ARGUN RIVER BASIN IN IMMINENT THREAT FROM WATER INFRASTRUCTURE AND DEEP NEED IN TRANSBOUNDARY CLIMATE ADAPTATION PROGRAM.

Many difficult questions on adaptation to climate change and allocation of scarce water for human use and ecosystem conservation exacerbate situation in the Amur Headwaters much earlier than in water abundant areas downstream. This region, known as Dauria, has pronounced natural climate cycle with a span of 25-40 years, and has been affected by its drought phase for last 9 years. Headwaters are highly transboundary: Onon and Uldz rivers are shared by Mongolia and Russia, and drought-prone Argun River Basin – by all three countries. In the whole Amur watershed Argun River presents the most comprehensive case of all aspects of free-flowing river dynamics and management problems. It has global ecological significance, and water management there is a classic example of improper decisions made on water resource allocation exactly because it is international basin and there is lack of consent and mutual trust between countries. Finally what happens here effectively shapes patterns of international water management in larger Amur for the future.

This paper focuses on a 200 kilometer transboundary stretch of Argun River from Zhalainor to Priargunsk, which contains wetlands of exceptional value, Dalai lake , and upstream areas connected ecologically to those two wetlands (see map Fig1). Free flowing river ecosystem in transboundary stretch is directly threatened by change in hydrological regime/water withdrawal, construction of dykes and other obstacles in floodplain, extreme pollution that exacerbates with reductions in flow volume. Factors influencing change in Argun wetlands also include: climate fluctuation, annual wildfires, overgrazing, soil erosion, fragmentation of habitats, fishing and poaching.

Local ecosystem and land use

The Argun-Hailaer River straddles the China-Russia border in northeast Inner Mongolia (China) and Zabaikalsky Krai (Russia). About 1-2 million migratory birds pass through transboundary Argun wetlands in spring and autumn. It is also an important breeding area supporting 19 IUCN Red List bird 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. (Goroshko et al 2006(2)) Floodplain wetlands of Argun River are very different in character from Ramsar wetland of adjacent Dalai Lake Nature Reserve, which together with Daursky (Russia) and Mongol-Daguur (Mongolia) biosphere reserves make up trilateral Dauria International Protected Area (DIPA). (Goroshko et al, 2006) (Li Xiaomin 2001)

Important feature of Argun River floodplain is very active and complex meandering process, leading to formation of multiple oxbow lakes and complex mosaic of reed-beds, willow thickets, meadows and sedge bog habitats. Relatively small river has wide braided floodplain with high speed of bank erosion and quick redistribution of flow between many alternative channels. Constant change driven by uneven water flow and meandering greatly contributes to habitat diversity and species diversity. (Glushkov et al. 2009)

Natural climate cycle adds a lot to temporal diversity and connectivity of regional habitats. In the course of climate cycle with a 25-40 year span ecosystems of Daurian ecoregion are subject to drastic changes. Dalai Lake that can cover 2300 sq. kilometers and depth of 7 meters, in 1904 was a small chain of shallow 1m deep pools.

Thousands of smaller steppe lakes dry completely in water-deficient periods, while flow of Argun River at the border fluctuates from 1.5 cubic kilometers per year to more than 6 cubic km per year. Many smaller streams dry completely or flow only during rainy periods. These cyclical changes are more evident in lakes, generally following long 30-year cycle, and less pronounced in large stream valleys that are sustained by influx of water from mountains even in some dry years. Since sources of Argun River and tributaries are in Great Hinggan and Dalai and Buir Lakes are fed both from Great Hinggan and Henti Mountains of Mongolia water abundant and water-deficient years do not coincide in different sub basins of Daurian ecoregion.

In Daurian ecoregion protection of single wetland-steppe clusters makes relatively little sense, since most of 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 some floodplains of rivers with permanent flow provide smaller and sub-optimal but stable habitat and most of steppe becomes highly inhospitable area. Real picture is much more complicated and differs from species to species, and most rare species populations use territory of at least two adjacent countries (Goroshko et al 2006) . Probably, this complex cyclical drought is the most pronounced ecological process forming local ecosystem dynamics in Dauria. (Simonov et al. 2007)

On-going climate change so far did not affect precipitation pattern, but mean annual temperature raised by 2 degrees centigrade and thus increased evaporation. (Mesherskaya et al 2008). It reasonable to expect more prolonged and severe droughts within the same cyclical pattern.

Argun fish fauna is in steady decline at least from end of the 1990-s. 41 species of fish are historically known from Argun River, but more than half have not been confirmed during 2005 study by ichthyologists. Mean fish productivity in May 2005 did not exceed 2 kg/ha while in comparable stretches of Shilka River it was 55 kg/ha, which shows that even available fish habitat is severely depopulated (Mikheev 2006). In time of low flow period, fish populations of Argun has shown further significant decline, likely due to lack of habitat and pollution, as well as fishing pressure. Since Chinese typically use much finer mesh, fishing is still a viable occupation and there are ten professional fishing camps just along the transboundary stretch of the Argun main channel. In Russia all professional fishing ceased at least a decade ago due to depletion of fish stocks, while in the 1960s 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).

Argun-Hailaer is the main source of surface water supply and aquifer replenishment for all municipalities of the area including Manzhouli, Hailaer, and Zhalainor cities in China, Zabaialsk, Krasnokamensk, and Priargunsk in Russia. In Argun Valley traditional cattle herding is still the dominant land-use in steppe zone, but in forest steppe zone it is complemented by cropland with wheat, soy, rapeseed, etc. Russian slope of the valley has more precipitation and thus more cropland. Irrigated crops are scarce, found mostly in China. Floodplain and wetlands serve as critical source of pasture and hay during dry

periods, when unavailable elsewhere and experience now enormous pressures throughout Dauria. Productive floodplain meadows are sustained through flooding and meandering processes.

Threats to the free flowing river

Rapid urban and industrial development of Manzhouli City and Zhalainor town (with population around 300 000) is due to influx of cheap resources from Russia via railroad. This makes Manzhouli and its Russian twin-city Zabaikalsk major future sources of pressure both on Argun-Hailaer River and Dalai Lake, since they raise high demand for water in times of declining supply.

Roads, bridges, pipelines are built with astonishing speed in China part of the area with little assessment of environmental impact and ecological appropriateness of this infrastructure development. For example In 2001-2007 the World Bank supported construction of international road from Manzhouli to Hailaer that for 15 kilometers dissected Argun floodplain right in the core area of Erka wetland nature reserve. 2007 field survey and imagery analysis gives overwhelming evidence that the road severly affected water flow in whole floodplain, triggered influx of herders, fishermen and other newcomers right inside the wetland. (Simonov et al. 2007)

Mining is a major growing source of direct impact on river valley, since best accessible oil, coal and other deposits (except for uranium) coincide with best preserved wetland areas and floodplains. Mining industry is also the main consumer of scarce water resources. For example, recent proposal to transfer flow of 3 major rivers in adjacent Eastern Mongolia (Kherlen, Onon and Balj) also has mining industry demand as driving force behind it.

The greatest direct threat to free-flowing Argun comes from water infrastructure policies. In transboundary stretch natural meandering process in Argun River is perceived by both countries as “loss of motherland” and often confronted by unsound embankment building. Since the border is marked by the main channel, meandering naturally threatens “national sovereignty” and leads to territorial losses and gains. Chinese side possessing greater and cheaper workforce is actively building embankments that arrest meandering. This leads to moving main channel deeper into Russian side of the valley and at some places like Starocuruhaitui village roads along valley slopes are disrupted by artificial change of water flow. According to observations from Russia by 2002 there were at least 10 such embankments along Chinese bank (Rosnivkh 2007). Normally Russian policy is to put blame on Chinese side for “territorial expansion” and ask for federal subsidies for building symmetrical embankments. In a long run such approach is detrimental for floodplain ecosystem. As meandering process is arrested the process of constant reproduction of floodplain habitats will be stopped or significantly slowed down. New oxbows will no longer be formed and succession of existing habitats will lead to filling of old oxbows. Resulting floodplain landscape will have much less geomorphologic diversity and succession of plant communities will go in new direction. At

the end of the day, which will come relatively soon, Argun floodplain will lose most of valuable bird habitat. Of course this change will take some decades and will be influenced both by climatic fluctuations and human induced alteration of river flow.

Streams of Argun Basin are practically free of dams and therefore no major withdrawal is possible. In two other prefectures of Inner Mongolia Tongliao and Chifeng located nearby surface water withdrawal reaches 25% of total runoff against 1% in Argun basin (CAE 2007). To "improve" the situation up to 10 new large water infrastructure projects are planned and implemented in China: Honghuaerji, Zhaluomude, Daqiao, Zhashuhe, as well as water transfer from Khalkh (Halaha) River - the main tributary of the Dalai and Buir Lakes - to Xilingol coal-mining area.

Honghuaerji Reservoir (0.3 cubic kilometers) to be completed in 2009 on the Yimin River – the principle tributary of the Hailaer River, it will serve a coal-fed 3600MW Yiminghe thermal power station that should supply electricity to Shenyang City 1000 kilometers eastwards. Zhaluomude Reservoir (0,6 cubic kilometers) on Hailaer River is designed for flood protection, and water supply to Hailaer City, Dayankuang mine and irrigation projects. (CAE 2007). These projects will affect flooding dynamics and sediment transfer in Argun River and require careful assessment and development of environmental flow provisions to secure ecosystem health.

Transfer project example Hailaer-Dalai

However, the most threatening proposal is to divert water from the Hailaer River to Dalai Lake IS IMPLEMENTED NOW IN 2009. The proposed canal 17 kilometers long would divert an annual volume of approximately 1.05 cubic km of water to Dalai Lake. Actual flow capacity of the canal is 70-93 cubic meters per second, while average flow of Hailaer (upper Argun) River at the construction point is 117 cubic meters per second. The project is expected to arrest further Dalai lake salinization, reduce eutrophication, prevent desiccation of adjacent grasslands, etc. The proponents also expect that higher stable water levels will help replenish diminishing fish stocks in Dalai Lake, provide water for additional 40 000 livestock and 2000 hectares of irrigated hayfields and supply the municipal needs of Manzhouli City. An associated project will subsequently use Dalai Lake water to supply new copper mines.

Transfer project is supported by the Government and Water Agency of Hulunbeier prefecture, since it may draw investment from national funds and seem to serve aspirations of many local constituencies. Tourist industry of Dalai Lake shore supports stabilization of lake level. Influential China Gold Corporation counts on this project for water supply to copper mines and can lobby higher levels of government. (Ramsar COP10, Resolution 13). Fishermen, farmers, mine owners, nature lovers – are made to believe that project is ideal answer to challenges of climate change and support this endeavor. As a result, there is a local belief that more pressure can be put on the Argun River to alleviate "problems of Dalai Lake" (Hulunbeier Water Management Bureau.2007).

Real impacts of this project are very diverse and complex. Rarely one could see such a small engineering endeavor that could result in such large dangerous changes in natural ecosystems. The project will most likely result in drastic decrease of habitat value of both Argun floodplain wetlands and Dalai lake ecosystem and will significantly diminish their natural character. (Hanish 2006).

Desiccation and degradation of wetlands. Project's EIA report (2005) claims that Argun River wetland ecosystems are much more resilient to environmental change than Dalai Lake. Thus EIA does not clear depict the difference between Dalai Lake Ecosystem adapted to long-term changes of water level and Argun River floodplain ecosystem which has very different dynamics dependent on frequent floods and not adapted to long-term water deficit.

Satellite derived and ground-proofed habitat change analysis in Argun and Dalai wetlands from 2000 to 2006 has shown that significant changes occurred over 31% of study area and within those zones of significant changes 82% shifted towards dryer conditions. (Fig 2. Comparison of 2000 and 2006 habitat humidity.). Change analysis in model plots over longer 15-20 years period also shows trend towards drying, but in some plots habitats shift to more humid conditions, which is most common in areas most affected by flooding and meandering processes. These processes sustain ecosystem dynamics, diversity and structure in floodplains. Changes occurring in wetlands in 2000-2006 were classified in 15 change patterns, with leading reasons investigated for each change pattern. Comparison between Dalai Lake and Argun River Floodplain has shown that both wetland areas have similar percent of territory undergoing drying (28% and 31% respectively). During the drying phase of climate cycle the leading change pattern for lakes is fall of water level with vast areas of bare substrate being slowly colonized by halophytic vegetation. For floodplains in the same phase the leading change pattern is desiccation/degradation of

dense meadows and reed beds, which is reinforced by fires and overgrazing. Hydrologically much more stable Three River Delta floodplain shows yet another set of change patterns with only 16% of territory drying.

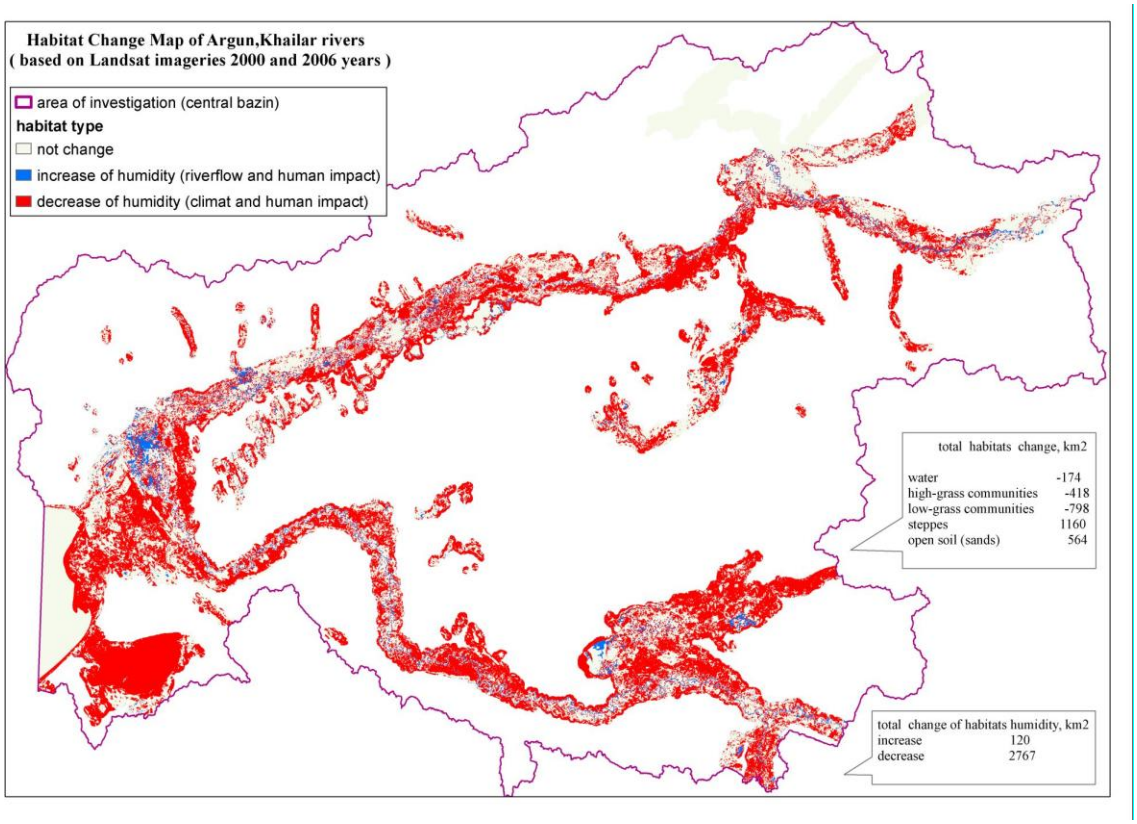

Figure 2. Trends in habitat change 2000-2006.

This initial research shows that Argun River floodplain wetland ecosystem has similar degree of change during current drought as Dalai Lake, but recovery and persistence of its floodplain ecosystem is more dependent on flooding dynamics, and at least 1300 square km. of wetlands would be severely altered if water transfer project goes ahead. (Glushkov I. et al 2009). Flooding and wildfire are two counterbalancing processes shaping wetland habitat, and during long droughts without floods endangered birds cannot nest in floodplain. Transfer project would cut off "surplus" flooding waters, therefore diminishing flood magnitude or completely arresting floods. In a short term it will deprive floodplain from cranes, geese and other birds, and in a long term will degrade whole ecosystem shaping process with braided river-bed changing to single non-meandering channel. (Rosniivkh 2007)

Drastic alteration of Dalai lake ecosystem will deprive it from main natural process – water level fluctuation , that ensures gradual cyclical succession of aquatic and lakeshore habitats. Lake will become stable reservoir and many species cease to use it. (Guo Yumin et al 2007)

Degradation of major wetlands will disrupt animal migration cycle in Daurian ecoregion as a whole. Project challenges many international efforts to protect endangered species, first of all 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.

Damage to nature reserve network development. Water transfer project will directly inflict damage on 4 existing nature reserves on china side: Erguna Wetlands, Huliyetu, Erka and Dalai Lake Biosphere Reserve. It will also diminish value of current effort to create a cluster of Daursky Biosphere Reserve on Russian side of Argun valley. (Ma et al 2007)

The project will reduce water available for human use, agriculture, fisheries 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 Priargunsk in Russia. Argun River is the only sizable source of water all the way to the Gen River mouth, and presently without any project there are already issues of water resources deterioration affecting local people. Even now, just in time of draught, people on both banks are forced to deepen wells or buy water from outside, stop fishing operations for lack of fish, stop grazing and haying on slope valleys for lack of grass and reduce planted cropland. Water transfer will prolong drought periods in Argun Valley and exacerbate all these problems. (Simonov 2007(2))

Increased accumulation of pollutants. It is already a plague of Argun River during last drought period. Paper mills and other dirty industries developed along Hailaer river already discharge toxic substances well in excess of river capacity for self-purification. Water transfer will further decrease pollution dilution capacity of Argun. Besides it will bring toxic pollutants from Hailaer River into Dalai Lake, which presently has not major sources of industrial and municipal pollution.

Encourage other transfers of transboundary waters. Project will also create and encouraging precedent for further unsound engineering interventions into natural water cycle of the region, and may pave way for 3-4 more water transfers from international watercourses (Kherlen, Uldz, Onon, Selenge rivers) in adjacent Mongolia, which are currently under planning. The Kherlen River is an important tributary of the Dalai Lake, which due to drought and poor watershed management ceased to reach the lake for at least a month in a year in 2007-2008. Transfer of "surplus floodwater" to Gobi should ensure supply to new mining camps and support tree planting. Mongolia officially informed China about this plan in 2008, which in turn reinforced desire to transfer Hailaer into Dalai Lake.

The Project does not address root causes of environmental degradation that now progresses both in Dalai lake area and Argun River area: reduced water retention capacity of upstream forests, inappropriate agriculture leading to erosion, growing pressure on Dalai Lake from expanding economy of Manzhouli City, etc. The project presents a classic example of introducing inappropriate engineering solutions to deal with natural water scarcity, instead of adopting sustainable land-use strategy adapted to regional ecological conditions.

Since early 2007 this project was under intensive criticism from international NGOs and Russian neighbors. Ramsar convention secretariat also filed a request for information

on project impacts. (Ramsar COP10) . As a result the project implementation was postponed due to lack of consent from national level. In summer 2008, when Dalai lake level suddenly raised by 80 cm, Hulunbeier prefecture government held a meeting to declare that "we have to learn to live with naturally fluctuating lake", but it never dismissed the transfer project and never disclosed EIA materials to Russian side or Ramsar secretariat. However right after Olympics earth works started and by May 2009 eight-kilometer stretch of the canal has been built along with several bridges. Construction could be completed in 2009.

Conclusions:

Hailaer River –Dalai Lake canal construction should be stopped to prevent ecological disaster. High international status of Dalai Lake wetland ecosystem and transboundary nature of not less important but less recognized Argun/Erguna river wetlands should be used in bilateral and international efforts to stop water transfer.

Coordinated use of region's scarce water resources by means of common climate adaptation strategy and trilateral water management treaty is the highest need for the region. Argun-Hailaer, Khalkh, Kherlen, Uldz, Onon, Imalka rivers– virtually all notable basins of the Amur Headwaters are transboundary. Greatest potential threats – competition for water imbedded into the national policies and prescribe demolishing transboundary wetlands to store waters on national territories. And this is in the making.

As UNECE Guidelines state "Adaptation to climate change must also occur through the **prevention and removal of maladaptive practices**. Maladaptation refers to measures that do not succeed in reducing vulnerability but increase it instead" (UNECE 2009). To avoid multiple maladaptations SEA of water management options in Dauria should be jointly carried out by three countries.

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.

Adaptation should also occur through the use of best water-saving technologies and appropriate resource-use practices, first of all in affluent Manzhouli city that can afford it. Here countries have different comparative advantages and have a lot to share. Mining seems to be one of most thirsty among growing economy sectors in all 3 countries.

Development of nature reserve network that provides for migration and breeding of species in all phases of region-wide drought cycle and preserves key hydrological features and all important refugia. Understanding interplay of permafrost, fire regime, drought

cycles, agriculture, infrastructure development in changing landscapes, with special attention to forest-steppe transition zone and freshwater ecosystems.

Communication strategy is needed for Dauria that makes climate cycling and limitations/advantages it brings better understood by local people and considered by governments in key planning/decision-making. This is communication for "adaptation and enhancing resilience".

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