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Abstract: Crop depredations by staging cranes have been an annual problem at Daursky State Biosphere Reserve in southern Siberia. In September 2001 we met at Daursky when crane populations peaked to investigate the problem and suggest methods to reduce damages. Peak of crane staging coincided with grain harvest. We counted ≈ 30,000 cranes of 5 species, primarily demoiselles (*Anthropoides virgo*), in the area. Poor grain yields and cooperative farming systems discouraged efforts to reduce damage. Moving crops further from roost areas may be the most reasonable short term control method, but it's effectiveness is yet untested. Hazing, lure crops and alternate food plants also may work.

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Key words: *Anthropoides virgo*, common crane, crop depredation, Daursky State Biosphere Reserve, demoiselle crane, *Grus grus*, *Grus monachus*, *Grus vipio*, hooded crane, Russia, Siberia, white-naped crane

As in North America, Russian wetland nature reserves often attract staging cranes in the fall becoming the foci of crop depredation. Farmers near Daursky State Biosphere Reserve (hereafter SBR) in southeastern Russia, near the borders with Mongolia and China (Fig. 1), have been pressuring the Reserve staff to solve crop depredation problems attributed to cranes. Daursky SBR is an important breeding area for white-naped cranes (*Grus vipio*) and demoiselle cranes (*Anthropoides virgo*), whereas common cranes (*G. grus*) rarely breed there. Daursky SBR is an important summering area for these species, plus non-breeding hooded cranes (*G. monachus*) and a few Siberian cranes (*G. leucogeranus*). The breeding and summering birds are joined in fall by large numbers of migrants. Peak populations of cranes and waterfowl coincide with harvest, and damage is alleged to be considerable at times. Thousands of ducks and geese are present during fall and contribute to depredation problems, but complaints were focused primarily on cranes. Our objectives were to visit Daursky SBR during peak fall populations to observe and suggest potential methods to reduce crop damage by cranes.

STUDY AREA

Daursky was established as a Nature Reserve in 1987, became a RAMSAR Site in 1994, and was designated a State Biosphere Reserve in 1997. It is an important reserve support-

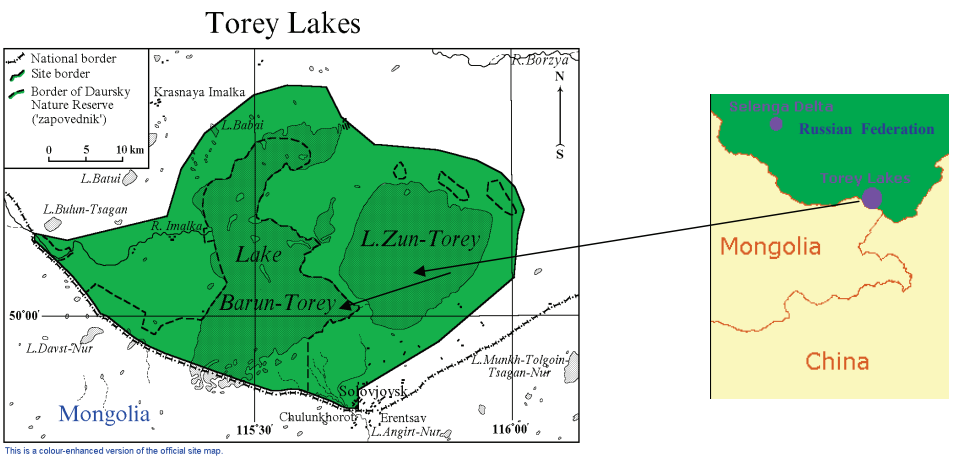

Fig 1. Map of Daursky State Biosphere Reserve and RAMSAR Site. Crane depredation problems occurred north and west of Lake Barun Torey and on the cape extending into the lake opposite the mouth of the Imalka River. Insert shows geographic location of Torey Lakes (UNESCO 2001, Wetlands International 2003).

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ing many endangered, threatened, and endemic species of birds, mammals, plants, and invertebrates (UNESCO 2001). The reserve is 700 km southeast of Lake Baikal in the Mongolian-Manchurian Steppe Biogeographic Region (Fig 1). Elevations range from 598 - 769 m above sea level. The climate is continental with winter and summer extreme temperatures ranging from -40 to 40 °C. The reed marshes (*Phragmites australis*) at the mouths of the Imalka and Uldz Rivers in and near Mongolia support ≈ 15 pairs of breeding white-naped cranes and 1,500 pairs of demoiselle cranes nest on the steppe of the Big Torey Depression (Goroshko 2002). Biosphere reserves are organized into 3 zones; the core area, the buffer zone, and the transition area. Only the core area requires legal protection. Daursky SBR is a cluster reserve covering 227,700 ha (UNESCO 2001). The core area is 45,700 ha, the buffer zone is 92,000 ha, and the transition area is 90,000 ha. The Reserve lies within the Torey Lakes RAMSAR Site (Fig.1). Barun Torey and Zun Torey (also spelled Zoon), are the largest lakes in the Trans-Baikal region and support up to a million migrating waterfowl and waterbirds including several threatened species. The lakes are sodic and have no outlet (UNESCO 2001, Wetlands International 2003). Daursky SBR has also been designated as an Internationally Important Bird Area (Goroshko 2000).

The steppe resembles mid-grass prairie of the United States with a mix of grasses and forbs. Dominant steppe vegetation included *Stipa baicalensis, S. krylovii, S. grandis, S. klemensii, Festuca lenensis, F. litvinovii, Koeleria cristata, Filifolium sibiricum,* and *Polygonum divaricatum* (UNESCO 2001, Wetlands International 2003). About 2,000 people live in 2 villages at the edge of the RAMSAR site, and in scattered dwellings every few km within the site. In 2001, most of the land was grazed, but some areas were cut for hay and about 20% was dryland grain fields, primarily wheat, and some oats. Most land was communally or government owned. Grazing, haying, and grain production seemed to be interconnected in an overall communal system. Most of our observations and counts were completed in the Buffer Zone of the SBR.

METHODS

We counted cranes near Barun Torey Lake and scattered wetlands adjacent to the Imalka and Borzya Rivers during September 2001. O. Goroshko collected fecal samples for dietary studies. We observed crane foraging and resting behavior from blinds located in croplands and on the lake shore. J. Cornely, who has experience with grain harvest in the Great Plains and western United States, visually evaluated crop quality. We discussed depredation problems with reserve staff, and with officials from the grain farming cooperative. O. Goroshko counted the area again in 2002.

RESULTS

We estimated ≈ 30,000 cranes (primarily demoiselles with lesser numbers of other species) were in the study area during our visit (Table 1). Thousands of geese, primarily swan geese (*Anser cygnoides*) and bean geese (*A. fabalis*), and ducks, primarily mallard (*Anas platyrhynchos*) and ruddy shelduck (*Tadorna ferruginea*), were also foraging in grain fields in September 2001. In September 2002, the combined estimate of cranes and waterfowl in crop fields was 52,700 - 60,700 birds (Goroshko 2003).

Most depredation problems stemmed from placement of the crop fields. Fields on a cape projecting into Barun Torey Lake experienced the worst damage. Most of the cranes were in fields < 1 km from roost sites. Demoiselle cranes roosted on pebble beaches whereas other species roosted in shallow marshes.

Cranes mainly fed in harvested fields, but unharvested wheat fields were also used. Unharvested oat fields did not seem to attract many birds. Waterfowl showed a similar pattern of field use as cranes. O. Goroshko's visual evaluation of fecal droppings suggested that in harvested fields cranes consumed mostly waste grain. In unharvested fields cranes selected 2 grasses, foxtail (*Setaria viridis*) and a self-seeding subspecies of millet (*Panicum miliaceum ruderale*). About 50% (range 10% - 90%) of the food intake from unharvested grain fields was seeds of these grass species (Goroshko 2002). Even when selecting other food items cranes still cause extensive crop losses in unharvested fields by shattering heads and knocking over stems.

Our cursory evaluation of grain crops suggested that they were marginal, a situation that may be contributing to the depredation problem. There is less incentive to expend additional effort to haze cranes from fields when potential yields are marginal. The fields had yields ranging from poor to very poor when compared with dryland grain crops in America. Stems were short, heads were small, and seeds were small and somewhat shriveled. Harvest was ≈ 50% complete during our visit. Assuming the best crops were harvested first, our evaluation of overall crop yields may be biased low. It appeared that only about 50% of the grain fields were planted in any year, with the remaining fields being fallow.

DISCUSSION

Our observations and discussions indicated that farmers were unwilling to expend much effort hazing migratory birds from fields. With poor grain production, there is little incentive and probably little return for depredation control work. Grain cooperatives often delayed harvest in poorer fields, hoping for early snows which would render them a complete loss (O. Goroshko, personal observation). Then they would be eligible for government crop loss payments without having to harvest.

Hunting as a control method is not an option, as crane hunting is prohibited in Russia. However, we heard reports of people shooting cranes to scare them from crops. Of the species using the area, Siberian cranes are listed as critically en-

Table 1. Number of cranes counted at various sites in the Torey Lakes area of Siberia, September 2001.

Location	15 Sept demoiselle crane	22 Sept common crane	22 Sept white-naped crane	22 Sept hooded crane	22 Sept Siberian crane	Total
Between Zun Torey & Barun Torey Lakes (50°08' N; 115°35' E)	21,800	266	176	813	2	23,057
Novaya Zaria Village (50°20' N; 115°40')	210					210
Borzya River (50°17' N; 115°49' E)	490					490
Imalka River, Aru-Torum Lake (50°12' N; 115°18' E)	1,185					1,185
Imalka River, Bulum-Tsagan Lake (50°08' N; 115°10' E)	1,500	679	8	208		2,395
Ukshinda Lake (50°21' N; 114°50' E)	115					115
Total counted	25,300	945	184	1,021	2	27,452
Total estimated (x 1000)	26.8 - 29.3	1.05 - 1.35	1.95 - 2.04	1.12 - 1.23	0.002	29.167 - 32.086

dangered, whereas white-naped and hooded cranes are listed as vulnerable (Birdlife International 2000).

Scaring cranes might be done economically by using children of local herders who are scattered throughout the area. Children on horseback, possibly assisted by dogs, could haze cranes from unharvested fields. Hazing works best if efforts begin as soon as the cranes arrive and before they become accustomed to foraging in specific fields. Hazing is more effective if lure crops or harvested fields are nearby. As with sandhill cranes in North America (Littlefield 1986, Sugden et al. 1988), cranes at Daursky seem to prefer short vegetation as long as food was available.

There are several options to produce lure crops. Sharecropping commonly is used on reserves in the United States and Canada. The land management agency provides the land, the cooperator provides the rest. The cooperator then leaves a percentage, usually ≈ 25%, of the standing crop for wildlife. If Daursky SBR can provide the land the farming cooperative may agree to sharecropping. Another alternative is to pay for lure crops or to have them donated. The farming cooperative is willing to plant lure crops if paid for the seed. The Cooperative may also want to be paid for the use of their equipment, as the Reserve has none. However, without a steady source of annual monetary support his approach appears unlikely at Daursky SBR. Overall, lure crops coupled with hazing can be effective in reducing crop damage (Knittle and Porter 1988).

Changing crops may present a partial solution. Oat fields appeared less attractive to cranes than wheat. If oats have similar nutritional value to livestock as wheat, then converting some wheat fields to oats may reduce damage without impacting livestock feeding operations. Whether this is feasible also depends on relative crop yields between oats and wheat as well as maturity dates. Later maturity would risk the crops to longer periods of depredation and greater risk of loss from early snow. Oat fields in the study area also appeared to have poor grain production. Varieties of corn tested near Torey Lakes have been unsuccessful (O. Goroshko, personal observation).

Moving grain fields further from the lakes is perhaps the best option to reduce depredations (Goroshko 2002). The larger fields are in the worst possible locations and encourage depredations, as cranes prefer to forage in fields near roost sites (Iverson et al. 1985, Littlefield 1986, Sugden et al. 1988). The larger fields are on a cape surrounded on 3 sides by water < 1 km away. In 1999, O. Goroshko recommended this method to local farmers and since 2000 the farming cooperative has starting moving fields further from the lake. This trend is likely to continue. There is sufficient arable land to accomplish this. Since cranes will fly nearly 50 km from roost sites to feed, this strategy may work only as long as some food, either waste grain or lure crops are left near the lake (C. D. Littlefield 2004, personal communication). For now this approach appears to be working, but will need further evaluation as less food becomes available near the lakes.

Encouraging or planting foxtail grass and millet in lure areas while discouraging their growth in grain fields may be an option to reduce depredations. Cursory examinations by O. Goroshko of feces from roost sites suggested that these grasses were preferred food. This food preference needs additional investigation. If corroborated, ways to incorporate this information into cultivation schemes could be developed. At the suggestion of O. Goroshko some farming cooperatives tested lure plantings of millet in 2001. Cranes fed in the millet and stayed

out of adjacent wheat fields until after harvest (Goroshko, personal observation).

Another option that could be used in outlying areas away from the Torey Lakes is to haze birds off wetland roost sites. This method has reduced crop damage by sandhill cranes in North America (Stephen 1967, Lovvorn and Kirkpatrick 1981). This is unlikely to work at Torey Lakes as there is a large area available for roosting and it is questionable whether wildlife, especially endangered and vulnerable species, should be hazed from a Biosphere Reserve. Away from the Reserve, where cranes roost on small, isolated wetlands, this technique might work in protecting local crops, but it could be counterproductive overall. More cranes might concentrate on the Reserve, thus increasing damage near there. Instead it may be desirable to protect small isolated roosting areas to encourage cranes away from the larger croplands near the Torey Lakes.

Ecotourism is a potential funding source that might support lure crops. This may be the only site in the world where 5 species of cranes can be seen in 1 field. With good blinds cranes often approach within 20-30 m providing excellent viewing and photographic opportunities. There may be some ecotourism companies that would organize tours, however, the difficulty of travel to this region plus the lack of infrastructure means that ecotourism may not provide substantial funding on a regular basis in the near future.

In conclusion, we believe that depredation problems are unlikely to ever be totally resolved. Some progress has been made and there is potential for much more. Starting in 2002 private individuals were allowed to purchase Russian farmland (Knight Ridder News Service 2002). If some of the croplands were privatized, one would expect that private owners should have greater incentive to undertake depredation control than cooperative members. The Daursky SBR should continue its cooperative work with farmers and cooperatives to use farm fields further inland from roost sites and to continue experimenting with alternative food crops, both for cranes and for livestock. The Reserve should investigate whether sharecropping is possible given the land designation and management constraints. In addition, the Reserve, concerned non-governmental organizations, and farmers should explore ways to develop monetary incentives for providing crane habitat. Ecotourism could help provide funds for lure crops, or even provide funds to assist farmers. The Reserve should continue efforts to educate the local populace about the value of both cranes and wetlands, and to seek ways for cranes and farmers to coexist.

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