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Review

Effects of habitat loss and human influence on the survival of black-crowned cranes in Africa

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Abstract: This paper reviews the effects of habitat loss and human influence on the survival of Black-crowned cranes in Africa. Black-crowned crane is distributed through Sahel and Sudan Savannah regions of Africa, ranging from the Senegal basin and Guinea-Bissau drainage in West Africa to the western Ethiopian Highlands and south-west Rift Valley in East Africa. Habitat loss, transformation and degradation, and illegal capture and trade for the pet industry are the major threats of the species. Because of habitat loss, the population of Black-crowned cranes is declining across its home range, and it is even disappearing in some countries in West Africa. It is predicted that the population decline will continue in the future due to habitat loss and trapping of cranes for domestication. The species is classified as Lower Risk from 1988 to 2000, Near Threatened from 2004 to 2008, and then Vulnerable from 2010 onwards. The rapid conversion of wetlands and intensive land use and different economic development with poor environmental protection threat the survival of Black-crowned cranes. In order to overcome the threats of Black-crowned cranes (*Balearica pavonina*), habitat conservation and community awareness are essential, not optional.

Keywords: *black-crowned cranes, habitat loss, vulnerable species, wetlands*

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Introduction

Cranes, the family Gruidae, include 15 living species that occur on five continents with greatest diversity in East Asia (nine species) and Sub-Saharan Africa (six species) (Harris and Mirande, 2013). Of the six species, the Black-crowned crane (*Balearica pavonina*), the wattled crane (*Grus carunculatus*) and blue crane (*Anthropoides paradiseus*) are Vulnerable, the grey-crowned crane (*Belearica regulorum*) is endangered (International Crane Foundation, ICF, 2017) and while the demoiselle crane (*Anthropoides virgo*) is Least concern (International Union for the Conservation of Nature, IUCN, 2016). They often serve as ''umbrella'' and ''flagship'' species in conserving wetlands and grassland ecosystems around the world, as such, they drew attention to, and provide protection for, a broad array of species and ecosystem (Meine and Archibald, 1996). Cranes have great charisma and have been effectively used as flagship species to gain recognition and support for conservation efforts (Harris and Mirande, 2013).

Black-crowned crane uses both wet and dry open habitats, but they prefer a mixture of shallow wetlands and grasslands (especially flooded lowlands in the sub Sahelian savanna) and dry farm land (Meine and Archibald, 1996). They can be considered year-round residents and local migrants, flocking together during the dry (non-breeding) season and moving from large permanent wetlands to smaller temporary wetlands

formed during the rainy season. For instance, a study conducted by Gemeda et al. (2016) in Ethiopia noted that maximum number of Black-crowned cranes were recorded in the dry season and less number in the wet season.

This article was based on the existing literature review. We aimed to review published scientific documents and reports on Black-crowned cranes with special emphasis on their threats, distribution and factors affecting the survival of the species in Africa. In order to accomplish this objective, we used online searching methods from various databases, Google Scholar, and Google web by using various keywords. Finally, the most appropriate articles or documents (42 documents) were selected for this review paper.

Black-crowned crane Distribution in Africa

The Black-crowned crane is distributed across the Sahel and Sudan Savanna region of Africa from Senegal and Guinea-Bissau on the Atlantic coast east to the upper Nile River basin in Sudan and Ethiopia (Boere et al., 2006; IUCN, 2016). Major wetlands including the delta of the Senegal River, the inland delta of the Niger River in Mali, the delta of the Wazi River at Lake Chad in Cameroon, and the extensive Sudd wetlands in southern Sudan are strongholds for the species *Balearica pavonina* occurs in the western part of this range, from Chad to Senegal and *Balearica pavonina ceciliae* is found in eastern Africa, with the largest concentrations in southern Sudan (William et al., 2003; Nowald et al., 2007). Black-crowned crane is known to be resident throughout the western part of the country and in the Rift Valley lakes and rivers of Ethiopia (Nowald et al., 2007). Substantial numbers of *Balearica pavonina ceciliae* occur in Ethiopia, including an estimated 1000 around Lake Tana and at least 100 in Ethiopia's southern Rift Valley (Williams et al., 2003). According to Gichuki (2004), Omo River Basin between Kenya and Ethiopia suggest a population of some 415 cranes, including an estimated 250 residents in northern Kenya. Substantial number of Black-crowned cranes was reported by Gemeda (2016) around Jimma zone in Ethiopia (Figure 1). Most of the time, the species stayed around wetlands (Figure 1).

Black-crowned crane Habitat, Diet, and Foraging Behavior

Black-crowned cranes use both wet and dry open habitats, but it prefers freshwater marshes, wetter grasslands, and the edges of water bodies. The species uses open grasslands, shallow wetlands and grasslands adjacent to water bodies for feeding, breeding and resting (Williams et al., 2003 and Diagana et al., 2006). The West African subspecies prefers a mixture of shallow wetlands and grasslands, especially flooded lowlands in the sub-Sahelian savannahs during the rainy season (generally June-September). They also forage and nest along river banks, in rice and wet crop fields, and even in abandoned fields and other dry lands, although always close to wetlands.

Figure 1. Black-crowned cranes in Jimma Zone, Ethiopia (©Dessalegn Obsi Gemeda, 2016)

Black-crowned cranes feed on a remarkably wide variety of plant and animal foods. Their diet includes tips of grasses, seeds, insects, and other invertebrates, and small vertebrates (ICF, 2017). Seeds from agricultural crops are a most important food source. The species experience local daily and seasonal movements for searching of feeds and breeding sites (Meine and Archibald, 1996). The foraging behaviour of the Black-crowned cranes reflects their varied strategies, niches, and diets. The diggers usually stay in the same area for extended periods of time, excavating holes that are continually enlarged to expose the tubers that proliferate in certain types of wetland soils.

Black-crowned cranes Courtship Behavior and Breeding Ecology

Black-crowned cranes are usually found in pairs (Figure 2) or groups of up to twenty, but during the no breeding season, flocks of several hundred individuals can be observed (Gemeda et al., 2016). The increase of Black-crowned cranes at the peak of the dry season is a tendency for cranes to gather in flocks before the onset of the next breeding season. Such flocking facilitates the transition for juvenile cranes as the leave their parents and join flocks of other young cranes that have yet to reach the first breeding age of 3-5 years (Gemeda, 2017). A study conducted by Gemeda et al. (2016) indicates that the local communities are converting

wetlands to agricultural fields for the sake of economic activities. The over-exploitation of wetlands by the local communities is affecting the breeding and nesting sites of black-crowned cranes in Ethiopia.

Figure 2. Black-crowned cranes displaying courtship behaviours, Jimma Zone, Ethiopia (©Dessalegn Obsi Gemeda, 2016)

As they are opportunistic and nomadic in choosing habitats, moving from area to area in search of food and security, they may not nest or forage in the same areas every season or year (Meine and Archibald, 1996). Black-crowned cranes are considered seasonal breeders nesting within May to December in West Africa and from July to January in Eastern Africa (Treca, 1992). The extended time of breeding season could be related to the suitability of the breeding environment (Bento et al., 2007). Successful breeding depends on securing a compatible mate and a breeding territory and appropriate conditions such as suitability of the breeding environment during nesting and chick-rearing (Sundar, 2009). After the chicks hatch, the cranes move into nearby open upland or grassland areas where they forage on insects and the fresh tips of plants. Parents are guarding the nest during breeding time in order to protect from any damage. When the female leaves the nest to forage, the male often guards the nest by perching on a nearby tree so as to signal an alarm call if any threats are perceived. Both the female and male assist with feeding the chicks. Like other crane chicks, Black-crowned crane remains near their nest for the first day or so, but by the second day after hatching are prone to wander off with their parents in search of food (Johnsgard, 1983).

Major Threats of Black-crowned crane

Black-crowned cranes face most severe threats such as wetland conversions and over-exploitation, egg removal, overgrazing and others. There are 13 key factors that threaten the life of Black-crowned cranes in Africa. These are conversion of wetlands, over-exploitation of wetlands, egg removal, overgrazing, disturbance of nests, inadequate laws, drought, bush fire, cutting of trees, subsistence hunting, agricultural impacts, live cranes trade and desertification (William et al., 2003). Black-crowned cranes are declining across much of their range and disappearing from some countries, but their geographic extent or rate of decline are not known (Williams et al., 2003; Beilfuss et al., 2007; Harris and Mirande, 2013). As indicated by IUCN assessment reports have shown a rapid population decline due to habitat loss and trapping for domestication and other factors lead to the vulnerability of the species from 2010 onwards (Table 1).

Table 1. Previously published red list assessment status (adapted from IUCN, 2016)

Year	Status
2012	Vulnerable (VU)
2010	Vulnerable (VU)
2008	Near Threatened (NT)
2006	Near Threatened (NT)
2004	Near Threatened (NT)
2000	Lower Risk/near threatened (LR/nt)
1994	Lowe Risk/least concern (LR/lc)
1988	Lowe Risk/least concern (LR/lc)

Loss of habitat and transformations, particularly wetland degradation is the main threats facing Black-crowned crane in Africa. The decreasing availability of habitat and its quality affect the distribution, movement, and breeding success of Black-crowned crane. Habitat loss and degradation are one of the most important threats of cranes in the world (Harris, 1994). The process of converting wetlands usually involves extensive clearing of natural vegetation, draining and other alterations of hydrological processes, burning, cultivation, and other activities that render former Black-crowned crane habitats unsuitable for nesting, feeding, roosting, and stopping during migration (Harris, 1994; Zhang, 1994). Black-crowned cranes face serious threats throughout their range. Direct threats to adult birds and chicks include egg removal, disturbance of nests, human-ignited bush fires, subsistence hunting and capture for trade and domestication (Williams et al..2003). Due to the rapid decrease of populations in certain areas, the ICF and Wetlands International launched the Black-crowned crane Programme in 1999 in order to determine the species' conservation status and prepare an action plan for its conservation and protection (Diagana et al., 2006).

The loss of wetlands worldwide has been well documented (Shuqing et al., 2007), as the recent re-

examination of the benefits and costs that dams bring to river systems, biodiversity and people living downriver (Brander et al., 2006). The Lower Zambezi River in southern Africa provides a good example of the impacts of a major dam, the Cahora Basa and the steps that have been taken to partially restore the ecosystem services threatened by dramatic changes in seasonal flows (Beilfuss and Brown, 2010). Agricultural expansion into grasslands affects Black-crowned cranes breeding and foraging habitat, especially in sub Saharan Africa, parts of South Africa (Winter et al., 1995). Most wetlands losses have been attributed to drainage for dry land farming or conversion for growing water-dependent crops such as rice (Shuqing et al., 2007).

Agricultural Land Use

Cranes have adapted to feeding and breeding, in particular traditional agricultural lands, the changes in choice of crops, fallow and rotation schedules, cropping patterns, field preparation, and cultivation and harvesting practices can have subtle but important effects on their life activities (Winter et al., 1995). In addition to this, burning is a common practice for a variety of crop types in many regions (Korontzi et al., 2006). These fires can destroy crane nests or habitats (Goroshko and Tseveenmyadag, 2002; Kong et al., 2007). Livestock grazing has resulted in the degradation of crane habitat through disturbance, alterations in wetland hydrology, and trampling of wetland vegetation. Disturbances on foraging areas also may reduce foraging time and food acquisition, force birds to feed at poorer quality sites or take more risk to feed (Luo et al., 2012).

In developing countries like Africa, people are over-exploiting forests for agricultural expansion which, directly or indirectly affects the life of Black-crowned cranes. Unlike other crane species, Black-crowned cranes prefer to roost in large trees but will use small trees or shallow water when necessary (Johansgard, 1983). Deforestation is one of the driving forces for the declining of Black-crowned cranes (Tursha and Boyi, 2011). Deforestation can negatively affect the Black-crowned cranes since this species uses trees for roosting sites (Meine and Archibald 1996).

Environmental Factors

Storms and other weather events can have important, and sometimes catastrophic, effects on crane populations. Longer-term climatic fluctuations may contribute to some of the recent changes in the species' numbers and distribution. Populations are highly responsive to changes in precipitation levels, the numbers rising and the range expanding during wetter years (Meine and Archibald, 1996). In drier years, grassland and wetland fires may take their toll. In many parts of the range, groundwater extraction has increased due to drought and rising demands for water for domestic, agricultural and industrial uses. This has lowered the water table in regions where wetlands are small. A combination of these and other factors have led to the decline of the East African Black-crowned crane from an estimated 100,000 in the 1970s to between 75,000 and 85,000 by 1994. Between 1985 and 1994 alone, the population declined by 15% (or 1.67% per year) (Meine and Archibald, 1996). Beilfuss et al. (2007) estimate that the population of the species is about 43,000-55,000 birds. This indicates that the numbers are decreasing at a faster rate than expected.

Environmental Contamination and Disease

Crane habitats around the world are threatened by many forms of household, agricultural, and industrial pollution. Some pollutants, such as chemicals and organic wastes, constitute long-term threats to habitat (primarily water) quality, with attendant effects on crane physiology and reproductive success and on ecological conditions (including crane food sources) within their wetland habitats (Zhang, 1994). Increased use of pesticides and fertilizers in agricultural systems impacts cranes directly through exposure and ingestion and indirectly through eutrophication and contamination of wetlands, accumulation in food sources, and changes in the trophic structure of ecosystems (Muralidharan, 1992). Presently, farmers are intensifying their agricultural activities by increasing the proportion of land under cultivation and increasing their reliance on commercial fertilizers and pesticides to improve crop yields. Those chemicals broadly affect both upland and wetland ecosystems, through contamination of the food web, changes in the trophic structure and eutrophication. Because of this, cranes living in association with agriculture are increasingly exposed to chemicals that affect them directly through consumption of contaminated foods, and indirectly through loss of important foods or altered habitats (Harris and Mirande, 2013).

Black-crowned cranes are vulnerable to a variety of infectious and parasitic diseases, including salmonellosis, avian tuberculosis, avian cholera, inclusion body disease of cranes (IBDC), crane herpes virus, eastern equine encephalitis, coccidiosis, avian pox, and Newcastle's disease (Meine and Archibald, 1996). In general, pathogens seldom pose a serious threat to wild crane populations and is only so during periods of high population density or environmental stress, or

when there is contact with domestic poultry. Unlike other crane species, black-crowned cranes are non-migratory, nesting in small, temporary wetlands during the rainy season and gathering in large, permanent wetlands during the dry season. This species may make variable local and seasonal movements depending on the abundance and distribution of food, nest-sites and rainfall (del Hoyo et al. 1996).

Trapping for Trade and Domestication

A few of the captured cranes are eaten or used for medicinal purposes, but most are domesticated within the countries of origin or traded internationally, most often through illegal markets. Reproduction of captive birds is low and mortality high due to poor care, poor diet, and lack of suitable facilities (Harris and Mirande, 2013). Trade of Black-crowned crane attracts local hunters, businessmen and exporters for some money and these results in high demand and exploitation of the species (Boyi, 2001). Illegal removal of eggs, chicks, and adults from the wild for commercial trade, domestication, and medicinal purposes is significantly impacting crane population in the wild (Morrison et al., 2007). Black-crowned cranes are trapped and sold to local, regional, and international markets for considerable profit (Beilfuss et al., 2007). In Africa, the most number of transactions of Black-crowned cranes occurred in Tanzania (ICF, 2009). Many local traditions encourage domestication of cranes within West Africa, and there is considerable demand for the birds in North Africa, the Middle East, Europe, and China. Majorities were exported to the Netherlands and other African countries where export occurred between 1993 and 2002 from Guinea, Mali and Sudan (CITES 2004). This species is also commonly traded on the black market in Guinea (Clemmons, 2003).

Human Interference or Disturbance

Rapid human population growth is one of an indirect cause of reproductive failure and mortality in Black-crowned cranes. Human being can disturb the species at any phase of the cranes' life cycles but is most critical during the breeding season, when adults are establishing territories and nesting birds, and young are most vulnerable for human-made activities (Daddy and Ayeni, 1996). Black-crowned cranes in agricultural areas can be intentionally or unintentionally disturbed by normal farming activities, such as planting or harvesting, as well as by foot and vehicle traffic. Repeated, intensive, or targeted disturbances can result in reproductive failure, abandonment of breeding territories, or avoidance of roosting or foraging areas (Austin, 2012). Disturbances on foraging areas also may reduce foraging time and food acquisition, force birds to feed at poorer quality sites or take more risk to feed (Luo et al., 2012). During the breeding season, human disturbances may keep adults off the nest or away from young chicks, providing greater opportunities for predation (Borad et al., 2002 and Olupot et al., 2010).

Lack of public awareness and support is another problem that influences the life of Black-crowned cranes in Africa. Although some studies were conducted on Black-crowned cranes concerning the pressure of human beings in conversion and transformation of cranes habitat like wetlands, little public awareness was conducted to save the species from threats and loss. Above all, scientific knowledge gaps in the species population's dynamics, life histories, migratory patterns, habitats, and ecological relationships affect the conservation of Black-crowned cranes. Lack of knowledge and support among elected officials, agency personnel, and other leaders in different sectors of society may hinder accurate assessments of their conservation status and needs (Archibald et al., 1987 and Diagana et al., 2006). It is crucial to involve the local people and stakeholders in Black-crowned cranes conservation plan (Gemeda, 2016). Lack of cooperation among different at the local, national, and international levels can be an obstacle to effective coordination and implementation of crane conservation plans (Meine and Archibald, 1996).

Conclusion

The Black-crowned crane is a highly influenced by habitat loss and degradation particularly in fragile environment due to over-exploitation of natural resources. Beside habitat loss, egg removal, overgrazing, hunting for trade and domestication, infectious and parasitic diseases, lack of public awareness for the species conservation are some of the major threats that affect black crowned cranes in Africa.

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