SPECIES REVIEW:

SIBERIAN CRANE (*Leucogeranus leucogeranus*)

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(with inputs from George W. Archibald, Nikolai Germogenov, James T. Harris, Borja Heredia, Eugenia Lanovenko, Tatiana Kashentseva, Tilman Schneider, Anastasia Shilina, Alexander Sorokin, and Maria Vladimirtseva)

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Siberian Cranes foraging at Momoge National Nature Reserve after water releases raised water levels (Photographer: Zheng Zhongjie, International Crane Foundation Contributing Photographer)

Red List Category: Critically Endangered
Population Size: 3,600–4,000
Population Trend: Overall probably stable
Distribution: Siberia to China, India, and Caspian Sea

Mirande CM, Harris JT, editors. 2019. Crane Conservation Strategy. Baraboo, Wisconsin, USA: International Crane Foundation.

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DISTRIBUTION AND STATUS OF KEY SITES

Subspecies/Populations

The Siberian Crane is a monotypic species with two isolated populations. The East Asian population spends the winter in China on Poyang Lake in the Lower Yangtze River Basin and breeds in the northeast Siberian tundra between the Yana and Kolyma Rivers. The Western/Central Asian population is divided into a Western Asian flock and a Central Asian flock. The former winters near the Caspian Sea shores of the Islamic Republic of Iran and nests in the central part of Western Siberia, but only a single individual remains. The Central Asian flock, at least formerly, wintered in northern India and bred in Western Siberia near the low reaches of the Ob River (Meine and Archibald 1996).

East Asian Population

The East Asian flyway stretches for nearly 6,000 km. The migration corridor of the population, including areas of flight concentrations and stopover sites, has been documented by the use of satellite transmitters and ground surveys (Kanai et al. 2002, Markin et al. 2005). The main breeding locations provide the basis for site protection and monitoring of the population (Germogenov et al. 2013). Core breeding sites have been well protected by the Yakutian government, and long-term ecological research is being conducted. Non-breeding individuals range widely and are sometimes observed during the summer near their breeding grounds and adjacent areas as well as in the Russia-Mongolia-China transboundary region (Degtyarev and Labutin 1991, Ilyashenko et al. 2010). Important stopover sites in the Aldan basin in Russia have been identified and protected in the last decade and serve as a key monitoring network to assess the status of the species (Germogenov et al. 2013).

On the southbound migration after reaching northeast China, Siberian Cranes need to rest and replenish energy reserves. In the 1980s, Siberian Cranes stopped primarily at Zhalong National Nature Reserve (NNR) in Heilongjiang Province and Momoge NNR in Jilin Province, while small flocks also used Keerqin NNR in Inner Mongolia and Xianghai NNR in Jilin as well as other sites (Li and Li 1991, Wu et al. 1991). The important migratory stopovers in northeast China have been affected by water diversions and drought. Rainfall has been highly variable, and wetlands frequently dry. Since 2004 the number of Siberian Cranes at Momoge NNR has increased up to 3,600 Siberian Cranes due to sustained and seasonally timed water releases by the local government (Germogenov et al. 2011; Jiang Hongxing, unpublished data). This site continues to be a critical stopover for migratory Siberian Cranes during both autumn and spring migrations. The number of birds at Zhalong has decreased due to reduced water supply and wetland fragmentation within the reserve (Pang et al. 2005).

Almost all individuals in the East Asian population winter at Poyang Lake in southern China, which is the largest freshwater lake in China. The lake faces severe threats including changes in hydrology, land use, climate, and economic development (Harris and Zhuang 2010). Legal protection of the cranes at Poyang Lake has been strengthened with two national-level, two provincial-level, and 15 county-level NNRs; however, protection of the fragile wetlands is facing enormous challenges.

Western/Central Asian Population

The Siberian Cranes in the Western/Central Asian population use two flyways. Both the Western and Central Asian flocks use the same migration route from their breeding grounds in Russia to Kazakhstan, where Siberian Cranes make their first long-term migration stopovers for up to 1.5–2 months, mostly in the Naurzum Lake System in the Kostanay Region of Kazakhstan (Bragin 2008). Until 2014 one or two Siberian Cranes were sighted almost every year in the Naurzum Lake System (Bragin 2008, 2011, 2014). After resting in Kazakhstan, Siberian Cranes continue their migration in one of two directions: along the Central Flyway to India and along the Western Flyway through the Volga Delta along the western coast of Caspian Sea to Iran. There are no recent records of Siberian

Cranes in Turkmenistan, Afghanistan, and Pakistan along the Central Flyway to India, whereas in Uzbekistan there have been reports of Siberian Cranes in the last decade, mostly in flocks of Eurasian Cranes (Shilina 2008, Fundukchiev and Belyalova 2008). Along the Western Flyway, a few Siberian Crane records continue to come regularly from the Volga Delta at the Astrakhan State Nature Reserve in Russia and from Kurinskaya Kosa in Gyzyl-Agach Nature Reserve in Azerbaijan (Shilina 2008; Sultanov and Kerimov 2008; Rusanov 2011, 2014; Rusanov et al. 2013; Rusanov, unpublished 2015 data). A single bird has arrived in Iran during each winter since 2006–07. The last pair was sighted in India on wintering grounds in winter 2001–02 (Vardhan 2002). The wintering areas for the other recorded birds are unknown. From 1996 to 2016 there are records in each year of Siberian Cranes on the breeding grounds in West Siberia or in the southern part of West Siberia along the Western/Central Flyway (Shilina 2008, Ilyashenko et al. 2010, Shilina et al. 2011, Sorokin and Shilina 2013; Alexander Sorokin and Anastasia Shilina, unpublished 2016 data). The last record of one Siberian Crane was in September 2016 in Tyumen Oblast (Province) in the southern part of West Siberia (Alexander Sorokin, personal comm. 2016).

Reintroduction efforts have resulted in the release of 181 birds into this flyway since 1991 (Tatiana Kashentseva, personal comm. 2016), out of which 152 started migration (Anastasia Shilina, personal comm. 2016). A total of 39 eggs, produced at the Oka Crane Breeding Center and International Crane Foundation, were placed in Eurasian Crane nests for cross-fostering in West Siberia on the breeding grounds in the Kunovat River basin and Konda and Alymka Interfluves. There were two sightings of Eurasian Cranes with Siberian Crane chicks. In the southern Ural, two injured cranes were found during the year of their release: in 2003 one juvenile Siberian Crane in the vicinity of Ekaterinburg, and in 2004 a one-year old Siberian Crane in the Republic of Bashkiria. Both cranes were returned to Oka Crane Breeding Center. Two banded Siberian Cranes released in previous years were sighted in Russia: one bird in spring 2001 in Omutninskiy District, Tyumen Region (Shilina et al. 2011), and one bird in spring 2008 in Khanty-Mansy Autonomous Region (Shilina et al. 2011).

ECOLOGY

The Siberian Crane is the most aquatic of the crane species and is dependent on shallow wetlands and wet mud. In winter and on migration the birds primarily eat tubers of aquatic plants. Until very recently, the eastern population had rarely been seen in rice (*Oryza sativa*) paddies or other agricultural lands.

Poyang Lake offers reliable wintering habitat to over 400,000 waterbirds each winter due to the remarkable fluctuations in water levels that occur between summer and winter (Liu and Ye 2000, Qian et al. 2009, Shankman et al. 2009). For most of the year, Poyang empties into the Yangtze River, but during summer floods Yangtze waters may flow the other way, into Poyang Lake. The rainy season extends through the warm seasons, after which water levels drop dramatically in autumn, falling as much as 11 m to expose vast shallows and mud flats in winter. Wind moves shallow water across this flat basin, so that feeding areas are diverse and constantly changing and thus can support East Asia's largest concentration of wintering waterbirds.

The Siberian Cranes feed primarily on tubers of submerged aquatic plants by digging in shallow waters and wet muds, with the most favored winter food being the submerged aquatic plant, wild celery (*Vallisneria*). *Vallisneria* in turn is sensitive to summer water levels, requiring good light penetration through the volume of water during the early summer growth period. Increases in turbidity, one effect of the sand dredging now occurring on a large scale at Poyang, reduce light penetration and thus impede growth of submerged aquatic plants (de Leeuw et al. 2010). In autumn, when water levels drop, the parts of *Vallisneria* above the substrate break away, leaving behind tubers buried in mud.

The cranes thus depend on suitable water conditions in summer for the growth of *Vallisneria* and on shallow water in winter so that they can readily dig the tubers (cranes cannot dig them out of dry lakebed or deep water) (Barzen 2008).

Siberian Cranes also depend on shallow wetlands during the long-term stopovers they make in both spring and fall in northeast China (Harris 2009). This semi-arid region has highly variable rainfall influenced by long-term cycles of drought and flood, so that wetland conditions change drastically from year to year. At Momoge NNR, the primary food is two species of *Scirpus*, emergent plants that also store nutrients in tubers buried in the mud. Distribution and availability of *Scirpus* tubers are influenced by seasonal and multi-year fluctuations in water level, salinity, and plant succession (Lim et al. 2000, Li and Zhang 2013). While a wide array of wetlands has historically provided a range of habitats in any one season, continued destruction of wetlands and growing human demand for water mean there is less flexibility in choice of habitats for cranes on their long journeys.

NUMBERS AND TRENDS

The Siberian Crane is the world's third rarest crane and the most endangered. The total population is estimated at 3,600–4,000 birds, almost all in the East Asian population. The Siberian Crane disperses across vast, inaccessible wetlands so double counting (or missing some cranes) may be impossible to avoid. Accordingly, complete counts depend on days when birds are highly concentrated or when multiple counting parties can be coordinated. This population estimate is based on years of synchronized winter counts at Poyang Lake (Li et al. 2012), supplemented by years of migration counts at Momoge where in recent years almost all Siberian Cranes have congregated on one large wetland (Jiang Hongxing, unpublished data). The Western/Central Asian flocks are almost gone and now estimated at 10–20 individuals. The last known pair of the Central Asian flyway was seen in Keoladeo National Park in India in the winter of 2001–02 (Vardhan 2002); in the Western Asia flock the number of birds has decreased and only one Siberian Crane has arrived in Iran each winter from 2006–07 to 2015–16 (Sadeghi Zadegan et al. 2009, Vuosalo Tavakoli 2014; Sadegh Sadeghi Zadegan, personal comm. 2016). There are regular sightings of up to 10–20 birds on the West Siberia breeding grounds and at migration sites, suggesting the existence of unknown additional wintering grounds for the central and western flyways (Shilina 2008, Sorokin and Shilina 2013, Rusanov et al. 2013, Rusanov 2014, Wetlands International 2014).

The Western/Central Asian population is no longer genetically or demographically viable and is at risk of extinction in the near future. The East Asian population remains stable or slightly increasing. Unfortunately, virtually all the East Asian population winters at a single site, Poyang Lake.

THREATS

East Asian Population

- Plans have been advanced for many years to dam the outflow of Poyang Lake to stabilize water levels to enhance navigation and other economic activities throughout the year. If such a plan were implemented, current crane habitats might be flooded and the population would likely suffer a dramatic decline;
- Knowledge is inadequate for stopover sites from Liaoning Province to Poyang Lake as a basis for habitat protection measures, especially for alternative sites that may be significant in very dry or very wet years;
- Dams and diversions of water alter critical wetlands in China (e.g., Poyang, Momoge, and Zhalong), with impacts exacerbated by climate change and by lack of greater cooperation between governmental agencies;

- Habitats are lost and degraded in China due to conversion to agriculture, livestock grazing, and oil drilling;
- Use of water resources is unsustainable and occurs within nature reserves in China (e.g., sand dredging and aquaculture practices such as crab farming); these activities contribute to reduced wintering habitat quality. In particular, crab farming can eliminate all aquatic plants and thus destroy habitats important for cranes and other waterbirds;
- Effective management is lacking for some sites including Huanzidong and Wolong Reservoirs, important stopover sites in Liaoning Province;
- Declining water quality may result in macrophyte-dominated wetlands changing to phytoplankton-dominated systems that do not provide adequate food for cranes. This sudden change has happened at lakes in the mid-Yangtze Basin (Fox et al. 2010);
- Human disturbance prevents cranes from utilizing suitable habitat. Energetics may be altered due to disturbance during foraging, especially at Poyang and Momoge;
- Disturbance from waterfowl hunters and mammoth bone collectors, competition from Tundra Swans (*Cygnus columbianus*) and Sandhill Cranes (*Grus canadensis*), and predation by wolverines (*Gulo gulo*) may be contributing to nest failure (Germogenov et al. 2015);
- Increased use of continuous or caterpillar-tracked transportation across the tundra is leading to loss of lichens, soil erosion, and replacement of tundra lichen cover with grasses (Flint 1987, Degtyarev and Labutin 1991, Bysykatova and Krapu 2009);
- Economic development may alter staging areas in southern Yakutia including river regulation, infrastructure development, oil and gas and mining industries, and power line construction (Nikolai Germogenov, personal comm. 2016);
- A significant disease event (e.g., a highly pathogenic avian influenza virus or avian cholera) could occur, especially at sites where wild birds, such as dabbling ducks, mix freely with domestic poultry and where Siberian Cranes are concentrated (e.g., Poyang, Momoge);
- Pollution from pesticides, herbicides, and heavy metals is an emerging problem along the flyway, including ingestion of lead shot at a stopover site in Yakutia (Pshennikov et al. 2001); and
- Climate change is degrading breeding habitat through erosion of lake edges by waves and ice melt increasing the surface area of lakes, and through loss of nesting islands and isthmuses in lakes used for nesting (Germogenov et al. 2013).

Western/Central Asian Population

- Traditional hunting along the flyways, especially in Afghanistan and Pakistan, is believed to be a primary cause of decline of this population. Crane hunting was formerly widespread in these countries but was recently been made illegal in all areas. Hunting is difficult to control, however, especially in tribal areas. Following the collapse of the USSR, hunting escalated in Azerbaijan, Kazakhstan, and Uzbekistan;
- Human densities are high at wintering areas in Iran. The remaining habitats at Ezbaran and Fereydoonkenar are privately owned and dependent on the goodwill of local rice farmers and the persistence of the traditional livelihood of duck trappers who restrict hunting. The Department of the Environment has officially established a Non-Shooting Area at Fereydoonkenar (Sadeghi Zadegan 2011); and

- The breeding grounds of both the Western and Central flocks have potential for gas and oil production that can contribute to disturbance of the Siberian Crane and habitat degradation; and
- Disease is a risk as noted above, especially at wintering areas in Iran.

CONSERVATION AND RESEARCH EFFORTS UNDERWAY

- Sixteen sites of importance to the Siberian Crane that are also significant to global biodiversity were included in the UNEP/GEF Siberian Crane Wetland Project (SCWP, 2003–2009), which aimed to protect an ecological network of these sites (http://www.scwp.info). Community and science-based management plans were developed for all project sites (Harris 2009, Mirande and Prentice 2010);
- Eleven range states developed the seventh Conservation Plan for the species (2010–2012) under the UNEP/Convention on Migratory Species (CMS) Siberian Crane Memorandum of Understanding (MOU) (see http://www.cms.int/species/ siberian_crane/sib_cnspln.htm for details). The Siberian Crane MOU was the first MOU developed under the auspices of CMS in 1993 (http://www.cms.int/en/legalinstrument/siberian-crane);
- The East Asian-Australasian Flyway Partnership oversees the East Asian Waterbird Site Network that includes major sites for the Siberian Crane;
- China's State Forestry Administration and Chinese provincial agencies manage critical wetlands, assess impacts of water management, and conduct monitoring, research and outreach, networking with local, national, and international organizations;
- Siberian Crane is listed in Red Data Book of the Russian Federation, providing the highest status of nature protection legislation for the species in Russia;
- Cranes and their key wetlands have been monitored and studied on the breeding grounds (Yana-Indigirka tundra) and migratory sites (basins of upper Indigirka and Middle Aldan) by the Institute for Biological Problems of the Cryolithozone (IBPC, Yakutian Science Center) in Russia, and the Amur/Heilong River basin (migration sites) by nature reserve staff in China;
- The Ministry of Nature Protection of Sakha Republic (Yakutia) has increased protection and management at key stopover sites in the Aldan River Basin;
- The Ministry of Nature Protection, Sakha Republic (Yakutia) strengthened protection and management of key areas of breeding and migratory stopovers, including 19 specially protected nature areas key to Siberian Crane conservation, and developed a state program of protection and monitoring of the Siberian Crane in Yakutia in 2016–2020. The status of Kytalyk Republic Resource Reserve was raised in 2014 to a Republic-level Wildlife Refuge. It is on a list to be elevated to a Republic-level Nature Park;
- The Oka Crane Breeding Center, Cracid Foundation/Weltvogelpark, International Crane Foundation (ICF), and zoos maintain a species bank with the capability of providing birds for release (Kashentseva and Belterman 2014); and
- A "Flight of Hope" project has been conducted by Russia (All-Russian Research Institute for Nature Protection, Sterkh Foundation, Administrations of Yamalo-Nenetski and Khanty-Mansiski Autonomous Regions, Oka State Nature Biosphere Reserve, and ITERA and Petroresurs Oil Companies) in collaboration with Uzbekistan (Gosbioncontrol, Institute of Zoology of Academy of Science of the Republic of Uzbekistan, Center for Breeding of Rare Animals) (Shilina et al. 2011). The project aims to develop a viable technique for reestablishing the Western/Central Asian flocks.

CHANGES SINCE 1996

The Western/Central Asian population has declined from 55 (Meine and Archibald 1996) to an estimated 20 individuals in 2008 (Shilina 2008). Data on numbers of birds at current breeding and wintering sites are scarce. Genetic and demographic viability of the Western/Central Asian population are poor due to reduced numbers. The recorded numbers of the East Asian population have risen from 2,900–3,000 to 3,600–4,000 birds. This increase may be attributed in part to concentrations of birds at key sites as other areas are lost or degraded and also to more complete counts, but the population appears stable or increasing.

Beginning with winter 2010–11, following a major flood that destroyed most *Vallisneria* across the Poyang Lake Basin, Siberian Cranes have been observed more frequently feeding in sedge meadows and rice paddies away from the mudflats and shallow waters (Barzen et al. 2011; ICF, unpublished 2011 data). On migration in southern Russia and northeast China, Siberian Cranes now sometimes join other cranes to feed in corn (maize, *Zea mays*) fields (Harris 2009, Bragin 2014; Sergei Smirenski and Hongxing Jiang, personal comm. 2016).

Croplands were rarely used in the past by this most aquatic of East Asia's cranes. The change may be the result of several factors combined: less fear of people, frequent use of croplands for foraging by other crane species in the flyway, and deteriorating natural habitats. Implications of this behavioral change for conservation may be significant – on the one hand, opening up large new areas for foraging, but on the other exposing these birds to agricultural poisons and poachers.

Coordination and communication among the range states have been strengthened through regular meetings and conservation planning under the auspices of the CMS MOU. Substantial progress was achieved under the SCWP including improved legal protection, application of sound science to management decisions, and engagement of local communities and stakeholders (Prentice at al. 2006).

There has been a significant increase in protected areas since 1996. Under SCWP, the legal protection of flyway wetlands at the project sites was strengthened for over 2.4 million ha in the four countries, including creation of new specially protected areas (SPAs), upgraded status and expanded size of the existing SPAs, and designation of buffer zones. Twelve of the 16 project sites have been officially designated as Wetlands of International Importance under the Ramsar Convention and nominations are in preparation for the remaining four sites (Mirande and Prentice 2010). A Western/Central Asian Site Network for Siberian Crane and Other Migratory Waterbirds was created under CMS, with 12 sites in six countries officially designated (Ilyashenko and Mundkur 2011, Siberian Crane Flyway Conservation Program 2016).

During 2012–2015, the International Crane Foundation collaborated with the Research Institute for Forest Ecology, Environment and Protection in China, as well as with Momoge and Tumuji NNRs, to develop Climate Change Vulnerability Assessments for each of the two nature reserves, and then the Climate Change Adaptation Plans. This project increased capacity of the reserves to sustain Siberian Cranes and other waterbirds through the fluctuating water conditions typical of semi-arid regions; this variability is expected to increase with climate change.

In 2014, the Disney Conservation Fund selected the Siberian Crane as one of ten flagship species under a ten-year Reverse the Decline initiative. The project focuses on the eastern flyway and applies the Open Standards for Conservation to intensive conservation planning and adaptive management. A strategic planning process has been undertaken, prioritizing key threats and developing strategies with result chains that link actions to key results and measurable outcomes (Conservation Measures Partnership 2013) with access provided through the International Crane Foundation.

PRIORITY RESEARCH AND CONSERVATION ACTIONS

- Strengthen conservation of major wetlands in China that serve as critical migration and wintering habitat for the East Asian population through research, management, and policy activities:
  - o Water management at Poyang needs to sustain wetland productivity and ensure that extensive mudflats and shallow water areas are available throughout the winter;
  - o Manage the most important wetland habitats in the 27 sublakes in the Poyang Lake and Nanjishan NNRs (also located at Poyang Lake) to integrate waterbird conservation with fisheries management and use as a model for management across the entire lake basin;
  - o Strengthen integrated water management at migratory stopover sites in Northeast China, guided by on-going monitoring of the condition of these wetlands, to support wetland ecosystems that provide growing conditions for abundant crane food resources and access to that food during Siberian Crane migration;
  - o Maintain or improve water quality at key stopover and migration sites to avoid detrimental ecosystem change or direct effects on crane survival;
  - o Continue long-term research on the effects of changes in water levels on aquatic plants and water birds at Poyang and sites in Northeast China; and
  - o Protect and manage additional stopover sites, especially from Liaoning to Jiangxi Provinces, based on further investigation of migratory habitats.
- Use telemetry and color banding to identify locations of unknown and important habitat (stopover, summering, and breeding), movements, and habitat use by Siberian Cranes during all stages of the annual cycle, and assess threats and conservation opportunities;
- Through community awareness activities, build capacity and inspire conservation leaders and boost community pride in having wetlands that support Siberian Cranes, leading to changed attitudes and deepened community involvement in protection of their wetlands and wildlife;
- Develop a model visitor management program at Poyang Lake to change behavior of bird watchers, tourists, and especially photographers that approach birds too closely, interrupting their feeding or forcing them to find other habitats;
- Upgrade protection of Sakha Republic-level Kytalyk Wildlife Refuge to a Sakha Republic-level Nature Park;
- Strengthen legal protection of nesting sites in the Yana River Delta at the Yana Mammoths Wildlife Refuge, including changing zoning so that crane nesting sites are more strictly protected (Bysykatova and Krapu 2009, Bysykatova 2012);
- Investigate potential impacts of climate change on breeding grounds in Yakutia;
- Identify, legally protect, and manage key staging areas in Yakutia, accompanied by mitigation of development impacts along the flyway;
- Provide technical assistance on wildlife health monitoring and management practices at staging and wintering areas;

- Continue and improve monitoring of Western/Central Asian population during annual cycle (breeding and non-breeding territories, migration stopover sites, and wintering areas);
- Continue and improve work by Russian specialists on captive breeding and reintroduction to the wild Western/Central Asian population using new data, technologies, and achievements;
- Incorporate management of *Western/Central Asian Site Network for Siberian Cranes and other Migratory Waterbirds* under the broader Central Asia Flyway management for migratory birds under CMS (http://www.cms.int/en/legalinstrument/central-asian-flyway);
- Foster relationships with hunters to improve awareness and promote sustainable hunting of waterbirds and to engage hunters in protecting and reporting sightings of Siberian Cranes, especially in Western and Central Asia; and
- Cooperate with gas and oil companies in Russia and China to minimize disturbance of the Siberian Crane and habitat degradation.

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