

SPECIES REVIEW:

WHITE-NAPED CRANE (*Grus vipio*)

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White-naped Crane in reed marsh in China (Photographer: Crane Wu)

Red List Category: Vulnerable

Population Size: 6,700–7,700

**Population Trend: Mixed; eastern population increasing;
western population decreasing**

Distribution: Northeast Asia



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DISTRIBUTION AND STATUS OF KEY SITES

The White-naped Crane (*Grus vipio*) shares a similar breeding range to the continental population of Red-crowned Cranes (*Grus japonensis*), occurring in wetlands across much of the Amur/Heilong Basin and adjacent areas in Russia, China, and Mongolia (Meine and Archibald 1996). Agriculture development has greatly reduced and fragmented its distribution (Jim Harris, personal comm. 2017). Preferring shallower waters than the Red-crowned and more readily foraging on uplands, the species ranges farther west than the Red-crowned (the latter species is rare in Mongolia, where the greatest density of breeding White-naped Cranes occurs) (Liyong Su, personal comm. 2017).

The breeding sites for the majority of White-naped Cranes are found in northeastern Mongolia (Mongol Daguur Strictly Protected Area, Onon River Basin, Khurkh and Khuiten River Valleys, and several other locations), northeastern China (including Zhalong, Tumuji, Hui River, Dalai Lake National Nature Reserves, and several wetlands in Sanjiang Plain, particularly in the Naoli-Qixing River Basin), and wetlands in southeastern Russia (including Muraviovka Park, Dauriski, Khinganski, and Khankaiski State Nature Reserves, and several game refuges). White-naped Cranes that breed in the western part of the range are believed to migrate through China to winter at Poyang Lake, China (Jia 2016), and (at least formerly) in surrounding areas, while birds that breed in the eastern part of the range migrate south through Korea. Approximately 50% of the global population of White-naped Crane has been documented in Mongolia (Wildlife Conservation Society 2013). However, less than a quarter of the known population overwinters in China (Li et al. 2012).

The Korean Demilitarized Zone (DMZ) is a wintering or staging area for more than 3,000 White-naped Cranes (over half of the world population). Departure or arrival of White-naped Cranes at different wintering areas varies according to local conditions. Individuals are known to winter in or near the DMZ (primarily at Cheorwon Basin and with small declining numbers at the Han River Estuary) and small numbers elsewhere in the Republic of Korea (ROK, South Korea). Many others continue south to winter at the Izumi Feeding Station in southern Japan. Some birds, however, depart late from Cheorwon in the DMZ for Japan, and others return early to the DMZ from Japan so that varying numbers are present in the DMZ through the cold months (Kisup Lee and Yuko Haraguchi, personal comm. 2015). An estimated 4,500–5,000 move between Korea and Japan (Kisup Lee and Yuko Haraguchi, personal comm. 2015), and counts are being conducted several times each winter to investigate movement patterns.

While some sites on both breeding and wintering grounds receive protection, important sites remain outside the network of protected areas including breeding areas at the Khurkh and Khuiten River Valleys in Mongolia and wintering habitat in the Cheorwon Basin in ROK. There is a need to designate additional protected areas for wetlands used during dry periods in the forest-steppe zone of Russia and Mongolia. Similarly, most migratory stopover sites are not protected. Recent research has identified at least two significant areas in China in need of protection, including Miyun Reservoir and Duolun (Jia 2016); no stopover sites are protected in ROK. Telemetry work conducted by Japanese colleagues in the 1990s identified important resting sites in the Democratic People's Republic of Korea (DPRK, North Korea), including the Baekchon wetlands (DPRK Natural Monument No. 164), the Eunyool fields (DPRK Natural Monument No. 133), and wetlands near Mundok, Kumya, Orang, and Sonbong (Chong et al. 1994).

Protected wetlands are highly vulnerable to actions that would affect hydrology of crane habitats within the watersheds but outside boundaries of the protected areas. As one example, construction of hydropower dams on the Zeya and Bureya Rivers in the Amur Province of Russia has prevented the major flood events that occasionally scoured out lowland areas in downriver parts of the floodplain,

removing sediments and vegetative debris. As a result, wetlands are gradually filling in, with a reduction in habitat suitable for cranes (Kazachinskaya 2012).

Subspecies/Populations

There are no subspecies of White-naped Cranes. There are two main wintering populations, one in the mid Yangtze Basin of China and the other in ROK and at Izumi, Japan. The extent of exchange between these two populations is unknown. While it is believed that most cranes breeding in Mongolia winter at Poyang Lake, one individual is documented to have taken the eastern flyway into Korea (Tsevenmyadag Natsagdorjign, personal comm. 2012).

ECOLOGY

For breeding habitat, White-naped Cranes rely on shallow wetlands and wet meadows typically found in broad river valleys, lake edges, and in lowland or mixed forest steppes (Meine and Archibald 1996). This species will also utilize these habitats for foraging, as well as nearby grasslands and farmlands. During migration and on their wintering grounds, cranes mainly feed on tubers, seeds, and waste grain, which they find in mudflats, wetlands, rice (*Oryza sativa*) paddies, and other farmland. In natural wetland habitats, individuals often stand in one place and dig for tubers of aquatic plants, in contrast to Red-crowned Cranes that share many of the same habitats but normally walk about while foraging and picking food from the surfaces of plants or water (Su 1993). Red-crowned and White-naped Cranes often breed in the same wetlands, with the Red-crowned Cranes preferring deeper water than the White-naped Cranes. These distinctive ecological differences between the two species apparently allow them to inhabit the same areas without inter-specific territoriality. At Muraviovka Park during the breeding season, single White-naped Cranes regularly fly out from the wetlands to forage on farmlands; once chicks can walk well, families sometimes venture onto the uplands as well. Red-crowned Cranes utilize these farmlands to a much lesser extent, mainly by non-breeding individuals or during migration but seldom adults with eggs or chicks during the breeding season (Sergei Smirenski, personal comm. 2016).

The two species thus have different vulnerabilities to human activity. In the 1990s, as local farmers encroached on the wetland edges at Zhalong, the White-naped Cranes were more adversely affected (Liyang Su, personal comm. 2015). But in more recent years at Muraviovka Park and other areas, water diversions and drought have meant that deeper water habitats have evolved into shallow marsh and sedge meadows better suited to White-naped than Red-crowned Cranes. While Muraviovka Park formerly supported 5–10 breeding pairs of each species, in 2012 Muraviovka Park had 18 nesting pairs of White-naped Cranes but only three pairs of Red-crowned Cranes (Sergei Smirenski and Tamaki Kitagawa, personal comm. 2015).

Winter diet and foraging habitat for White-naped Cranes vary among the three main wintering areas. In Japan, the cranes are artificially fed although some forage on nearby farmlands. In the DMZ, most cranes feed on waste grain in rice and other fields, although artificial food is sometimes provided during severe weather. At Poyang Lake, White-naped Cranes feed in shallows and wet muds on tubers of *Vallisneria* in company with Siberian Cranes, or in the drier and slightly higher sedge-grass zone in company with Hooded Cranes. Occasionally, the White-naped Cranes may forage in fallow rice paddies.

NUMBERS AND TRENDS

This species is more easily counted on its wintering grounds where it concentrates in only a few locations. Its current population is estimated at 7,000 to 7,800. However, there are challenges to getting accurate counts for both populations. The western population wintering in China ranges over the vast,

inaccessible shallows and mudflats of Poyang Lake where aerial and ground surveys can easily miss birds or double-count those moving during the count period. On its eastern flyway, while the vast majority winter in very limited areas along the DMZ and at Izumi, individuals have been spending more of the winter in Korea, with a substantial number only moving south to Izumi in mid-winter. Counts are therefore being carefully synchronized among the locations, in particular between Korea and Japan.

The wintering population of White-naped Cranes at Poyang Lake 15 years ago was estimated at 3,000 and has since dropped by two-thirds, to >1,000 or fewer cranes. Results of multiple counts averaged over a period of years serve as a more reliable indicator of population change than counts for single winters. The average of eight basin-wide counts from 1996–2004 was 2,278 White-naped Cranes. In contrast, the average of six counts from 2005–2012 was 1,167 (Li et al. 2012).

In contrast, the White-naped Crane population is increasing in the eastern parts of its range, growing from 4,900–5,300 (Meine and Archibald 1996) to 5,500–6,500 individuals (Wetlands International 2012). The last years have seen more rapid growth to a current 6,200–6,500, based on multiple counts from winters 2012–13, 2013–14, and 2014–15 (Haraguchi 2014a,b; Kisup Lee and Yuko Haraguchi, personal comm. 2016).

The trends in the two populations may be attributed to White-naped Cranes shifting from the western to the eastern flyway. Alternately, the changes in size of the two populations may be due to conditions on the breeding grounds related to rainfall patterns, which have been distinctly different in the western and eastern parts of the range (Simonov and Dahmer 2008). This part of Asia exhibits a strong gradient of declining rainfall from east to west. Eastern portions of the range lie within forested or formerly forested regions with relatively stable rainfall from year to year (700–800 mm rainfall annually on average in the Ussuri Basin on the Russia-China border). But as one moves west, conditions become less favorable for forests or croplands until rainfall is too erratic to support crops without irrigation, and grasslands supporting cattle, sheep, and other livestock now predominate (annual rainfall of 300 mm or less for the Onon River Basin of northeast Mongolia). These western regions have erratic rainfall and tend to experience cycles of drought and wet. On the Daurian steppe where Mongolia, Russia, and China come together, these cycles span roughly 25–30-year cycles. The decade after 2000 was characterized by increasingly severe drought, succeeded with increasing rainfall beginning around 2012–2014.

In the western part of the breeding range, during the drought years after 2000, crane reproduction had dropped dramatically (Goroshko 2012). While data on crane reproduction from the eastern part of the range is lacking, conditions remained more stable during this decade and may have favored successful nesting. In addition, cranes migrating as far south as Izumi have an abundant food supply of artificially provided food at the feeding stations, which likely has favored survival of chicks.

THREATS

Range-wide

- Conversion of wetlands to agriculture on breeding and migratory areas, especially in China and Far East of Russia;
- Changes in agricultural land use on wintering sites in China and Korea;
- Poisoning of cranes, either from chemicals placed on bait to catch waterfowl and other birds for the market, or from cranes eating seeds coated with chemicals to kill invertebrate pests. Poisoning of Red-crowned Cranes, a species that occupies a similar range, is believed to be a significant cause

for decline of this species on its western flyway (Su and Zou 2012). Dead Red-crowned Cranes, due to the cultural prominence of this species and its white color, are likely to be reported with much greater frequency than the predominantly dark White-naped Cranes. But the latter species utilizes farmlands more frequently and may be more vulnerable to poisoning. Two of three White-naped Cranes tracked migrating north from Poyang Lake in spring 2014 appear to have been poisoned at Duolun, Inner Mongolia, a major unprotected stopover area for the species. One crane tracked on its way south in fall 2014 was rescued in a poisoning incident involving six White-naped Cranes. Fortunately, four of the cranes were rescued and released (Shengwu Jiao, personal comm. 2015); and

- Collisions with power lines.

Breeding Grounds

- Changes in hydrology and loss of suitable habitat due to water control projects;
- In western parts of the breeding range, prolonged drought associated with the dry portion of 30-year climate cycles reported for this region, perhaps also an indication of long-term climate change;
- Fires that destroy nests, eggs, young, and/or vegetative cover. Fire danger grows much more severe during drought or when diversions and other human activities reduce water levels in the wetlands;
- Disturbances from people and livestock. This problem has become more severe due to fragmentation of breeding habitats in the eastern part of the range, where pressures to expand farmland are greater, and in more sparsely inhabited western parts of the range due to prolonged drought that caused concentration of breeding birds, people, and livestock within the shrinking areas of available water (Goroshko 2012). Predation from free-roaming dogs may be a problem and is being studied in Mongolia;
- Spring hunting is serious threat in Russia. Although the White-naped Crane is not a game species, legal spring hunting of other waterbirds creates intensive disturbance for breeding cranes;
- Taking of eggs by people. This problem may be growing due to wetland fragmentation and expanding human activities in China;
- Illegal hunting of cranes in Russia; and
- Mining development. Mining is accelerating in Mongolia and also expanding in parts of Russia and China, leading to habitat loss, wetland degradation, water diversion, and pollution of waterways.

Wintering Grounds

China

- Dams and diversions of water that alter critical wetlands. Plans have been advanced for many years to dam the outflow of Poyang Lake with a goal to stabilize water levels and enhance economic activities year round. If implemented, this plan could flood current crane habitat that might result in a dramatic decline in crane populations (Harris and Zhuang 2010). Even if operation of a dam provided for preservation of shallow water areas, stabilization of water levels could negatively impact productivity of the wetland, including the tuber-producing submerged aquatic plants, an important food source for White-naped Cranes;
- Recent years have seen greater fluctuation in water among years, with more frequent floods and droughts at unseasonable times. For example, during the normally dry late autumn period in 2015, heavy rains raised water levels of Poyang by 5 m in 20 days (Guanhua Liu, personal comm. 2015).

While waterbirds appeared still able to find food, they shifted away from typical habitats (in many cases within protected areas) to areas of greater human use such as fallow rice paddies. Aside from the high water that prevented birds from accessing food, early flooding in summer 2015 may have wiped out the favored food *Vallisneria*, forcing a shift in diet. These extreme events may reflect climate change and also result from changes in the watershed and encroachment on wetland edges around Poyang;

- Sand dredging, that for years was concentrated near the outlet to Poyang Lake, appears responsible for early and rapid outflow from the lake in autumn, causing shortages of water needed for irrigation (de Leeuw et al. 2010, Lai et al. 2014). Low water levels in early autumn are one reason a water control structure across the lake outlet has received close consideration over the last five years. Sand dredging also raises turbidity of the water, a negative trend for growth of *Vallisneria* that needs a clear water column so that light can penetrate to the rising stems and leaves;
- Declining water quality could lead to poor conditions for *Vallisneria* and other food plants at Poyang Lake, or even a major shift away from macrophytes to a system dominated by phytoplankton (Fox et al. 2010);
- Human disturbance;
- A recent ban on grazing of water buffalo (*Bubalus bubalis*) around the exposed meadows surrounding Poyang as waters recede in winter—to reduce the spread of schistosomiasis among local people—is already leading to changes in the sedge/grass community. Tall, rank vegetation discourages foraging by cranes and other waterbirds, especially geese that depend in part on this habitat (Jiefeng Jin, personal comm. 2014); and
- Poisoning in agricultural areas.

Japan

- The severe loss of wetlands across the wintering grounds of White-naped Cranes and the artificial feeding at the Izumi Feeding Station in Japan have caused an unnaturally high concentration of birds, which are now dependent on intensive and costly feeding and security measures. If Kagoshima Prefecture and the Japanese government discontinue land rental, purchase of wheat (*Triticum aestivum*), artificial feeding, or roost protection, the birds would be forced to disperse without adequate alternative wintering sites;
- Daytime foraging areas on private lands outside the protected area are threatened by human disturbance, road development, and power lines at Izumi;
- The cranes at Izumi use the nearby rice fields, and resulting damage to vegetables and to water dikes between rice fields causes conflict with humans. Local community values could shift to prioritize development over crane-compatible agriculture; and
- Because of the high density of birds at the Izumi Feeding Station, there is a risk of a significant disease outbreak. In winter of 2010–11, nine White Naped Cranes were found dead at Izumi, although none were associated with the highly pathogenic H5N1 avian influenza virus. The same winter 55 Hooded Cranes were found dead, of which seven had died of H5N1 (Haraguchi 2011). Although this incident did not develop into a significant mortality event and cranes are currently thought to be less at risk from H5N1 than waterfowl or many other bird species, it is a reminder of how vulnerable these populations could be to a more virulent H5N1 or other disease. There are also poultry farms holding about 5.2 million chickens in Izumi City, Kagoshima prefecture

(Izumi Agricultural Department, personal comm. 2014). Regulatory authorities are very concerned about the presence of any infectious disease in the Izumi cranes and the resulting possible risks to the poultry industry; this concern could result in negative feelings and pressure for alternative management for the cranes.

Korea

- Commercial development of the Civilian Control Zone (CCZ) buffer area, which is the primary location where cranes feed on rice gleanings. In recent years, the Republic of Korea's government has allowed expanding human activity in the CCZ, leading to increased disturbance from photographers and construction of greenhouses by farmers. The Ministry of National Defense removed about 504 ha of land from the CCZ near Yangjiri in 2013, and removal of more land is expected;
- Double cropping, greenhouses, plastic sheeting on crops, plowing land after harvesting, collecting all straw for livestock feed, and spraying of liquid manure all reduce food availability for cranes in the CCZ;
- Development of lowland parts of the DMZ, which is the most important feeding and roosting habitat for cranes;
- Increase in power lines and disturbance, partly to provide light and heat for greenhouses across feeding areas important to cranes;
- Low sense of urgency and environmental consciousness among major governmental and corporate decision makers about the importance of protecting the DMZ and CCZ habitats;
- Disturbance from increasing tourism including photographers and birdwatchers at roosting sites outside of DMZ or CCZ; and
- Political tension between nations, leading to a breakdown in conservation activities and resulting in vulnerability of DMZ habitats.

CONSERVATION AND RESEARCH EFFORTS UNDERWAY

General

- The species has some level of protected status in all range countries; most locations currently used by the species have some degree of protection by national or local governments with the major exception of Cheorwon Basin and the DMZ, which have persisted in a natural state due to the security situation;
- Monitoring cranes and their key wetlands have been carried out in parts of the Amur/Heilong River Basin, and at wintering sites at Poyang Lake, Cheorwon in ROK, and Izumi in Japan. Long-term studies of White-naped Cranes have been carried out by staff of Dauriski State Nature Reserve and Muraviovka Park in Russia, with similar efforts in northeast Mongolia. Data on numbers and migration are regularly shared among researchers along the flyway;
- Some sites important to the White-naped Crane belong to the waterbird flyway site network under the East Asian – Australasian Flyway Partnership, and/or are proposed to be nominated for designation as Ramsar sites;
- A workshop, Conservation and International Cooperation for Hooded and White-naped Cranes, held in Japan in November 2003, provided updates on current population surveys, banding and telemetry work, range and habitat assessments, and migration stop-over and wintering range (Korea

and Japan) conservation actions. The idea of forming a White-Naped and Hooded Crane East Asia Network was discussed;

- A White-naped and Hooded Crane Network was initiated in 2015 and met in March 2015 near Huanzidong wetland in Liaoning Province of China; and
- North-east Asian Subregional Programme for Environmental Cooperation (NEASPEC) selected two species of cranes including the White-naped Crane and Hooded Crane as priority flagship species; scoping surveys and joint studies are underway in transboundary areas in Mongolia, China, Russia, and ROK including threat assessments, population monitoring, community awareness, and crane counts at wintering and breeding sites.

Western Population

- Protected areas at Poyang Lake have expanded to cover over half the wetlands of the lake basin, and capacity is growing for research and management by Poyang Lake and Nanishan National Nature Reserves;
- Research, monitoring, public education, and technical advice regarding the Poyang Lake ecosystem is ongoing, involving numerous organizations such as International Crane Foundation (ICF), World Wildlife Fund, Beijing Forestry University, and others within and outside China;
- Global Environment Facility (GEF) funding, through the United Nations Food and Agriculture Organization (FAO), is expected for the Poyang Lake National Nature Reserve. Another GEF project, through UN Development Programme, is planned for the migratory stopover at Shengjin Lake in Anhui;
- Research and advocacy is ongoing for water supply to sustain wetlands important for cranes in northeast China.
- ICF is cooperating with the Chinese Academy of Science and Momoge and Tumuji National Nature Reserves on a demonstration project assessing climate change vulnerability, developing climate change adaptation plans, and implementing pilot activities;
- The Asian Development Bank recently implemented a major project on behalf of six protected areas with White-naped Cranes in Sanjiang Plain; GIZ (German Corporation for International Cooperation) funded a four-year project to improve capacity in two reserves in Sanjiang and the Yellow River Delta;
- ICF, Wildlife Science and Conservation Center, Mongolian Academy of Science, U.S. Forest Service, Beijing Forestry University, Poyang Lake National Nature Reserve, and the Korean Crane Network are cooperating on a migration tracking study for cranes nesting in the Khurkh and Khuiten Valleys of Mongolia and wintering at Poyang Lake;
- The Wildlife Conservation Society (WCS) chose the White-naped Crane as one of two primary focal species for its Living Landscapes Program on the Daurian Steppe (including Russia, China, and Mongolia). Research and conservation planning for the species were conducted by WCS in northeastern Mongolia;
- ICF, Wildlife Science and Conservation Center, Mongolian Academy of Science, and U.S. Forest Service are collaborating to conduct research on nesting ecology, hydrology, and rangeland management in the Khurkh and Khuiten Valleys of Mongolia and promoting protection of this key breeding habitat;

- Ecological education of local people living near crane breeding sites located outside of protected areas has been conducted by staff of the Dauriski State Nature Reserve in Russia; and
- Efforts by the Dauriski State Nature Reserve to reduce crop depredation by cranes has significantly reduced illegal shooting of cranes by farmers.

Eastern Population

- Research and advocacy in ROK for crane protection in the DMZ, CCZ, and Han River has been carried out;
- At Izumi, rental and flooding of roosting habitat, artificial feeding, monitoring, and measures to reduce conflict with farmers are being put forth; and
- ROK and Japan have been coordinating to conduct accurate winter counts.

CHANGES SINCE 1996

The global population of the White-naped Crane has substantially increased in the past 20 years. Currently however, the eastern and western populations are not following the same trends. In the west, where natural habitat in winter is available, numbers have fallen by half. In the east, the species continues to increase even though very little natural habitat is left either in the Korean Peninsula or Japan.

The eastern population is increasingly dependent on the fragile situation on Cheorwon Plain where people increasingly use the CCZ; the future of the DMZ itself as a refuge for cranes and other wildlife depends on continuing the current balance between war and peace maintained by an uneasy truce. Izumi becomes increasingly crowded. While numbers of White-naped Cranes wintering there are reduced as more birds stay at Cheorwon, numbers of Hooded Cranes are increasing year by year.

During the past decade, the greatest loss of wetlands has probably occurred along coastal areas of the Yellow Sea in China and Korea (MacKinnon et al. 2012). Along China's 18,000-km coastline, for example, sea walls had been constructed along 11,000 km or 61% of the coastline by 2010. Bird watchers reported increasing crane numbers at Miyun Reservoir near Beijing. In spring 2014, 1,330 White-naped Cranes were counted (Yifei Jia, personal comm. 2014), a number representing most of the population wintering within China. However, the cranes are no longer using this site due to habitat alteration (Spike Millington, personal comm. 2018). An inland migration route leaves this population less vulnerable to coastal development. In 1985–1986, Williams et al. (1991) reported only small numbers migrating past Beidaihe on the coast of Bohai (part of the Yellow Sea), suggesting that the species may have long preferred the inland route. Yet a tracking study in the early 1990s indicated use of coastal wetlands by White-naped Cranes at that time (Harris et al. 2000).

Over the past 20 years, while additional sites have come under protection, the overall quality of habitats for White-naped Cranes has declined for breeding, migratory, and wintering periods as sites should be identified for quality assessment. Fragmentation of habitat—in particular after reclamation of most wetlands in the major crane breeding area of Sanjiang Plain in China—means that many birds may now be too disturbed by human activity to breed successfully (Liyong Su, personal comm. 2014).

Factors that reduce breeding success—wetland reclamation, fires, human disturbance, habitat fragmentation—also force cranes into greater human proximity on farmlands and leave the species increasingly vulnerable to mortality factors such as poisoning and power line collisions.

PRIORITY RESEARCH AND CONSERVATION ACTIONS

General

- Sustain efforts for the long-term water supply to maintain wetland functions for key cranes habitats in all parts of the flyway;
- Designate additional protected areas, including wetlands used during dry periods in the forest-steppe zone of Russia and Mongolia, the breeding area at the Khurkh and Khuiten River Valleys in Mongolia, additional stopover sites on migration including Daedong and Cheongcheon River Estuaries in the DPRK, Miyun Reservoir, and Duolun in China, parts of the Cheorwon Basin in the ROK, Borzya River in Russia, and alternate wintering locations in Korea and Japan;
- Study migration routes and habitats used by cranes along its flyways, identify additional stopover locations, and determine if there is exchange between populations wintering in China and Korea/Japan;
- Develop strategies for responding to climate change impacts on the species and/or its habitat;
- Better integrate crane conservation with agriculture production by promoting environmentally friendly farming practices adjacent to wetlands, reducing human disturbance and better managing breeding habitat within farming areas (particularly in the Sanjiang Plain in China and Cheorwon and Yeoncheon in the ROK), and developing mitigation methods for crop depredation that meet local community needs;
- Improve enforcement of conservation regulations near crane habitats particularly for the western flyway;
- Develop monitoring program to gather reports of poisoned cranes and secure information from tissue samples from dead cranes (whether poisoned or not) of levels of toxins including heavy metals;
- Develop strategies to reduce mortality from poisoning resulting from cranes ingesting poisoned baits illegally placed to capture ducks and geese and crane, and from cranes ingesting seeds treated to increase crop yield. Strategies should include awareness, better monitoring, local community, and forestry bureau cooperative action, increased enforcement, and poisoning “hotlines”; and
- Improve crane population estimate methods and assess effectiveness of count techniques and timing. Collect data to investigate population trends for Daurian, Primorye, and middle Amur regions.

Western Population

- Closely monitor changing wetland conditions and food supply for White-naped Cranes at Poyang Lake and develop mechanisms to better integrate waterbird conservation with management for fisheries of winter sublakes at Poyang Lake;
- Reduce disturbance to cranes by tourists and photographers through better enforcement, public education, and visitor management;
- Work with local herdsman communities in Mongolia, Russian Daurian Steppes, and northeast China to enhance management of grasslands and water resources, and to reduce disturbance to breeding cranes;
- To reduce effects of legal spring hunting, establish small “peace sites” on key breeding areas in Dauria where spring hunting is prohibited; develop model program at Khanka Lake; continue work to stop spring hunting in all of Russia; conduct ecological education for hunters; and strengthen protection of crane habitats during hunting seasons; and

- Increase prevention and control of grassfires on breeding grounds in Russia and Mongolia.

Eastern Population

- Reduce threats to quality of Korean wintering habitats in CCZ (Cheorwon and Yeoncheon) including power lines, greenhouses, ginseng (Panex) fields, and other farming practices adverse for cranes, and disturbance from tourists, photographers, and birdwatchers. Develop a protection and sustainable development strategy to reduce conflict between crane habitat protection, farmers' economic needs, and tourism;
- Continue international collaboration to find alternate sites in case the critical habitats of the DMZ and CCZ are developed;
- To offset impacts of urban development, develop alternative feeding sites in Gimpo and Imjin River Estuaries in ROK;
- Coordinate effort to protect and manage alternate wintering areas in Japan and facilitate the dispersal of significant number of cranes to those sites, reducing the need for intensive feeding and resulting crane concentration at Izumi. Conduct research on habitat selection preferences to help manage alternate wintering sites;
- Work with Japanese and Izumi City Governments to develop contingency plans for emergency response to a significant disease event at Izumi and other concentration areas building on model for highly pathogenic avian influenza;
- Coordinate counts between Japan and Korea to provide accurate winter numbers;
- Investigate the use of wetlands during migration through DPRK and coordinate with migration dates/numbers from Russia and other countries as appropriate;
- Advocate for strengthened regulations and raise awareness of disturbance to migrating Red-crowned, White-naped and Hooded Cranes at stopovers in DPRK;
- Communicate with local government and farm leaders to limit usage of agricultural chemicals including pesticides in DPRK; and
- Train managers and rangers in nature reserve and wetland management for stopover sites in DPRK.

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