WETLANDS OF THE ERGUNA/ARGUN RIVER BASIN – TO BE OR NOT TO BE?

REPORT TO 2007 BRISBANE RIVERSYMPOSIUM

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1. Introduction:

The team that produced this paper included Chinese, Russian and Australian members and was formed initially in 2006 by an international cooperative effort involving AusAid's "Australian Youth Ambassadors for Development" program, local authorities of Erguna District of Inner Mongolia, the Daurian International Protected Area (DIPA), WWF Amur/Heilong River Basin Program and North-East Forestry University, Harbin, China. We were brought together by a common desire to bridge discrepancies in river management and biodiversity conservation in the Daurian "Global 200" ecoregion – a magnificent steppe and wetland area that spans China, Mongolia and Russia. We focused on the river known as the Erguna in China and Arguna in Russia –source of the mighty Amur - which has tremendous global biodiversity values and ecological significance but is virtually unknown by the world's conservation community. In 2006, we began our work with a biodiversity inventory of the 120,000 ha wetland reserve lying in the bounds of Erguna City. These wetlands are under-studied and subject to several pressures from surrounding settlements. Studying pressures that this river faces, we realized that it is severely threatened by a planned water transfer into the Dalai Lake Ramsar Wetland. The natural Dalai Lake ecosystem is also likely to be severely altered and harmed by this water transfer. The logic of integrated river basin management and need for a better understanding of the wider distribution and interconnection of rare birds populations made us strive to expand our activities to the full middle portion of the Erguna River Basin. In 2007, continuation of this effort was supported by a BP Conservation Partnership which enabled us to undertake a project focusing on assessment of the viability and conservation status of important habitats for migratory, breeding and post-breeding bird populations in the Middle Erguna Basin. As part of this project, socio-economic conditions and current trends in water utilization within the project area will be assessed through a participatory survey. Obtained data will be used to underpin a Community Outreach Program and Conservation Action Plan for Erguna Midflow, and explore and manage threats arising from the proposed water transfer scheme and other major economic developments. The project will be completed in 2008, but this paper includes preliminary findings from 2007.Our present mission is to make the biodiversity values and unique pattern of environmental flows of the area known to the world conservation community, to prevent any unsound water transfer from happening and

help to lay the foundation for wise use and protection of these unique ecosystems. The paper also outlines requirements for improved river basin management, including education and capacity building for environmental flow-based management planning and policies.

2. Natural History, Biodiversity and Ecological Flow Patterns:

The Erguna River straddles the China-Russia border in northeast Inner Mongolia (China) and Chitinskaya Province(Russia). The wetlands that are supported by the Erguna River and its tributaries provide habitat for breeding populations and internationally significant numbers of several IUCN Red List and migratory species. These wetlands belong to two globally important ecoregions: Daurian Steppe Ecoregion and Amur Basin Wetlands and Rivers Ecoregion and extend northwards and eastwards from the Important Bird Area (IBA) and Ramsar wetland of Dalai Lake Nature Reserve (see map of area at Attachment A).

The Erguna River originates on the western slopes of the Great Hinggan Mountains in China. From here it runs in a westerly direction, initially under the name of Hailar River. At a point 25 kilometers from Dalai Lake, the Hailar makes a wide curve, hits the Sino-Russian border and, under the name of Erguna, flows in the opposite direction towards the north-east. At this turning point it is connected to Dalai Lake by a small stream severely altered by mining and railroad building in the beginning of the 20th century, and finally substituted by the man-made Xinkaihe canal. Like many other lake-stream systems in the steppe region, water in the small stream sometimes flows from Dalai Lake to the Erguna River and sometimes in the opposite direction, depending on whichever water level is higher. Under the name of Erguna, the river once again reaches the foothills of the Great Hinggan Mountains about 300 kilometers north of its own source and dissects the mountain region in a north-north-east direction until it forms the Amur river at its confluence with Shilka River. The project area for our 2007 BP-sponsored project is mainly the middle part of the Erguna valley that makes a loop in the steppe region near Dalai Lake. Here we find well developed floodplain wetlands along the Hailar/Erguna main stem at its tributaries such as Moergol and Huihe. The most extensive stretch of floodplain wetland 250 kilometers long and 5-15 kilometers wide is situated right on the Chinese-Russian border.

Climate conditions have a pronounced gradient from north-east to south-west with further local variations. While the forest-steppe in the Great Hinggan foothills may receive well over 400 mm of rainfall, the dry steppe near Dalai Lake may well receive less than 300 mm a year on average. The steppe is also subject to a 25-40 year climatic cycle during which the ecosystems of the Daurian ecoregion undergo drastic changes. For example, Dalai Lake - which can cover 2300 sq. kilometers and a depth of 7 meters - was reduced to a small chain of shallow 1m deep pools in 1904. Thousands of smaller steppe lakes dry completely in water-deficient periods, while the flow of the Erguna at the border fluctuates from a low of 1.5 cubic km per year to more than 6 cubic km in high rainfall years. Many smaller streams dry completely or flow only during rainy periods. These cyclical changes are generally more

evident in the steppe lakes that closely follow the climatic cycle, and less pronounced in large stream valleys that are sustained by influx of water from mountains even in some dry years.

In the Daurian ecoregion, protection of single wetland-steppe clusters makes relatively little sense, since most charismatic fauna migrates between these areas in the course of climate cycles. In humid periods, steppe with large lakes and multiple small shallow pools becomes optimal habitat for most wildlife, while in dry periods forest-steppe and floodplains of rivers with permanent flow provide smaller and sub-optimal but stable habitat, while most of the steppe becomes a highly inhospitable area. This complex cyclical drought is probably the most pronounced ecological process forming local ecosystem dynamics in Dauria.

Another important feature of Erguna floodplain is the very active and complex meandering process, leading to formation of multiple oxbow lakes and complex mosaics of reed-beds, willow thickets, meadows and sedge bog habitats. The river has a wide braided floodplain with high speed of bank erosion and quick redistribution of flow between many alternative channels. The constant change is driven by uneven water flow and meandering greatly contributes to the observed habitat and species diversity.

Surveys of the waterways, floodplains, marshes and oxbows of the Erguna valley have found the area is a globally important breeding and stop-over site of many migratory waterbird species. Most work done in the Erguna midflow has been lead by Dr. Oleg Goroshko on the Russian side of the border. According to the research of Dr. Goroshko, the Erguna valley is one of the largest breeding grounds for the endangered Red-crowed Crane in the world. It also is part of the Daurian bottle-neck site of the continental branch of the global East Asian-Australasian Flyway: about 1-2 million migratory birds gather there in spring and autumn. It is also an important area for threatened bird species, supporting 19 IUCN Red List species. Internationally significant populations of Swan Goose, Red-crowned, Siberian and White-naped Cranes, Great Bustard, Red-necked Stint, Broad-billed Sandpiper, Bean Goose, Tundra Swan, Gadwall and Northern Pintail have been recorded in the area. According to Goroshko (2006), the whole Eerguna midflow wetland cluster meets Ramsar criteria: 1a, 1c, 2a, 2c, 3a, 3c. It is listed as IBA#57 in the latest IBAs of Asia list, in the Russian section. Since the meandering Erguna/Argun and floodplain wetlands are a holistic inseparable ecosystem and the Chinese-Russian border follows the mainstream of the river, all general values should equally apply to the China part of floodplain. Tables 1 and 2 present figures for the whole Dauria ecoregion, while Table 3 uses data from the Russian side to show the international significance of Erguna midflow wetlands.

Table 1 Importance of Daurian ecoregion for conservation of some rare bird species (Goroshko, 2006; Goroshko et al, 2006)

Species	Number in the region	
	Count (individuals)	% of world population
Swan Goose (*Cygnopsis cygnoides)*	41000	75
Great Bustard (*Otis tarda. dybowski*)	1050	66
Demoiselle Crane *(Anthropoides virgo)*	73000	37
White-naped Crane *(Grus vipio)*	1400	29
Relict Gull *(Larus relictus)*	2430	20
Japanese Crane *(Grus japonensis)*	275	13
Hooded Crane *(Grus monacha)*	1200	13
Asiatic Dowitcher *(Limnodromus semipalmatus)*	300	2

Table 2. Importance of Dauria ecoregion for conservation of some migratory bird species (Goroshko, 2006; Goroshko et al, 2006)

	Count (individuals)	% of birds migrating along East Asia-Australian flyway
Gray Plover (*Pluvialis squatarola)*	6500	40
Lesser Golden Plover	48000	50

(*Pluvialis fulva*)		
Wood Sandpiper (*Tringa glareola*)	12000	20
Rufous-necked Stint (*Calidris ruficollis*)	150000	32
Broad-billed Sandpiper (*Limicola falcinellus*)	4500	16

Table 3. Global significance of Argun/Erguna River Midflow wetlands in terms of share of bird populations (Goroshko et al, 2006)

Species	Count (individuals)	% of birds in East Asia (*% of world population)
Great Bustard (*O.t. dybowski*)	300	19*
Japanese crane (*Grus japonensis*)	45-60	2-3*
Wood sandpiper(*Tringa glareola*)	4000	6
Rufous-necked Stint (*Calidris ruficollis*)	5000	1*
Broad-billed Sandpiper (*Limicola falcinellus*)	800	2*
Swan goose(*Cygnopsis cygnoides*)	2000	3-4*
Bean Goose (*Anser fabalis*)	20000	36
Whooper swan (*Cygnus Cygnus*)	10000	17
Gadwall (*Anas strepera*)	25000	2-3
Pintail(*Anas acuta*)	20000	2

The information above shows both the global significance of the Erguna midflow wetlands for waterbirds and its role and important interconnection with the whole Daurian

ecoregion. Altogether about 200 species of birds were registered in the Erguna valley by ornithologists and 60 more species are suspected to be present judging by similar better studied habitats in other parts of Dauria.

The spring survey of April-May 2007 has confirmed the great significance of middle Erguna for migrating waterfowl. In particular, significant numbers of Tundra Swan (2350), Bean Goose (23000) and Swan Goose(1600) were recorded in the area. Many Swan Geese were paired which suggested they were preparing to nest in the area. (Dou Huashan et al, 2007)

Research on rare birds (Goroshko et al, 2006) shows that in years of low flow volumes (2001-2005) their habitat in the Erguna wetlands undergoes very clear adverse changes. Observations in the course of our project in 2006-2007 confirmed that floodplain habitat available for breeding birds decreases substantially in times of drought. In 2004-2005, up to 20 territorial pairs of Japanese Crane were observed in the stretch between Priargunsk and Abagaitui, while in June 2007 only one bird was observed in the same area. According to local herders and hunters, many more Japanese Cranes had visited in spring, but quickly moved on from the area after being unable to find suitable nesting habitat. The same pattern is observed in the Swan Goose population. Common species of waterbirds breeding locally also decreased significantly in number during the very dry years of 2006 and 2007 (Goroshko & Liu, 2007)

Of course the Erguna has other significant species diversity besides birds, but insufficient research precludes us from making total estimates of species diversity and population dynamics. However, a more or less systematic inventory in the Russian part of the valley was conducted in 2004-2005 by a team tasked with planning a protected area along the river (Goroshko, Kochneva, Mikheev et al, 2006). Altogether 38 species of mammals were registered in the area and 11 more are believed to be present. Pallas Cat, River Otter, Daurian Hedgehog and Manchurian Zokor are among those most requiring protection. Wolves are still numerous and just at the time of our 2007 inventory attacked a sheep herd on the Russian side. A century ago, the Erguna valley was an important migration corridor for Mongolian gazelle, but for the past several decades only single individuals occasionally reach the area and are doomed due to suboptimal conditions and high-level harassement by humans (Kiriliuk, 2007). The last eight Mongolian gazelles that migrated from Mongolia through the Russian part of the Erguna valley in 2001 were killed by poachers (Goroshko *et al*, 2006).

The fish fauna of the Erguna is in steady decline, at least from end of the 1990-s. Forty-one species of fish are historically known from this stretch of the Erguna River. From this list more than half were not recorded during a 2005 study by an ichthyologist that involved both scientific sampling and interviews of local fishermen (Mikheev, 2006). Mean fish productivity in May 2005 did not exceed 2 kg/ha while in comparable stretches of the

nearby Shilka River it was 55 kg/ha, which shows that available fish habitat is severely depopulated (Mikheev, 2006). Our questioning of Chinese fishermen in 2007 has confirmed that the largest salmon species *Hucho taimen* has just recently gone extinct locally, while Kaluga Sturgeon (*Huso Dauricus*) is not known by the current generation of fishermen. Both charismatic species still have viable populations in the adjacent Shilka River basin. During periods of low flow, like the one that has lasted from 2001 to 2007, fish populations of the Erguna have shown further significant decline.

3.Where have all birds gone?

Environmental Impacts and Issues: China vs Russia

Below we briefly describe the interplay of various human-induced impacts on the Erguna/Argun ecosystem and its birds against the backdrop of severe drought. Student teams conducted social surveys using detailed questionnaires on China side of the river, while on both sides we conducted objective observation of human impacts. Distribution and dynamics of some impacts was clarified by preliminary analysis of satellite imagery.

3.1. Drought as a multiplying factor for human pressures.

The major socio-environmental trend from the 1980s has been an increasing disparity between the limited and unstable carrying capacity of the fluctuating ecosystems and linear economic growth, partly driven by the influx of new settlers on the China side. Unsustainable resource use multiplies the impacts of natural cyclical drought – a consideration that is unaccounted both in general government planning and planning of individual households.

In China, as compared with Dalai Lake Basin, the Erguna valley is locally considered a water-rich area, which encourages rather irresponsible water use. The problem with this is that the current condition in the Erguna midflow is judged by comparison with the drier western areas around Dalai Lake, rather than careful analysis of cyclical trends in each wetland site. As a result, there is a local belief that more pressure can be put on the Erguna to alleviate problems elsewhere. The most extreme example of this is a proposed water transfer from Hailar/Erguna River to Dalai Lake, which is described in more detail later in this paper.

The impact of the drought is manifested both in deepening of communal wells by 4-5 meters in the course of the last 8 years, and by virtual desiccation of the “Three River” floodplain at the mouth of the Genhe River which is a tributary of the Erguna. Active desertification can also be observed and is likely to be the cumulative result of severe drought, overgrazing coupled with privatization of pasture, and earlier attempts to develop

cropland in the Erguna river valley. Each location visited during the 2007 project has shown a reduced yield of certain valuable vegetation - either harvestable reed or grass in pastures - but most deterioration is attributable to various human impacts rather than to drought per se. Many locals see clear linkage between the severity of the recent drought (in comparison with previous drought cycles) and recent shifts in local economy and population density. Local people mostly fear that new redistribution of pastures between local families scheduled for this year will result in smaller individual plots and even further degradation of pastures under the dual impact of overstocking and drought.

In Russia, the Argun River Basin is considered among the two most water-deficient areas in Dauria and water allocation is a continuous headache of local authorities. Suitable groundwater is virtually absent in the area, therefore several small towns get their water supply from the Argun floodplain. Since 2000 they have experienced increasing problems with water quality and even limitations on quantity. However, the rural population is in decline and old irrigation systems are broken. Therefore, there is no immediate potential for rise in water consumption. The much lower population density and slower economic growth makes the interplay of drought and human pressures less evident and acute than in China.

3.2. Livestock industry

Historically the most important industry in the Erguna basin is livestock breeding, which just 50 years ago was predominantly nomadic herding.

"Privatization" of pastures and resultant growth in sustained livestock pressure left very little room for adaptation to the changing availability of moisture. Little of the former communal summer ranges is available for the seasonal migration of livestock. As for standards of grazing pressure, it was established as 1 "sheep-unit" per 19 mu (15 mu =1 hectare) in the 1970s, with 1 cow = 5 sheep units. Presently, average pressure is officially assessed as 1 sheep-unit per 10 –13 mu, which far exceeds the regenerating capacity of most grasslands (Dalaihu NNR director Butegen, expert on livestock management, interview with Simonov, May, 2007).

Fencing and "privatization" was encouraged in the mid -1990s. Fencing was triggered by necessity to ensure rights to the land and equality issues, rather than by resource – conservation considerations. Wetlands, riverbanks and lakeshores evaded privatization and thus remaining classic "commons", so they became places of tremendous concentration of livestock with obvious negative ecological consequences. In 2007, upland grasslands were mostly dry and most livestock grazing was conducted in floodplains and on the lower slopes of the river valley without the slightest consideration for ecosystem carrying capacity. As water recedes, most active erosion and salinization happens exactly in the denuded belt surrounding wetlands. Livestock frequenting shores and wetland meadows presents significant harassment for breeding birds. Direct destruction of nests with clutches is also

quite common. Sheep become the direct competitor of grazing Swan Geese and Greylag Geese in wetland meadows, and cows even eat young reed shoots. Most types of wetland vegetation are likely to regenerate in the next humid period, but in the meantime severe water shortage coupled with poor management arrangements expose wetlands and its wildlife to tremendous pressures. Estimates we made for July 2007 found grazing pressure to be at 1 sheep–unit per 5 to 2 mu of wetland and its immediate vicinity, which is 2- 6 times higher than the average pressure in local grasslands in the foothills or uplands.

Hay cutting is an important activity in uplands and some wetlands, and in July 2007 it was rather intensive in the part of the river near Heishantou village. In general it seems to be a less important factor than grazing on the China side of the trans-border stretch, but still results in some bird harassment. Wildfires are subject to strict control by village authorities, the forest management agency and border guards. Significant areas of wetland meadows are subject to annual prescribed burning and a 100-meter wide fire-break is renewed annually along the wetland edge to prevent grass fires from invading inland areas. In years of normal or high rainfall this yields rather good results, with Chinese banks having 2-5 times less burned acreage than the Russian bank. However, in June of the extremely dry 2007 year, observed acreage of wetland burned was almost equal on Russian and Chinese banks (20 to 25% of floodplain area). This was also confirmed by analyzing MODIS satellite imagery. Spring grass fires are one of most important factors negatively influencing wildlife in Erguna River wetlands. Our observations suggest that in times of drought, when wildlife is especially vulnerable to fires, even the strict fire-prevention policies implemented on the Chinese bank might be insufficient to protect bird habitats.

Despite all the negative factors associated with the herding activities listed above, the livestock industry, in which new resource-conservation measures are introduced annually (although some of them lack a good ecological basis), is still likely to be the most ecologically conscious sector of the local Chinese economy. Herdsmen know that 50-70 years ago their nomadic precursors were much better adapted to local natural conditions and they still have hope to restore such equilibrium in the future. Better incorporation of wetland conservation (and water-source conservation) into the ecological agenda of herdsmen and livestock management agencies is an obvious important task in the area.

In Russia, livestock numbers declined 3-5 fold during the last 20 years. Therefore grazing pressure is much less than on the Chinese side. Large tracts of land are still held by only thirteen collective farms, which allows for timely relocation of livestock from point to point to avoid overgrazing. In 2007, suitable grass was available only in the floodplain, which imposed a greater degree of harassment on wetland wildlife. By Russian scientific assessment standards, 45-50% of the river valley is “overgrazed”, especially around villages, which means that it shows some signs of change in plant community composition (Goroshko, Kochneva et al 2006).

Grass fires are the main hazard for wetlands and wildlife on the Russian side. Russian settlers for at least 200 years have traditionally burnt old grass to "improve quality of the meadows". In a given year up to 80% of dry vegetation in sedge meadows, grass meadows and reed-beds is affected by fire. This leads to a sharp reduction in the quality of breeding habitat, considerable alteration of the nutrient cycle, and direct destruction of birds, their nests and other wildlife. From mid-April to May the river valley is full of smoke and in a dry year fires ignite as late as July, which was the case in 2007. National and local legislation prohibits grass-burning, however, collective farms' management encourages it to sustain the harvest of good quality hay. Given large uninterrupted expanses of highly flammable dry grass and constant winds in spring, "controlled burning" on limited areas is hardly possible. Quite often severe fires from Russia jump over the main stem of the Erguna and continue on Chinese territory. Areas burned in a given year do not provide sufficient shelter and nest-building material for many species of local birds, including cranes, geese, herons, etc. Given that in an average year Chinese fire-control techniques work relatively well to protect most of the local wetland habitat, there is a lot of potential for cooperation and knowledge exchange.

3.3. Cropland and irrigation

General surveys conducted by the Chinese government show that on average 50% of newly opened cropland in the semi-arid steppe areas of Inner Mongolia is abandoned after 1-2 years of planting as it transforms into moving sands or other forms of desertification. Therefore in the steppe it is discouraged and most croplands are concentrated in the foothills of the Great Hinggan mountains (e.g. Erguna city, etc). Since this is where the headwaters of Hailar and Erguna tributaries are located, these activities are likely to have some influence on flow regime downstream.

Despite a general ban on irrigation development, there are many places in Chenbaerhu county with large irrigated hayfields supported by the groundwater of the Hailar floodplain, and even more irrigation developed with water from the Genhe River in Erguna City. In 2007 due to severe drought the yield of wheat, rape seed, and other crops dropped in that area by 30-70%, which might trigger further expansion of irrigation. We do not know what impact it has on the local water regime presently, but the fact that water withdrawal is not reflected adequately in statistics may lead to flaws in water management decisions.

An intention to develop 2000 hectares of irrigated hayfields in the vicinity of Chagan town on Hailar river was widely discussed in the local press in 2004-2006, in relation to the proposed water transfer from Hailar River to Dalai Lake. The EIA for the project, however, does not directly confirm such use of diverted waters.

Due to the different relief of river valley slopes and, presumably, their higher rainfall Russia has a much greater area under cropland directly adjacent to the Erguna floodplain. This is

the most important grain production base for Chitinskaya Province and the current main source of income for all local collective farms. Therefore, the rate of development of new cropland in the upper slopes seems to be much higher than in China, but the rate of erosion is actually lower. Only a small part of this cropland is irrigated, mainly in small areas where Russians and Chinese cooperate to grow vegetables. Such an expanse of cropland may decrease breeding habitat for Great Bastard (*Otis tarda*) in the river valley, and disrupt connectivity of upland and wetland habitats, but the direct impact on wetlands seems to be minimal.

3.4. Fisheries

The fisheries in the Erguna valley are already depleted in most natural water bodies, but new leases are given to firms from other provinces for yet unexploited areas with the explicit aim to deplete fish stock in several years and then, probably engage in artificial restocking. Fishing has several possible types of impact on birds:

- habitat alteration through the creation of fish farms (e.g. changing water levels, massive 'fencing" by netting devices and traps)
- increased disturbance levels in the best quality habitats
- direct mortality of birds both accidental, while netting and poisoning fish, and intentional, for food or to remove "competitors"
- decrease in the food base for fish-eating birds (e.g. cormorants).

There is drastic difference in mesh size of netting used on the two banks of the river. Since Chinese typically use much finer mesh, fishing is still a viable occupation for locals and even visiting fishermen from other areas. Five to ten professional fishing teams are stationed along the transboundary stretch of the Erguna main channel, while in the rest of the floodplain waterbodies, fish are actively harvested by local residents by all possible netting devices and even by poisoning.

In Russia all professional fishing ceased at least a decade ago due to depletion of fish stocks, while in the 1960s the Erguna fish harvest reached 400 tons a year. Locals occasionally fish for subsistence, but harvest is minimal not exceeding 2-3 tons a year for the whole 200 kilometer stretch of the river (Gorlacheva, Mikheev et al, 1995).

3.5. Reed harvest

Reed harvest in some wetlands dropped threefold over the last 5-8 years, due to overexploitation and drought. It is conducted in winter, which leaves habitat alteration and biomass removal as the likely main impacts of this activity on wetlands.Since reeds are essential habitats for cranes,

geese, etc., this activity definitely has an impact on local bird populations. Most Red-crowned Crane habitats at Moergol tributary are located in areas with intensive reed harvesting. From other places, like Zhalong Nature Reserve or Danube Delta, we know that reed cutting could decrease or increase habitat quality for a given species, depending on how it is planned and conducted (WWF, 2003). How this factor works locally should be further explored. Reed cutting also has interesting links to pollution since most of the reed goes to the Hailar paper mill, which is the most infamous local polluter in the area. The paper mill uses reeds from several of the most precious wetlands such as the Huihe tributary and Moergol tributary. So far, the paper mill has not used reeds from the main stem of the transboundary stretch of Erguna due to transportation difficulties, but this might change as the road network improves.

3.6. Direct taking of wildlife

We discovered solid evidence of egg collection activities in all study sites of the 2007 research project. In the Moergol tributary area we identified villages where this trade is an important source of additional income, identified poisoning and collection techniques, discovered possible links to the market and visited incubation and breeding farms. In July 2007, survey of areas where bird collection was apparent in spring repeatedly showed an absence or very small numbers of Swan Geese with newborn young, while adult birds were still present in their hundreds. One of the local questionnaire respondents reported that in 2006 he bought about 1800 Swan Goose eggs for incubation from local villagers in Moergol wetland, which roughly equates to 300-350 geese clutches taken from the area. Our most optimistic spring estimates of Swan Geese preparing to breed in Moergol in 2007 does not exceed 1000 pairs, which means that the activities of just three egg-traders of this type may achieve complete destruction of the total number of nests in a given year. Based on our observations, it is likely that we witnessed exactly such a situation at Moergol and Huliyetu study sites in 2007.

Bird poisoning happens in spring in pools of the first shallow melting water. This affects the strongest birds that arrive first in the Erguna valley from their spring migration. According to locals, such operations might yield several hundred birds a day. We did not witness this activity in 2007, but only heard of it from many locals, which might indirectly confirm that it is in decline in the past two years due to stronger enforcement.

Rifle hunting, though prohibited by law in China, is also common, but dissimilar with the Russian bank where it has been legally allowed. It is unlikely to be a very serious factor influencing bird numbers, given that only a limited number of local high officials accompanied by police (who have rifles) can conduct such an activity. But it is extremely detrimental for local morale, spurring local villagers to use other means of trapping and poisoning to harvest birds.

In Russia, rifle "sport" hunting is having a particularly high impact both in terms of direct taking of birds, but even more in terms of harassment at the beginning of the breeding season. In previous years this lead to a concentration of most migrating bird flocks on the Chinese bank. New "Border Guard Regulations of Russia" issued in late 2006 prohibit any hunting within 5 kilometers of the national boundary. Our survey on the Russian side in June 2007 makes us believe that the scale of hunting conducted this year was much smaller than in previous years. However, despite regulations, it was conducted at all the most important habitats. Swan Goose and Tundra Swan seemed to be the most affected rare species in spring 2007, at least at the Duroi Lakes study site. We expect that in a few years the new border regime will preclude ordinary villagers from hunting in the floodplain, while border guards, local officials and other "noble citizens" will find a way to continue hunting. One technique already being employed to get around the regulations is to obtain a permit "to collect bird samples for avian flu analyses", which entitles its holder to shoot any bird that he considers worth "sampling". At least one incident of killing a Red-Crowned Crane in 2005 in the course of "sampling' is known from the Duroi study site.

We have to explore the cumulative impact of this group of "direct taking" activities, since they might constitute the main group of human impacts immediately influencing bird populations. While diverting water from rivers and other impacts might adversely change the whole wetland habitat in the long term, actual populations of rare birds might be dramatically reduced just by these marginal economic activities in the short term.

3.7. Tourism/recreation development and impacts

The tourism industry grows rapidly in the Chinese part of Erguna River basin as tourists are attracted to the beautiful natural environment and ancient culture of the area. Tourism is traditionally perceived as a friendly alternative to extraction of natural resources. In reality it does not necessarily play such a role. Examples we witnessed for the most part show that it is very far from becoming a part of the local nature conservation strategy.

The most acceptable examples we witnessed are family-based small enterprises, when Mongolian or Russian herders sustain a guest house or yurt for tourists. Old Heishantou village has good examples of such facilities.

Equally common are big rich camps established on large expanses of grasslands by firms from outside of the region. Design and management of these camps may be associated with intensive impact on the local ecosystem (e.g. excavation of a giant pond on the Gen River floodplain near Heishantou). Tourist programs may include questionable items like "eating Swan, Wild Geese and Wolf meat" and hunting (Huhnor tourist camp). Establishment of such camps is often associated with the relocation of original herders to other areas. One of the typical uses of these facilities is receiving and entertaining delegations of government officials.

Dalai Lake north shore near the town of Zhalainor presents the best example of inappropriate tourist development. Huge man-made structures are erected on the lakeshore and inside the lake (man made islands with plastic palm-trees). Since, at the time of establishment, the fact that the lake level was in a periodic high water-level fluctuation was completely disregarded, the owners of these facilities are now among the most aggressive proponents of "stabilization" of the lake level by means of the proposed water transfer from Hailar River.

Except for small family-based tourism enterprises that supplement other occupations like herding, all other examples are typically associated with huge outside investment, displacement of previous land-holders, influx of outside workers and little or no alternative employment opportunities for local herders. Therefore, expectations that such tourism development will significantly reduce pressure on dwindling local natural resources is not well founded in current practices.

Russia has strict border regulations and access to areas adjacent to the national boundary requires special permits. No "tourism" in the economic sense could be developed under such conditions. However, traditional "recreational" activities exist and have environmental impacts.

At least one summer camp for schoolchildren exists adjacent to the floodplain in Zabaikalsky district. Children are involved in growing vegetables in an irrigated field on a slope above the floodplain lake. This promotes extreme eutrophication of this water body, which is a breeding area for Swan Geese.

A more widespread activity involves visitors establishing small cabins inside the floodplain and occasionally occupying them for hunting, fishing or just a barbeque. This requires good relations with border guards who control the area and the cabins normally belong to influential people. From any hill in the area three to ten such facilities can be seen. However, they are uninhabited for eleven months of the year and may represent only a small disturbance factor.

4. Impacts of infrastructure, urban growth and industry on wetlands.

At the beginning of our article we promised to analyze the environmental merits of one particular development – the proposed large water transfer from the Hailar/Erguna River into Dalai Lake. However, we need to firstly provide some background by briefly describing

other major engineering projects already undertaken in the area and the general course of local development. In this region, the China Government Program "Revitalizing Northeast Industrial Bases" takes several directions:

4.1. Urban growth

Rapid urban and industrial development of Manzhouli City and Zhalainor town (with a growing population of around 200 000 soon to surpass the prefectural seat of Hailar City) is due to the influx of cheap resources from Russia and possibly Mongolia. Urban growth coupled with water-thirsty industrial development at a location with minimal underground water resources makes Manzhouli the major future source of pressure both on the Erguna-Hailar River and Dalai Lake. Now we can say with certainty that the Hailar water transfer project in the long term has the implicit goal of securing industrial water supply for the Manzhouli –Zhalainor urban area. In the short term the City has just completed construction of a second water pumping station in a floodplain section known as Erka wetland.

Manzhouli (in line with state-policy on border trade) encourages development of processing industries right in the border area, which results in greater water demand. Mineral exploration is also encouraged in the area, since presumably more investment funds are available here than in other counties. The city's wastewater has a natural outlet into Erguna River at the westernmost part of the transboundary stretch.

On the positive side of the equation, Manzhouli is unlike other areas in that it has both private and public resources, and by its nature is an international trade city more open to dialogue with the environmental community.

In Russia, the same border trade spurs development of a twin city called Zabaikalsk across the border. Due to smaller share of cross-border revenue and poorly developed business infrastructure, the scale of this development is smaller, but the direction and problems are similar. Water supply is already a serious limiting factor, but the development master plan prescribes rapid expansion of this small town.

4.2. Infrastructure development.

Roads, bridges and pipelines are planned and built with astonishing speed in the Chinese part of the region. Little or no thinking is put into assessing environmental impact and ecological appropriateness of infrastructure.

In 2001-2007 the World Bank supported construction of an international road from Manzhouli to Hailar that for 15 kilometers dissected the core area of one of most vulnerable and valuable wetland areas – Erka Wetland Nature Reserve. The 2007 survey provided

overwhelming evidence that the road significantly affected water flow in the floodplain, triggered an influx of herders, fishermen and other newcomers right inside the wetland, and created a “bird-free” corridor at least 1 km wide across the wetland. This wetland now has only the slim chance of being saved from full deterioration as bird habitat by costly active management as a “wetland park”. From an economic standpoint, the road shortened the way from Hailar to Manzhouli by 10-20 kilometers.

Simultaneously, a new sealed road was built along the whole border stretch of Erguna River from Heishantou to a new international road bridge opening this area up to development. Taken together these projects drastically improved access to steppe and wetland areas along the Erguna River in Xinbaerhu and Chenbaerhu counties, which will inevitably attract new visitors, settlers and businesses to this fragile area.

The first hydropower station in the whole basin is reportedly under initial development on the Yiminhe River – the principle tributary of the Hailar-Erguna River. Data on likely redistribution of seasonal flow is yet to be obtained. Water transfer from Halaha (Khalkh-in-gol) River to the Nen River basin is planned. The Halaha is the main tributary of the Dalai and Buir Lakes. This is additional proof that the Hailar River transfer to Dalai Lake has many objectives beyond “saving the lake”, like making up for decreased inflow from Halaha river. We have not yet visited these two sites during our 2007 studies.

Massive construction of state-sponsored “model farms”, “model tourist camps”, “model production bases”, half of which are never completed or already abandoned impresses anyone moving along the new and old major roads. Together they represent an alarming trend in local land-use, where both land and resources are simply wasted to achieve immediate gain in the form of state subsidies or private investment. Many such developments are established on old communal pastures by newcomers or powerful locals, while local herders were relocated elsewhere.

If outright cancellation of some of the new infrastructure and mining projects might be unfeasible, major mitigation measures should be advocated and subsequently introduced. For example, if there is no hope for outright cancellation of the Hailaer-Dalai water transfer, there are considerable opportunities to negotiate how water flow will be regulated in the new canal to preserve some agreeable ecological flow parameters both for Dalai Lake and Erguna River. But such an argument will require the gathering of a solid body of baseline data on the pre-project situation and a good understanding of specific ecological flow requirements, which depend both on the ecology of a particular waterbody and associated land-use.

However, from a planning perspective, the increasing amount of infrastructure in a region with such obvious climatic fluctuations (and a pronounced desertification trend added to it) will inevitably lead to huge environmental and economic risks and losses. In both China and Russia it is still feasible to revise development plans and relocate investment and trade to areas better suited for massive development; areas where water is abundant, ecosystems more resilient and fluctuations in biological productivity of the landscape less pronounced. From this perspective, China's recent proposal to expand the trading corridor through the Priargunsk-Erguna counties in the lower part of river stretch is worth exploring and assessing.

4.3. Mineral extraction

Mining always has been the principal industry in the Erguna basin with a heavy toll on the environment (gold-mining started in the 18th century). We are currently seeing a rapid new rise of mining throughout western parts of the Amur basin in China, Russia and Mongolia and related major threats to key habitats and river courses. Therefore, if we consider long-term work in the area to save whatever wilderness is yet possible to save, we must face this issue in a highly transboundary context, since all mines serve the demands of more or less the same markets. For example, a recent proposal to transfer the flow of three major rivers in adjacent Eastern Mongolia (Kherlen, Onon and Baldj) also has mining industry demand as the driving force behind it.

Oil exploration and development is an ever growing impact on the Dalai Lake Nature Reserve and a source of constant development encroachment even in some core areas. It is potentially a threat to Huihe, Huliyetu and other major wetland sections, since oil deposits are often associated with wetland complexes.

Deposits of low-quality coal are widespread in the river basin and their exploitation is accelerating. During the 2007 study, three coal mining sites and two exploration sites were visited. We were able to conclude that both in China and Russia, coal mining is a major growing impact in the Erguna River Basin. In China examples include:

1. Dalai Lake NNR and Erka NR both presently receive a significant part of their inflow from an old coal mine in Zhalainor. This mine, with 100 years of history, once disrupted natural flow between the Dalai Lake and Erguna River via Mutnaya channel. It is also likely to contribute to changes in the water table in the vicinity of the two nature reserves. Up to six new mines for coal, silicon and other commodities are being developed in this south–west corner of the river basin.

2. Moergol River valley has 2 new coal mines rapidly developing adjacent to the floodplain (and partly expanding onto floodplain) with obvious dramatic impacts on the local hydrology. This mine is likely to contribute to the severe deterioration of water quality in the Moergol River wetlands and Huhnor Lake.

3. The floodplain at the confluence of the Genhe and Erguna Rivers is presently a site of intensive coal exploration. Mine development is scheduled for the end of 2007 within the Erguna Wetland Nature Reserve.

In Russia, so far only one poor quality coal deposit is exploited near Kuti village on the edge of the river valley. We know that 3-4 additional mining sites are planned for opening or redevelopment in the Erguna River valley on the Russian bank, at least two of them planned as joint Russia-China enterprises. Most of Russia's new mining operations are triggered by international market demand, a large part of which is China's demand.

A large uranium mine in Krasnokamensk, located 50 kilometers north of the river valley, uses water from the Erguna, but reportedly discharges water only in small closed inland basins. Given the enormous tailings stored from 50 years of operation and plans to expand processing to ore from other deposits, we consider this mine a potential source of water pollution, which if released would go into the Erguna River via Urulunguy tributary with its mouth at Priargunsk town at the downstream end of our study area.

Lack of environmental planning and enforcement in the mining sector is obvious both in China and Russia. Mere imposition of environmental mitigation costs into planned projects might make other deposits located outside of wetland areas equally attractive for development.

Clearly the most accessible oil, coal and other deposits (except for uranium) coincide with the best preserved wetland areas. It is obvious that if current mining expansion goes unchecked and impacts unmitigated, in just 10 years half of the most valuable wetland habitat in the Chinese part of the region and an unknown share in the Russian part will be severely affected by mining.

5. Hailar-Dalai Water Transfer – last drop?

We will dwell in detail on one important example of poorly conceived development with potential impacts on the hydrology and ecology of the Erguna valley. This proposed infrastructure project, if implemented, may significantly alter environmental flow both in the Erguna River Valley and Dalai Lake basin. This example is even more interesting since "restoring the environmental balance" is at the heart of official justification behind this water-transfer project.

5.1. Water transfer project proposal status

The proposal is to divert water from the Hailar River to Dalai Lake. Ordinarily, the water of the Hailar River flows from east to west before turning north-east about 20 km north of Dalai Lake. At this point, the Hailar River becomes the Erguna River and forms the Chinese-Russian border in this area for 900 kilometers. The proposed canal would divert an annual volume of approximately 1 cubic km of water to Dalai Lake per year. The actual flow capacity of the canal is 70-93.6 cubic meters per second, while the average flow of Hailar River at the construction point is 117 cubic meters per second. This means that, judging by its size, the new canal is probably capable of diverting about 60-75% of the water from Hailar River, if equipped with pumps.

However, project documentation states that the canal will divert water in amounts somewhat proportional to river flow volume in amounts up to 28-30% of average annual flow of Hailar River. More specifically it will not divert any water when flow is less than 11.9 cubic meters per second; only divert 71 cubic meters per second when Hailar flow is 198 cubic meters per second (36 %), and only divert the maximum of 93.6 cubic meters per second when Hailar flow is 253 cubic meters per second. Diversion will occur during the warm and wet period of the year from May to October/November.

In the Dalai Lake area, a similar rather unsuccessful project was implemented in the 1960s when the new Xinkaihe canal was built to direct water from the rapidly rising lake into the Erguna River. Due to poor maintenance, the canal was ineffective after only nine years. In recent response to our concerns Hulunbeier Water Management Bureau claims that dikes along Xinkaihe canal became major man-made obstacle for Hailar River flood waters that naturally replenished Dalai Lake (Hulunbeier Water Management Bureau, 2007). Now the plan is to create another canal from Hailar River in order to confront decreasing water levels. It seems that both plans do not take into account the natural dynamics of the lake and therefore are a tremendous waste of resources.

Over the last five to six years, Dalai Lake has held a reduced volume of water due largely to low rainfall, which resulted in lowering water level, lake area and overall volume. The reasoning given for the diversion of water to the lake is to protect this environment from the assumed negative impacts of these low rainfall years. In particular, it is expected to arrest further salinization, reduce eutrophication, replenish aquifers, prevent desiccation of adjacent grasslands, etc. The proponents also expect that higher water levels will help replenish diminishing fish stocks in Dalai Lake and provide water for an additional 40000 livestock and 2000 hectares of irrigated hayfields. According to latest confession of Water Bureau 0.3 cubic kilometers or roughly 30% of diversted water will be used to supply the municipal needs of Manzhouli City and other local settlements (Hulunbeier Water Management Bureau, 2007)

5.2. Potential Impacts

Impacts of this project are very diverse and complex. The formal Environmental Impact Statement (EIS) was prepared in China in 2005, but it does not address the complex interplay of ecological processes and ecosystem dynamics. It has never been a subject of rigorous scientific review and discussion. Below we briefly present our analysis of potential consequences, outlining important issues that require further assessment.

5.2.1. Dessication of downstream wetlands

The most obvious potential impacts are on the downstream habitat of the Hailar-Erguna River system. The Erguna River is a relatively fragile branch of the Amur-Heilong River catchment with a total annual flow of between 1.5 cubic km in low rainfall years and 6 cubic km in high rainfall years. Similar to Dalai Lake it has had reduced annual inflow of 1.5-1.7 cubic kilometers since 2001. The river does not have any significant tributaries for at least 200 kilometers from the point it comes to the Sino-Russian border to the mouth of the Gen River at the Heishantou-Priargunsk border crossing. It does not take great imagination to see that the removal of 1 cubic km of water from this system per year is likely to have significant downstream impacts. Importantly, the project EIS does not clearly recognize the difference between the Dalai Lake ecosystem, which is adapted to long-term changes of water level, and the Erguna River floodplain ecosystem, which has very different dynamics dependent on frequent floods and not adapted to a long-term water deficit.

The EIS has been done on the assumption that water - after the initial 5-15 years following canal construction – will accumulate in Dalai Lake to the level of 544.8 meters ASL. At this level, water is expected to start flowing via Xinkaihe channel into Erguna River almost in the same amount that is diverted from the Hailar River. This prediction done by hydro-engineers is very difficult to believe in, since data on the historic water balance of Dalai Lake presented in the EIS indicate that in the last 40 years the average release of water from the lake into Erguna river was very small (0.09-0.144 cubic kilometers a year). This was despite the fact that the Lake water level often exceeded the “projected level” established by the EIS and, on average, was 544.5 meters ASL. Given many other likely uses of the diverted water quoted in the press, such replenishment is even less likely. The EIS also mentions that Xinkaihe canal is in poor condition and cannot presently deliver a large amount of water into the river. This, therefore, presents an additional flood hazard in water-abundant years if, as the EIS predicts, a rising lake level necessitates the transfer of water into the Erguna River. Given all of the uncertainties, it is most likely the flow via Xinkaihe will not increase, and if it does it will happen only in extremely water-abundant years, while in all other times the water deficit downstream will be equal to the full amount of water diverted from the Hailar River.

Other major concerns are associated with the ‘filling time period”, when the lake will not have any discharge into the Erguna River, even the minimum it has nowadays. This period may last 5-15 years after canal construction – time which is likely to be fully sufficient to degrade the river

wetlands downstream. No detailed analysis of ecological consequences has been done for this critical period. Another key question is the absence of any detailed analysis on periods when drought affects both Dalai Lake and the Hailar/Erguna valley. The greatest competition for water between the project's needs and natural needs of the Erguna River will occur in these periods.

We believe that the proposed action is extremely likely to decrease the quality of the wetlands along the Erguna River to the point that they no longer provide viable habitat for large populations of waterbirds and numerous other species that rely on wetland habitat. Diversion during low-flow periods will result in drastically reduced flow downstream, leading to lowering of water tables, reduced water retention and desiccation of floodplain wetlands, disappearance of many shallow water habitats, drastic change in sedimentation and channel formation patterns. The proposed diversion of up to 30% of annual average flow may also leave the downstream stretch without sufficient flow during the high rainfall period in summer, the river will not break its banks to inundate the floodplains and marshes and the bulk of the wetlands will simply dry out.

5.2.2. Drastic alteration of Dalai Lake ecosystem

The other possible set of impacts relates to alteration of the natural high-low volume cycle of Dalai Lake. It has been shown that the Dauria ecoregion experiences 25-40 year climatic cycles of high rainfall-low rainfall years. At the moment, we are in a low rainfall period that is not expected to end until 2010 and after that the water levels of Dalai Lake will rise again.

Dalai Lake is known to have become almost dry in 1903-4 (as even acknowledged in EIS report for this project). Similar Torey Lakes in the Russian Daursky Reserve and the Hoh-Nur Lake in Mongol-Daguur Reserve dried several times in the 20th century and are shrinking now as well. The point is that, while the proponents of the project are advocating the environmental merits of the project for the lake, the truth is that we do not know how this artificial stabilization of lake water levels and loss of the wet-dry cycle will affect the ecosystem of Dalai Lake. However, we do know that this lake is not dissimilar with all other brackish lakes of Dauria, which periodically dry out naturally. The regional biota is adapted to such a natural cycle. This was studied on similar large Torey lakes in Daursky Biosphere Reserve, Russia, and on smaller lakes of the steppes, and at least for fish, there is evidence that such "pulsating" water bodies have higher productivity levels compared with spring-fed lakes with stable water levels in the same region.

Only one line in the project's EIS states that fluctuation of water level is a major factor sustaining a diverse and productive belt of wetlands on the border between the lake and steppe. However, the EIS recommendation to sustain this fluctuation within +/- 20 centimeters from the "projected water level" is unfounded. It is very evident that both diversity of species and habitats and high productivity of brackish lakes of the Daurian steppe is largely a result of current drought cycles associated with a much higher amplitude of natural changes. The proposed project will halt or

diminish this natural phenomenon on Dalai Lake and likely result in decreasing biodiversity and productivity of this ecosystem in the long term.

In the same EIS, a comparison of water quality in river and lake ecosystems based on "drinking water standards" fully disregard the fact that at different stages of the drought cycle the steppe lakes have a very different natural water quality. Therefore, to halt or decrease the natural fluctuations in salinity will likely have adverse impacts on the unique character of the aquatic ecosystem and is highly unlikely to result in a long term gain for fisheries.

A precautionary approach should be taken, particularly given the acknowledged importance of Dalai Lake as a National Nature Reserve, component Reserve of the Dauria International Protected Area, Ramsar site, UNESCO Man and Biosphere Reserve, International IBA and Important Shorebird Site of Wetland International's Shorebird Site Network, and North East Asian Crane Network Site.

5.2.3. Increased accumulation of pollutants

Another grave concern is that the Hailar waters are highly polluted by all major settlements and industries of the Hulunbeier prefecture to a point that has necessitated the formation of a special international Russian-Chinese commission in 2003. Favorable influence of such water on the Dalai Lake ecosystem, fisheries, etc. is highly unlikely, and quick deterioration of hydrobiological systems due to massive influx of new pollutants and pathogens is very probable. Unlike the Erguna River presently receiving this pollution and bringing it further downstream, Dalai Lake is likely to accumulate most dangerous non-degradable pollutants. Presently, the absence of major point-source pollution in the whole Dalai Lake watershed is the best safeguard for its unique ecosystem. Accidental spills(or intentional dumping) of various chemical substances frequently happening in the Hailar River (as reported by Russian monitoring stations downstream) further increase these risks.

5.2.4. Disrupting animal migration cycle in Daurian ecoregion

The wetlands of the Dauria eco-region are, as far as the birds and other migratory fauna are concerned, all part of an interconnected system. If the habitat provided by Dalai Lake is non-optimal for fauna during low rainfall periods, the birds and mammals will find an alternative suitable site within the impressive wetland complex of Dauria (encompassing China's Eastern Inner Mongolia, Russian Chita Province, and Eastern Mongolia), that has experienced greater rainfall or that provides more stable habitat during low rainfall periods. Later, when rainfall and lake water levels have increased, the fauna will return to Dalai Lake. Interference with the flow of water will alter this flow and movement of fauna and affect the ecology of Dauria, which is a Global 200 ecoregion, in unknown ways. Therefore, the complex ecological interplay between the various wetland areas within the Dauria ecoregion, which currently supports the impressive populations of wetland species

seen in the area, contradicts any argument suggesting that the proposed water diversion will provide a required conservation outcome.

5.2.5. Damage to nature reserve network development.

The extensive potential impact on ecosystems is especially evident looking at the Daurian nature reserve network:

In China, the diversion will have great impact on the Erka Municipal Nature Reserve just downstream from the point of diversion. This highly important habitat of many rare birds and stop-over site for migrating Siberian Crane has already suffered from an international road built through the middle of it in 2005-2007 with World Bank assistance. Project documentation contains clear reference that the impact on Erka wetland could be offset by artificial inundation with water from the same canal. This is definitely not an option for all other wetlands of Erguna midflow further downstream.

The Erguna Wetland Provincial Nature Reserve, on the confluence of the Gen and Erguna Rivers will be profoundly impacted by the proposed water diversion. Appxoximately half of the 120 000 ha floodplain wetlands within its bounds are fed by Erguna river flow.

Huliyetu District-level Wetland Nature Reserve (60 000 ha), lying in Erguna midflow between the project site and Gen River mouth, is known as an extremely important habitat for 5 species of crane (Li Xiaomin, 2000) and its wetlands and lakes are fully dependent on Erguna river flow and severely suffer from draught. The new wetland management plan for this reserve suggests pumping Erguna River waters into lakes to prevent them from drying. This is an extreme “conservation measure” the validity of which should be better subjected to careful analysis.

As indicated earlier, in the Dalai Lake National Nature Reserve the ecosystem is likely to be dramatically altered and practically converted into an artificial reservoir with controlled water levels. New water (and sediment) flow from the new canal will enter Dalai Lake Nature Reserve within the core zone where any alteration is strictly prohibited by nature reserve regulations.

Last but not least, the canal is likely to affect migration of the last remaining Mongolian Gazelles, whose last small herd is regularly observed in the area directly adjacent to the canal construction line. Additional linear infrastructure definitely decreases any chances for gazelle restoration in the nature reserve core zone north-east of Dalai Lake. The Chinese EPA suggested to confront it by “building artificial passes for animals”, which is unlikely to be an effective solution.

Russia is in the final planning stages for the development of a nature reserve along the Erguna River between Abagaitui and Heishantou. The 150 kilometer long "Wetlands of Middle Argun" will be a national-level protected area. Values of this new protected area will diminish dramatically if the flooding regime of the Erguna River changes.

All abovementioned reserves were studied by scientists of the Daurian International Protected Area (DIPA) and – since the 2006 trilateral meeting of DIPA – have been officially targeted for coordinated management and monitoring. If the water diversion project is implemented it will decrease the chances of the DIPA reserve network successfully expanding into the Erguna midflow, which had been discussed as a very likely development at intergovernmental meetings in 2006 and 2007. Plans to form a trilateral international biosphere reserve also are likely to be reevaluated if such a project is implemented, as are plans for the first tri-lateral "Daurian Steppe" World Heritage Site nomination. The same issues relate to the projected establishment of a bilateral Ramsar site (and trilateral Ramsar complex), since the Erguna (Argun) Midflow definitely meets Ramsar criteria and the three adjacent DIPA reserves are already Ramsar wetlands of international importance.

5.2.6. Important socio-economic issues

The proposed project has important implications for water quality and equality of access to resources. The project will reduce water available for human use, agriculture, fisheries and pollution dilution further downstream, which will negatively affect the well-being of the already economically depressed districts of Xinbaerhu, Chenbaerhu and Erguna in China and Zabaikalsk, Krasnokamensk and Priaargunsk in Russia. Erguna River is the only sizable source of water and has no tributaries all the way to the Gen River mouth, and presently without any project there are already issues of water resource deterioration affecting local people. Even now, people on both banks are finding themselves forced to deepen wells or buy water from outside, stop fishing operations for lack of fish, and stop grazing and hay-cutting on valley slopes for lack of grass. The waters are also severely affected by pollution. Water transfer will prolong drought periods in Erguna Valley and exacerbate all these problems.

The project will reinforce the unsustainable trend in water-use in Hulunbeier prefecture. Many potential water-consumption projects are discussed in the local Hulunbeier press as dependent on this water transfer. The EIS does not provide clear figures, but according to Hulunbeier Water Bureau projected loss due to percolation underground is added to 0.3 cubic kilometers of water withdrawn for needs of Manzhouli city, the maximum water volume actually available to replenish the Lake would be about 0.6 cubic kilometers out of 1.05 cubic kilometers diverted from Hailar River. As project progresses we would expect that additional users will claim their "fair share" of water resources. This means that at the time of project completion, the "consumptive use" of diverted water may leave an even

smaller amount for “environmental purposes” under the guise of which this project was conceived.

5.2.7. Possible international policy consequences

The proposed project will be damaging to China-Russia relations and bi-lateral co-operation on conservation matters, particularly since:

1) There is an existing agreement between Inner Mongolia and Russia to protect the waters, biodiversity and landscapes of Argun/Erguna River. A unilateral decision to alter this ecosystem by water diversion is clearly contrary to the objectives of this agreement.

2) Conditions and even the configuration of the border line that goes along the deep water of the Erguna will drastically change with the change of river flow. There is a fair amount of tension over the border line and unilateral dyke/embankment building even without the water transfer. This tension may increase multifold as the project progresses.

3) Decrease in the quality of the environment, availability of water and productivity of agricultural land will result not only in worse living conditions for local Russians, but probably in lessening cooperation with the Chinese side in border districts due to this decline in resources.

4) The project presents a classic example of introducing inappropriate engineering solutions to deal with natural water scarcity, instead of adopting a sustainable land-use strategy adapted to regional ecological conditions. If implemented, it will trigger similar efforts to divert Kherlen and other rivers in Mongolia and will fully preclude the three countries from establishing a coordinated, equitable and ecologically-sound water use regime in the Amur River headwaters.

5) The project challenges many international efforts to protect endangered species, including rare cranes and geese, and secure networks of suitable habitat across North-East Asia flyways. Since important migratory routes are affected, negative consequences for various species populations are possible in many remote areas (even in Australia).

5.2.8. Root problems underlying the project.

The project does not address root causes of the environmental degradation that is currently occurring both in the Dalai Lake area and Erguna River area, including reduced water retention capacity of upstream forests and grasslands, inappropriate agriculture leading to erosion, new infrastructure altering historic water flow, mining operations leading to dropping ground-water tables, and growing pressure on Dalai Lake from the expanding economy of Manzhouli City. A multitude of more effective methods to confront environmental degradation and protect natural ecosystems could be used in the Hulunbeier Steppe, rather than trying to achieve an ever greater change of the natural ecosystem dynamics by proposed water transfer. Rarely one could see such a small engineering endeavor that could result in such large and dangerous changes in natural ecosystems.

5.3. On-going debate - Status to Date.

According to the Chinese press, by the end of March 2007 the project had secured all the necessary funding, received the necessary approvals and its objective to "save the Lake and stop degradation of the wetlands" was supported in one of the speeches of the PRC Prime Minister in December 2006. Construction was scheduled to start in May 2007. Given that the amount of engineering works are limited to an 18-kilometer long canal and investment is relatively small, slightly exceeding 80 million yuan (10-11 million US dollars), the canal construction could be concluded in the same year.

In late 2006 our group prepared information on the water transfer project and published it on the web in Chinese, Russian and English, sharing concerns with various stakeholders. Subsequently several conservation organizations including the Russian Bird Conservation Union, Wetlands International, and PERC voiced their concern and requested a postponement of implementation of the water transfer project until comprehensive evaluation of its ecological impacts on:

- The Erguna River aquatic ecosystem;
- The Erguna River midflow wetland hydrology and ecology;
- Populations of globally endangered species and important migratory bird habitat in the Daurian ecoregion;
- The freshwater biology of Dalai Lake and the role of long-term drought cycles in sustaining its ecosystem
- The impact of polluted Hailar River waters on downstream ecosystems, including the Erguna River midflow and Dalai Lake.

Russian governmental agencies also addressed their Chinese counterparts in the State Environmental Agency and Ministry of Water Resources with a request to share information and perform joint assessment of impacts on the transboundary basin before any implementation takes place. In August 2007 China invited Russia to special consultations on transboundary water issues. At these talks, the China ministry of Water Resources reconfirmed their position that this water transfer is the internal business of China and not subject to detailed joint evaluation.

Despite these setbacks the threat is still postponed at least until September 2007 and there is still an opportunity to voice more detailed concerns and suggest alternative solutions to solve the root problems that brought this project into being. While the water transfer is, by strict technical definition, the internal business of China Ministry of Water Resources, its possible environmental and socio-economic consequences may affect internationally important ecosystems and species. The key requirement for us, therefore, remains reevaluation of the problems that have driven this

project and looking for more sustainable and environmentally sound ways to mitigate degradation of ecosystems in the Daurian steppe.

6. General directions for further focused investigation and action.

6.1. From the preliminary assessment performed by the BPCP project research team in 2007, it appears that adaptation to cyclical climate change is the key issue. In the end, all human activities will either adapt to this overarching pattern and enable retention of a sizable wetland habitat, or adaptation will not occur and large amounts of wetland habitat will be destroyed in the course of this or next drought cycle. Right now we have a good chance to observe a period of severe drought and document its effects on bird populations, wetland habitat and land-use patterns. We still are desperately looking for a professional hydrologist to assist us in obtaining and interpreting data on river flows and precipitation from the last 30 –40 years. Another important challenge we face is a lack of information on the river headwaters, which might be critical to understanding which of the observed factors are natural and which are human-induced.

6.2. Public outreach activities and a communication program should be developed to address misconceptions of drought-related problems by the general public and responsible officials. Wetland birds will serve as symbols of ecosystem fragility, connectivity and dynamics. Key messages to be delivered will include:

- Encouraging sympathy for birds that are suffering from drought as much or even more than humans populating the area and finding ways to adapt to natural ecosystem limitations and coexist with the wetland and its wildlife rather than destroy it during times of drought.
- Emphasizing the larger transboundary ecosystem, the conservation of which requires common efforts of Russian and Chinese authorities and common standards for conservation and development in the region. This should be focused on wise use of available water resources and conservation of key ecological processes.
- Advocating a halt to the direct taking of birds and lighting of grass fires in any form, since these two factors have the most obvious adverse effects to our audiences;
- Promoting best planning and technological solutions, preferably based on successful examples that are already available from ecologically similar regions.

While this communication will target local audiences, there will also be constant communication of the environmental values and problems of the Erguna valley to the broader international community

6.3. Infrastructure and mining require a quite different specialized intervention and intensive communication with responsible agencies. A special group will be formed to concentrate on this requirement in the course of field research, policy analysis and awareness raising activities. So far we have established working relationships with the China-Russia Working Group for Biodiversity, Chita Regional Government and Inner Mongolia Environmental Bureau to facilitate and inform bilateral dialogue on these issues.

6.4. The group of factors obviously affecting the distribution of birds and condition of habitats should be identified for further observation on model plots. Combined with the bird survey work, this will give us a much better assessment of the interplay of generic factors. Such work will be conducted in carefully selected model plots in each of the major survey areas of our 2007 studies. On some factors that lend themselves to satellite imagery analysis, the results obtained in the model plots will be used to analyze similar factors in the total area by ground truthing and extrapolation of findings. A list of parameters to be assessed and assessment protocols are currently being developed.

6.5. Further research and intervention in the field of international relations is required, including efforts to help facilitate the following processes:

- Improving coordination and expanding cooperation in the trilateral Dauria IPA;
- Developing a joint biodiversity and landscape conservation approach for the Erguna River basin under agreement between Chitinskaya Province of Russia and Inner Mongolia in China.
- Establishment of a nature reserve network along the Erguna River and linking it to Daurian IPA research and monitoring mechanisms.
- Employing mechanisms of the Ramsar convention to promote regional initiatives for protection of the Amur River Basin Wetlands, with Erguna River Basin being one of the main foci.
- Building a foundation for trilateral agreement on integrated river basin management in the Upper Amur Basin.

7. Conclusion

Of course, our small research group cannot solve or investigate in detail each of these huge topics that merit the attention of research institutes, governments and international organizations. But we aim to help raise and formulate the questions most important for nature conservation and sustainable development in the Daurian ecoregion. We also hope

to provide contemporary relevant information on this area, that so far lacks international attention, to the broader conservation and development community and, by doing this, bring pressure to bear on Chinese authorities to properly consider alternative solutions and mitigation measures.

Unfortunately, the response we received so far from the Hulunbeier Water Management Bureau is very discouraging. They have stated that "most environmental crises in China are results of human activities, and it is very natural and not subject to any discussion that humans equipped by scientific knowledge must confront those disasters. They will successfully confront these disasters by methods such as appropriate inter-basin water transfers and other engineering undertakings" (Hulunbeier Water Management Bureau, 2007).

We hope that the international community can help us communicate to the local authorities the message that engineering solutions to perceived environmental problems are rarely successful, and those that do succeed are always based on a mix of the best scientific evidence available and a healthy dose of caution.

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