maize and beans. The furrow-ridge system, used to reduce the impact of waterlogging on crops, causes all water accumulating in the furrows to be channelled to the river. This farming system, practised by over 90% of the farmers, alters the wetland's natural flooding and river flow patterns. Potatoes are grown during the period May–October and thereafter most farmers grow a second crop (maize or beans). Total removal of wetland vegetation, intensive annual tillage, furrowing and growing of crops in a rotational system represents permanent crane habitat loss in the already converted sections of the wetland. Respondents, especially the elderly, reported observing dozens of Grey Crowned Crane pairs breeding before the wetland was reclaimed for potato production in the late 1970s. They reported a gradual decline in nesting sites. At the time of data collection, six crane breeding pairs were using the uncultivated wetland patches for nesting and foraged in the cultivated parts of the floodplain.

Land and agricultural policies of the 1970s led to the emergence of current land access, ownership and management systems. Wetland reclamation was encouraged to boost agricultural production and ten agricultural cooperatives were formed. The cooperatives subdivided the wetland into plots (standard size 400 m^2) and allocated them to their members (households), marking the beginning of encroachment onto the wetland. Households then cleared the vegetation and dug drains to channel excess water from their plots. The cooperatives still have control over who can access land for crop production as well as ensuring cordial relations among plot-holders. When a plot becomes vacant, they allocate it to another household. Households that express interest in acquiring a wetland plot pay $20 first to be registered as members of the cooperative.

On average, households produce 25 kg of beans, 60 kg of maize and 90 kg of potato from the standard 400 m^2 plot per season. Potato production is a major livelihood activity for Nyamuriro farmers. Households may earn as much as $140 per annum from the sale of potatoes and if they decide not to sell their harvest, may have a three-month supply of potatoes. A lucrative market for potatoes in the nearby Kabale town makes potato production a profitable enterprise. Increased demand for the crop from the fast-food industry in nearby towns was cited as a key driver of intensive potato production at Nyamuriro and adjoining wetlands. High population growth in the area during the last century, a phenomenon known to most of the respondents, was said to have led to the extensive conversion of land on hillslopes for crop production. With the greater part of the floodplain having been converted to crop fields, the remaining uncultivated land is the only common pool source of papyrus for the community. There is no more land for rain-fed crop production on hillslopes hence the only option farmers have is to intensify the use of the 400 m^2 plots they were allocated. A cooperative leader described fallowing to allow the soil to recover as a "luxury" that farmers could not afford.

Agricultural encroachment onto the wetland prompted Nature Uganda (a local environmental organisation) and the Uganda Wetlands Management Department to initiate community-based conservation activities to curb further encroachment and restore already degraded sections of the wetland. This collaborative initiative was leveraged by the existence of a national wetlands policy, which provided the institutional framework for participatory stakeholder engagement for sustainable management. A wetland management plan was developed in 2002, with input from the wetland user community and district authorities. Since 2006, wetland management committees, formed under the initiative, have regulated plant harvesting and enforced no-encroachment regulations within 15 m wide buffer strips on either side of the river. The community's recognition of the buffers and acceptance of community-based regulation mechanisms has contributed to the regeneration of wetland vegetation along 70 % of the length of the river targeted under the restoration exercise.

It was evident that wetland conservation outreach by Nature Uganda and the Wetlands Management Department had raised community awareness on the need for communities to stop wetland drainage, a provision of the wetlands policy enacted in 1995. However, respondents concurred that Environmental Officers did not strictly enforce the ban and as a result, farmers continued to till in wetlands without any fear of being penalised. Agricultural and Environmental Officers cited the lack of financial and material support as a factor that hindered their capacity to provide regular conservation extension support to the farmers. They also stated that when the policy was enacted, encroachment had already taken place and lamented the fact that the policy was not clear on what to do about already-encroached wetlands. They also pointed out that political goodwill, at local and national levels, was lacking. They added that often they feared retribution from politicians if they were seen to be radically implementing policies that could upset key livelihood activities (potato production) of the electorate. Most respondents (85%) cited population increase as the major driver of increased utilisation pressure on the wetland. One farmer expressed a sense of hopelessness by saying: "*our forefathers left the wetland intact but now there are too many of us that depend on it, so it will continue to be degraded as nobody has a solution*".

2.3.5. Eucalyptus trees in wetlands at Mitooma

Although stands of eucalyptus in wetlands were observed at various sites in Kenya and Uganda, the phenomenon was particularly widespread at Mitooma. In this regard, results from the site are presented to illustrate the social causation and associated ecological processes associated with eucalyptus in wetlands.

The eucalyptus stands can be categorised into trees scattered haphazardly and trees planted in rows (plantations) in wetlands. Trees are planted, managed and integrated into the overall land use plan within well-defined plots managed by households. Eucalyptus seedlings are mostly planted along streambanks but owing to their invasive capacity, they gradually spread to other parts of the wetlands. This has a negative impact on cranes as they prefer nest sites located in open grassed wetlands, not dominated by tall leafy trees. Eucalyptus trees are fast-growing and it is common knowledge among community members that they reduce groundwater levels. Evidence of dominance of eucalyptus trees in wetlands that were noticeably previously covered with sedges was documented at seven fenced plots.

The prevailing land ownership patterns and the gradual introduction of eucalyptus in the wetlands are a legacy of land tenure systems during and after the colonial period. Elderly members of the community spoke of the shift from customary land tenure to the current patterns dominated by privately owned plots, with small patches of communally managed wetland systems remaining. There is limited space for plantations in the uplands as they are mostly used for crop production. All plantation owners interviewed were aware that planting eucalyptus in wetlands is prohibited but noted that they continued with the practice as the government had not taken any action. Two common responses to a question about why they were not planting indigenous trees were that indigenous species took longer to mature and that there were no local markets for them.

Growing eucalyptus was said to be a venture that involves minimal effort and low financial costs. One could easily propagate thousands of seedlings from seeds picked from eucalyptus trees at business centres or the commons. High rainfall and well-drained soils create conditions conducive for optimum growth of eucalyptus and make the plantation maintenance costs nominal. To establish an average plantation with 50 trees, it takes only one day for households to dig holes and plant seedlings. Maintaining the plantation (pruning and removal of unwanted herbaceous plants) is done during the first two seasons and takes only some hours per year. Poles, harvested from the plantations at different growth stages, are sold to the Uganda Electricity Board directly or through intermediaries. Local construction companies also buy the poles for use as scaffolds, reinforcements for walls and materials for wooden structures. Prices of the small poles (<15 cm diameter) range between $ 6 and $10 whereas the large poles (> 20 cm diameter) can fetch up to $20 per pole. Eucalyptus trees are viewed as an investment and to quote the words one plot-holder, "*eucalyptus plantations are an alternative way of making and banking money*".

According to Nature Uganda's Project Assistant who also hails from the area, three nesting sites had been rendered unsuitable for breeding due to the introduction of eucalyptus trees since the mid-1990s. Where eucalyptus has not completely covered the wetlands, cranes breed in open grassed sections. However, the size of these remaining refuges may shrink as eucalyptus self-propagate and spread in wetlands. The Project Assistant attributed cases of successful breeding to minimal human disturbance as nine nest sites are located on fenced plots that are not accessible to the public. These notable successes were being used to promote a culture of crane custodianship among the wetland plot holders.

2.3.6. Vegetable gardens along streambanks and dam edges in the Driefontein Grasslands

The Driefontein landscape is characterised by sparsely populated rolling grasslands interspersed with riverine wetlands. Crane breeding sites, situated in the low-lying areas, are associated with streams and dams constructed during the colonial era[19]. Vegetable gardens (average size: 100 m^2), are located around dams and on river edges, were identified as the key livelihood activity causing crane habitat loss. The zones in which the gardens are located were pegged by the Ministry of Lands and Rural Resettlement during the implementation of the land reform exercise between 2000 and 2002. A regulation that gardens should not be within 30 m of wetlands or streams, a guiding principle during the pegging process, was meant to create wetland buffer zones. There are expansive patches within the wetlands that are unutilised and open for allocation to prospective gardeners.

[19] Zimbabwe attained independence in 1980 after 90 years of British colonial rule.

The situation in Driefontein exemplifies a case of active agricultural encroachment as households establish new gardens in wetlands on annual basis. To secure plots for gardening, households approach the village management committee. By executing their duties, village committee members simply fulfil socio-cultural obligations. Being a committee member improves one's social status but there are no other benefits, financial or otherwise. Though village committee members claim to know boundaries of gardening zones, they are not standardised and subject to personal interpretation. Though it is common knowledge among community members that no cultivation should take place within 30 m of streams or wetlands, seasonal soil moisture changes make the wetland-grassland boundary fuzzy. This explains why some gardens and fields for summer crop production are located in seasonally wet grasslands associated with the riverine wetland system. Environmental and agricultural extension officers, tasked to enforce wetland buffer zones, have limited technical knowledge and practical skills in wetland delineation.

Although in some areas, the water table in the uplands makes it possible for households to dig shallow wells for supplying irrigation water, presumptive advantages of locating gardens in wetlands influence the community's norms and standards for land allocation for gardening. Households can only have one garden in the village's designated gardening zone and only relinquish them when they emigrate from the village. Logs, branches and bark are used for fencing which makes the cost of establishing and maintaining gardens minimal. Households get a four-month supply of fresh vegetables in addition to an average income of some $25 from the sale of vegetables from the 100 m^2 gardens.

BirdLife Zimbabwe, a bird conservation organisation, funded the construction of community gardens in 2004 in two villages to prevent the proliferation of scattered household-owned gardens. Approximately 9 % of the households from the social catchment benefitted. In Shashe village, where one of the gardens is located, no new household gardens have been established since then. In the other village, Daviot, the community garden was constructed after some members had already acquired plots for household gardens. Despite benefitting, these households did not stop cultivating their wetland gardens. Since joining the community gardening projects was voluntary, some households opted not to join and maintained their stand-alone gardens. Respondents' narratives revealed that villagers perceived community gardening as initiatives that succeed if there is financial aid to facilitate group formation and to provide start-up inputs and technical support. This perception is mainly based on the communities' experience with cooperative projects in the 1980s when the government pursued socialist policies and in the 1990s when several donor-funded cooperatives were formed with support from development and relief non-governmental organisations.

After having been the lead agency in land allocation during the land reform exercise, the Ministry of Lands and Rural Resettlement now has a peripheral role in land use monitoring, as the local village committees are now primarily tasked to allocate land and only forward records to the Lands Office at a later stage. The negative impact of the post-land reform economic downturn on the extension services manifested by low budgets allocated to government departments was cited as one reason why extension officers could not undertake regular land use monitoring during the period 2002–2010. Land is still an emotive issue and respondents indicated that any propositions for well-intended rules and regulations to conserve wetlands might be misconstrued by the political leaders as attempts to reverse the gains of the land reform programme. This was noted as one of the reasons why extension officers often do not act against politically connected households that have fields within wetland buffers.

2.3.7. Overgrazing and trampling of breeding sites in Kenya and Uganda

Crane Project Coordinators (whose details are provided in the introductory section of this chapter) in Kenya and Uganda confirmed incidents of overgrazing and trampling at active and potential breeding sites since the early 2000s. At the time of this research, signs of overgrazing were observed during transect walks at Kaku and Mitooma (in Uganda) and Kimondi-Kingwal (in Kenya). Narratives provided by livestock owners and herders shed light on how overgrazing and trampling take place in fenced plots and community grazing zones. Incidents of droughts and late onset of the rains that had resulted in increased grazing pressure on and trampling of wetlands were reported at Kaku and Kimondi-Kingwal. Cases of persistent overgrazing and trampling resulting in breeding pairs abandoning sites were reported by community members at Kimondi-Kingwal and Mitooma.

Two distinct wetland grazing systems were identified. First, communal grazing areas are managed customarily. Under such systems, there are neither restrictions on the movement of livestock nor monitoring of grazing pressure to ensure carrying capacity is not exceeded. The second system involves household-managed plots containing wetland patches where cranes breed. Owing to the small size of the fenced plots confining livestock to restricted zones and absence of enough land for rotations of pastures at Kimondi-Kingwal and Mitooma, grass is intensively grazed, and potential breeding sites trampled. The situation is made worse by the drainage of water which makes recovery of grass slow, especially during the dry season. Livestock owners that own quasi-private plots are also allowed to graze their livestock in the common grazing zones. Due to the depletion of pastures in the uplands, cattle end up frequently grazing in low-lying wetland zones, where crane breeding sites are located.

In both Kenya and Uganda, livestock owners explained that they did not receive much technical advice on how to manage the grazing zones from national agencies responsible for livestock management. The grazing management systems are therefore mostly influenced by traditional practices whereby communities share grazing areas but there are no platforms for the community to work out modalities on how to prevent overgrazing. Some sheep and goat owners resort to zero-grazing and exclusive grazing in the uplands. The main reason for adopting zero-grazing is to save household labour (reduced time allocation to herding activities). However, since the livestock owners' decisions are made without consulting fellow herders due to the absence of platforms for coordinated collective planning, overgrazing tends to occur at sites under common grazing regimes.

Since joint herding arrangements are not common, household labour is involved in the prevailing grazing systems. Wetland grazing was reported to be very critical in sustaining livestock during dry and wet seasons since land in the uplands is gradually being taken up by human settlements and crop fields. Livestock owners that own plots incur costs in erecting fences around their plots and in maintaining them. Barbed wire and poles for fencing a 100 m x 100 m plot (average plot size at Kimondi-Kingwal) cost $260. At Mitooma, eucalyptus poles, either grown by the family or purchased from neighbours, and live hedges are mainly used. If properly erected, the fencing may only need to be maintained after 3–4 years and this entails replacing the old poles.

2.4. Discussion

This study showed that crane habitat loss is an environmental challenge nested in broader wetland degradation processes driven by a host of underlying institutional and socio-economic drivers exerting influence at community level and beyond. The drivers were identified through the use of a methodological approach that involves analyses of motivations and actions that have decision-making powers on how the wetlands are utilised and managed. Broadly, the drivers of wetland degradation represent a cross-section of challenges that should be addressed to secure crane habitats and save the species from local extinction. It is therefore important to undertake a deeper analysis of the drivers, to identify entry points for and possible bottlenecks to landscape management and habitat conservation planning. A deeper analysis of drivers of wetland degradation is a foundational step in programmatic and policy processes aimed at sustaining ecosystem functions and services provided by wetlands (Narayan and Venot 2009; van Asselen *et al*. 2013; Nguyen *et al*. 2016). This chapter focuses on commonalities and differences among drivers of wetland degradation across study sites, drawing insights for tenable landscape and patch management interventions required to curb maintain suitable crane habitats.

Identification of common drivers of habitat loss is important in the generation of knowledge for the design of conservation programmes in a species' geographical range (Fischer and Lindemayer 2007). Common underlying drivers identified through this study can be clustered into four categories: past land policies, weak landscape governance, local land tenure complexities and emerging markets for products from wetland-based enterprises. Although the drivers are presented and analysed separately in this section, there are notable causal linkages among them. It implies therefore that when addressing the drivers, integrated approaches should be adopted, acknowledging that securing crane sites against human-induced threats should be part of landscape management. Integrated approaches to the management of landscapes to balance socio-economic needs and environmental concerns are increasingly being applied in biodiversity conservation planning (Estrada-Carmona *et al*. 2014; Reed *et al*. 2017; Landis 2017).

2.4.1. Influence of land policies

At all study sites, loss of crane habitats in the study countries was found to be historically rooted in landscape transformation processes which were, to a great extent, precipitated by land policies enacted by governments in the past to enhance land access to boost rural agriculture. Whilst in Uganda the policy was intentionally designed to promote wetland reclamation for agricultural purposes, in Kenya and Zimbabwe the policies inherently created a favourable environment for encroachment into wetlands by farmers. In Uganda and Zimbabwe, the policies were largely driven by populist political agendas of the then national governments. Capitalising on opportunities created by land policies and low priority accorded to environmental considerations for sustainable use of wetlands, households privatised and utilised wetlands in ways that fragmented and degraded crane habitats. In the three countries, not much attention was paid to the long-term negative effects of agriculture on wetland integrity and functions. These site-based experiences reflect prompts, enablers and trends in landscape transformation. They exemplify rural communities' historical interactions with land policies, triggering land management decisions and actions that negative implications on the ecological integrity of ecosystems. These findings represent the post-colonial narratives of land degradation in Africa which should be analysed to define ways to navigate sensitive issues pertaining land access, resource governance and equity in conservation planning (Fairhead and Leach 1995; Jones 1999; Carswell 2003).

Apart from the ecological manifestations, past policies have social, economic and political dimensions that add complexity to wetland conservation planning processes (Chapman *et al*. 2001; An *et al*. 2007). In this study, linkages among the dimensions were reflected in narratives captured through an actor-based approach to environmental problem analysis. A common thread in these narratives is the way in which communities adopted wetland-based livelihoods, despite the inherent risk of degrading wetlands, with local and national governments ratifying the land uses. The challenges of dealing with legacies of these past land policies become evident when the need to develop policy and programmatic interventions to address wetland degradation arises. Regarding the three study countries, such interventions would entail transforming already entrenched livelihoods contributing to local economies, getting diverse wetland users to accept pro-conservation wetland management systems, while acknowledging political agendas of local and national authorities. Balancing such issues without creating resentment among stakeholders calls for deliberations to build common agendas with stakeholders that have social, economic and political interests in land management (Mahanty and Russell 2002; Brechin *et al*. 2002; Sayer *et al*. 2013).

Experiences from Kenya and Uganda show that the legacies of land policies persist for decades and thereby pose challenges if new policies, responsive to emerging environmental issues, are to be enacted and implemented effectively. If a clear roadmap and imperatives for transitions from old to new environmental policies are not defined, the desired impacts of the new policy may not be realised (Kemp *et al.* 2007; He *et al.* 2012). In Uganda, the enactment of a wetland-specific environmental policy did not effectively address some of the drivers of wetland degradation. The wetland policy was enacted and widely publicised but practical steps to effectively deal with agricultural encroachment were not clearly defined. It is therefore critical to reflect on ways to ensure that new policies chart a new dispensation while addressing legacies of past policies. As of 2013, sustainable wetland management was increasingly taking centre stage in Kenya and Zimbabwe. The Kenyan government initiated pioneering stakeholder consultations as a precursor to the formulation of a national wetlands policy. Zimbabwe ratified the Ramsar Convention on Wetlands, a sign of commitment to prioritise wetland management issues. While these were steps in the desired direction from a wetland conservation perspective, there was a likelihood that challenges emanating from past policies could impede policy or programmatic interventions in the two countries.

A lesson to draw from this is that formulating new policies and reviewing existing ones presents opportunities to articulate visions and pathways to sustainable wetland management but should not be viewed as an end in itself. To address past policy legacy issues, a transition management strategy is required. In the case of the three countries, the strategy would entail defining a host of interventions required to make policies socially acceptable, hence, implementable. These comprise articulating the building blocks for the successful transition, including necessary technical support, incentives for switching to desirable practices, creating experimentation and learning opportunities and building social and institutional structures supportive of the new policy regime (Loorbach 2010; Frantzeskaki *et al.* 2012). These interventions provide opportunities to respond to site-level challenges to policy implementation to avoid situations whereby environmental policies remain blueprints that cannot be operationalised on the ground.

2.4.2. Weak wetland landscape governance systems

Weak landscape governance systems, characterised by lax enforcement of environmental policies and ineffective local institutions governing wetland resources, were documented across the sites. Weak landscape governance creates leeway for the adoption of practices that degrade natural resources, leading to biodiversity loss (Paloniemi and Tikki 2008). Assessing natural resource governance systems at community, local administrative authority and national levels help define horizontal relationships and trust (bonding social capital) and vertical hierarchical relationships (linking social capital) that should exist for effective protection of landscapes and associated resources (Pretty and Smith 2003; Bodin *et al.* 2006).

To develop solutions to the challenge of weak governance, it is worthwhile to take a closer look at factors that contribute to lax enforcement of policies by state-based environmental agencies. Through this study, common systemic issues that contribute to inhibiting enforcement of policies and regulations were documented. They include limited resources (financial, human and material) allocated to environmental agencies, low priority accorded to the protection of wildlife habitats outside formally protected areas, implicit assumptions that wetland conservation policies and regulations provide effective protection of habitats for wetland-dependent species, arbitrariness in the delineation of wetland buffers. These challenges represent disconnections between environmental policy and landscape management practice that confront crane conservationists. Acknowledging that limited capacity on the part of government agencies is a major bottleneck policy implementation, suggestions have been made to strengthen bottom-up approaches that empower primary users of natural resources to seek and implement solutions to environmental problems, aligned with the framework of national policy provisions (Hartter and Ryan 2010; Koontz and Newig 2014).

It is also important to gain insight into the dynamics associated with ineffective local institutions, focusing on factors that stifle the emergence of collective and binding arrangements for sustainable resource use. Customary institutions (rules, regulations and norms) enforced by traditional leaders and known to regulate the management of common pool resources in most African rural landscapes did not have a notable influence on the management of wetlands at all study sites. In the absence of customary management regimes, the next issue to explore would be the prospects, conditions and motivations for community self-organisation to create platforms for collective problem analysis and solution-seeking to address wetland degradation and loss of shared wetland ecosystem services. Across the sites, pre-conditions for self-organisation such as respected leadership, existing local community groupings and potential common benefits from sustainable resource use (Varughese and Ostrom 2001; Pagdee *et al.* 2005) generally existed. However, in Kenya and Uganda, it appears the points raised earlier (tenure insecurity and privatisation of commons) discourage community self-organisation. It was encouraging to note organisations promoting crane conservation were working towards building local institutions to spearhead habitat conservation actions around the sites. These institutions could be supported and nurtured so that they can grow into networks of local organisations tackling crane habitat loss across the species' range.

2.4.3. Local land tenure complexities

Overall, experiences across the study sites tell stories of disappearing wetland commons, a socio-ecological process characterised by gradual privatisation of wetland patches, evolution of land boundaries (clear and fuzzy) and emergence of household-based exclusive land use rights. These were land tenure changes that transformed wetland characteristics, with households gradually attaching new socio-economic values to patches they owned and utilised. Mapping the processes behind the tenure change, in spatial and temporal terms, and determining the ultimate environmental and socio-economic impacts of the processes is a critical consideration in land use and conservation planning (Karanth 1992; Altrichter and Basurto 2008).

Across the six sites, land tenure influenced how wetlands were managed. Diverse facets of land tenure (ownership, access and utilisation regimes) influence landowner and user' motivations for and commitment to conserving resources found on the land (Soule *et al*. 2000; Scherr and McNeely 2007). Land tenure patterns were not straightforward and formalised. Whereas in Zimbabwe and, to some extent, in Uganda, land tenure was noted to be relatively well-defined, tenure ambiguities that drive wetland encroachment and drainage were observed in Kenya. If land tenure is clearly defined, actors and actions behind land degradation are relatively easy to identify. Also, if tenure is clear, households involved in processes such as land subdivision, leasing, ownership rights transfer, withdrawal of use rights, and bequeathing are discernible. However, when land tenure is fuzzy, the issue of *de-facto* ownership and utilisation rights crops up. This paves way for land grabs which may lead to inequitable ownership patterns, with community members that fail to access land being forced to exploit marginal areas thereby causing land degradation, as was the case at Saiwa. There is a high likelihood of landscape degradation and fragmentation if boundaries of household-owned patches are fuzzy and when locally-enforced rules and regulations governing the commons do not exist (Wanassai and Shrestha 2008; Teshome *et al*. 2014).

Experiences from Kenya and Uganda prove that land tenure complexities go beyond fuzzy boundaries to include ownership-utilisation dynamics. Cases where plot users (cultivators) changed seasonally due to varying leasing arrangements were documented at Saiwa. Although households had full ownership rights, they ceded utilisation rights periodically for financial gain. Lease agreements were verbal and did not involve conditionalities for ensuring good land husbandry. Given that households had the liberty to lease plots at Kimondi-Kingwal, Mitooma and Saiwa, the possibility of wetlands being degraded by lessees should not be ruled out. Another pertinent facet of this tenure system is the exclusion of local institutional structures (third parties) in the leasing and ownership transfer transactions. Since the plot holder’s motivation is to earn extra income and the lessee seeks to maximise yields, the system paves way for the incentivisation of the conversion of the remaining patches of wetland used by cranes. Quasi-private ownership tenure systems prevailing at Mitooma and Kimondi-Kingwal, where plots are fenced to delineate boundaries and assert ownership, add a different dimension to the issue of wetland utilisation rights. Observations at these two sites showed that the plot holders could (mis)manage their land without taking into consideration the welfare of other wetland users downstream with virtually no influence from state environmental agencies. Understanding land ownership-access-utilisation dynamics is critical for conservationists if they are to engage the right actors and promote interventions for incentivising and securing commitment to sustainable land management (Soule 2000 *et al*. 2000; Cocklin *et al*. 2007).

2.4.4. Emerging markets for products from wetland-based enterprises

In Kenya and Uganda, socio-economic developments at local community and national levels contributed to the emergence of markets for agricultural products generated through wetland-based enterprises. This was the case for milk production at Kimondi-Kingwal, potato production at Nyamuriro and eucalyptus plantations at Mitooma. As the evidence gathered at these sites showed, emergence of lucrative markets may lead to intensification of crop, livestock and tree production as communities strive to maximise monetary benefits from wetland-based enterprises. In making decisions at household and community levels, negative environmental impacts of the intensive utilisation of wetlands are often superseded by the communities’ socio-economic goals. Although the influence of markets was not documented in Zimbabwe, the site is not immune to utilisation pressure emanating from market-driven livelihoods that could emerge in the future.

Trends in the influence of markets on wetland utilisation have been documented in East Africa. A study by Low (1997) describes how potato production in valley bottom wetlands evolved in southwestern Uganda, culminating in the crop becoming the main cash generator for most households in the district by the 1980s. The district of Kabale, where Nyamuriro is located now produces 50–60 % of potatoes consumed in Uganda (Bonabanna-Wabi *et al*. 2013). The influence of market pressures on land degradation and biodiversity loss continues to grow globally. The interplay between markets and land shortage is evident in the case of eucalyptus plantations in East Africa.

Increasing demand for electricity due to population growth and industrialization has pushed governments in East Africa to prioritise power generation and distribution to business centres in rural areas (Kaijuka 2007; Cook 2011). Wooden poles, made from eucalyptus, are used as part of the distribution infrastructure. The growth of small business centres has also necessitated construction of buildings, creating a demand for wood. This is one of the reasons for the escalating demand for eucalyptus. Since land is no longer readily available, communities resort to planting the trees in wetland patches that they consider too waterlogged to be used for crop or livestock production. These findings also expose weaknesses of current sectoral policies and, by extension, clashes in mandates of government agencies. The current situation is not addressing the issue of incompatible and competing land uses (i.e., agriculture in wetlands vs eucalyptus plantations vs wetland biodiversity conservation). If harmonisation of these sectoral policies is not achieved, efforts to protect wetlands against encroachment and unsustainable utilisation may not succeed.

2.5. Conclusions and recommendations for conservation planning

Through this study, narratives of crane habitat loss in a wide range of social and ecological contexts were documented. The focus was on six sites that support globally significant populations of the Grey Crowned Crane. Activities impacting negatively on crane habitats fall into five broad categories: ditching to drain water from agricultural fields, wetland edge cultivation, the introduction of alien invasive trees, overgrazing and trampling by livestock, overharvesting of wetland plants and persistent human presence in wetlands. To generate insights for crane habitat conservation planning, underlying drivers of wetland degradation, which is contributing to crane habitat loss, were identified. Common underlying drivers were clustered into five categories: past land and environmental policies, weak landscape governance, local land tenure complexities and emerging markets for products from wetland-based enterprises.

The use of the actor-based approach to analyse the factors and underlying drivers of crane habitat loss generated information that could be used for conservation planning. In the discussion section, subtle reference was made to some of the possible entry points, key considerations and recommendations for the design of conservation interventions required to address the underlying drivers of wetland degradation. The interventions should address both the proximate factors causing crane habitat loss and the underlying drivers. Conservation planning processes would therefore entail defining not just the practical actions implementable at site-level by primary actors (households and community groups) to reduce threats to crane habitats but include aligning the habitat conservation agenda with plans and priorities of local administrative authorities and national environmental agencies.

Analyses of drivers of crane habitat loss revealed various contextual bottlenecks that could hinder the implementation of conservation actions. Key intervention areas identified include formulation of guidelines on ways to deal with legacies of past policies, empowering communities to define defensible wetlands to secure them against encroachment and unsustainable utilisation, strengthening wetland landscape governance systems and providing incentives for balancing wetland conservation and utilisation. One of the findings relevant to conservation planning are windows of opportunity for securing the crane habitats. These include actions to ensure that the unconverted wetlands managed as commons and wetland patches in agricultural plots used by cranes for breeding are intentionally secured for the benefit of the species. One way to achieve that is to promote crane custodianship ethics among households that own and manage the agricultural plots and the community groups that derive benefits from the wetland commons. This could mean providing incentives to promote the adoption of pro-conservation practices and the development of local conservation groups, building on already existing community groups and leadership structures. In the following chapters, the feasibility and effectiveness of these broad recommendations are explored through site-based case studies in the three study countries.

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