Worlds Rivers in Crisis- Water quality & Water dependent Biodiversity at Risk

Human civilisation is inextricably linked to the Worlds Rivers. Many of the ancient societies developed along side of the rivers and a number of major cities have been built on river banks. Rivers provide freshwater for humans, industry and food production (agriculture), supports inland fisheries (fish is a source of protein & micronutrients, about 60 million fishers depend on inland fishing). Rivers are also a source of biochemical's, genetic resources and a means of navigation, recreation & ecotourism. It has also aesthetic, spiritual and cultural values. Discharge of chemicals and biological pollutants into rivers (Figure 1, 2) and development of engineering infrastructures such as dams and weirs over rivers have modified rivers ecosystems threatening the worlds water security, water quality, and water dependent biodiversity (Table 1). Furthermore, climate change (e.g. extreme weather events and sea level rise) would impact future river flows and river water quality.

Rivers contaminated with elevated levels of ***chemicals pollutants or toxicants*** such as salt, pesticides/herbicides, trace metals (e.g. Cu, Cd, Pb, Hg), pharmaceuticals (e.g. antibiotics, NSAID), endocrine disrupting chemicals (e.g. estrone, estradiol), nutrients (e.g. N,P), blue-green algae/cyanobacterial toxins (e.g. microcystins), and ***biological pollutants*** (e.g. faecal coliform) may cause river water unsuitable for beneficial water usage including human drinking, raw town supply, crop irrigation, recreation, and aquatic ecosystems protection. Rivers in the USA, most of Europe, large portions of Central Asia, the middle East, the Indian subcontinent, and eastern China are currently under severe threat due to pollution and river habitat modification where 80% of world population (4.8 billion) lives[Ref.1] (Figure 1). The Buriganga river in Bangladesh is extremely polluted as evidenced by low dissolved oxygen content (<2.8 mg/l or hypoxic condition) and very high levels of metals levels (Cd, Cu, Cr, Ni, Pb). The trace metals in Buriganga River water are 5 to 500 times higher than the recommended guidelines trigger value for protection of aquatic ecosystems (see Figure 2, Table 2). According to US NWQ Inventory (2004), the 44% of the US Rivers is impaired due to agriculture pollutants, hydro modification, pathogens loadings and organic enrichment. The faecal coliform counts (*Escherichia coli*) in the Ganges River in India (Ganga at Haridwar) have reached to an alarming 5,500 coliform (should be zero counts/100 mL for drinking water, 150 counts/100 mL for primary contact recreation). The 80-90% (fish biomass) of the Murray-Darling River in Australia is occupied by alien fish threatening the survival of native fish such as the iconic Murray cod.

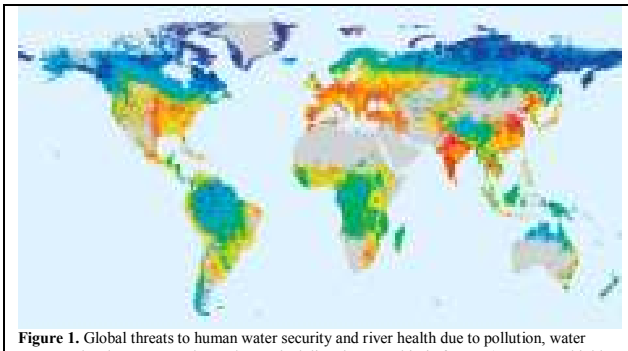

Figure 1. Global threats to human water security and river health due to pollution, water resource development, catchment/watershed disturbance & biotic factors (note: **Red**= highly polluted areas; **green**= moderately polluted, **blue**= little affected regions). [Source: Vörösmarty et al. 2010: Nature: 467: 555-561].

Figure 2: Burnt oil, dyeing chemicals being dumped into Buriganga River in Bangladesh [Source: The Daily Star, Bangladesh. July 3, 2009].

Table 2: Metals conentrations in Buriganga River compared to international guideline value.

Trace metals (µg/L)	Cd	Cr	Cu	Ni	Pb
Average (µg/L) in Buriganga water) [Ref 4]	9.35	587.2	163.1	8.8	65.4
Australian guideline for 95% protection of aquatic ecosystems (ANZECC, 2000)	0.2	1.0	1.4	11	3.4

Furthermore, engineering infrastructures such as dams/ weirs/levees (barriers) built over rivers for the good purpose of irrigation; drinking water supplies, flood control, and hydroelectricity are often at environmental costs. For example, dams disconnect rivers from their flood plains and wetlands, reduce water flows in rivers, and affect the migratory patterns of fish. The natural downstream movement/transport of sediments to wetlands, flooded forests, deltas, inland seas, and estuaries is blocked by dams affecting the species composition and productivity of rivers. In general, water retention by dams eliminates or reduces spring runoff or flood pulses that often play a critical role in maintaining downstream riparian and wetland ecosystems including the lifecycle of fish. Older dam's releases water that is stored at the bottom of the dam, which is typically colder and adversely, affects species adapted to warmer temperatures. Such affect is sometime referred to as 'cold water pollution'.

There is a need to protect rivers water quality, river ecosystems and rivers dependent biodiversity from pollution and dam's development. It is also essential that a balance between river water usage for consumptive purposes (drinking water, industry and irrigated agriculture), and environmental water requirements for smooth functioning of river ecosystems is found.

Table1: Key threats to some of world selected rivers and their important biodiversity ([Ref 2. & Ref 3])

Country & River	Threats to rivers	Important biodiversity and environmental assets
Argentina, Brazil, Paraguay **La Plata**	infrastructure for shipping, proposed large dams (27), pollution, climate change, over-fishing	350 fish species (85 endemic), La Plata dolphin, Lungfish, 650 species of birds, 90 species of reptiles, 1,600 flowering plants, 80 species of mammals including jaguars
Australia **Murray-Darling**	11 invasive species, river regulation &fragmentation, salinisation, nutrient, Bluegreen algal blooms/toxins, climate change	57 fish species,, 16 mammals,35 birds, platypus, river red gum forest, 2442 environmental assets, 30,000 wetlands (12 Ramsar sites)
Bangladesh **Buriganga**	Tanneries, textiles and sewage wastes, pharmaceuticals, shipping oils (launches)	endangered Ganges river dolphin
China **Yangtze**	pollution (industrial, agricultural and domestic waste), 105 large dams, over fishing	350 fish species, (112 endemic), critically endangered paddlefish, endangered finless porpoises, critically endangered Chinese river dolphin
India **Ganges**	water extraction (over extraction), large dams (14 proposed), climate change, chemicals and biological pollution (tanneries, sewage waste)	140 fish species, 90 amphibians, endemic birds, 5 species of cetaceans including the endangered Ganges river dolphin, rare freshwater shark
Egypt, Ethiopia, Sudan **Nile**	climate change (possible salt water intrusion), excessive water extraction, invasive species	129 fish species (26 endemic), 137 amphibians, 69 wetlands supporting endemic bird and bird migration routes, endangered marine turtles (loggerhead and green turtle)
Germany, Hungary, Romania **Danube**	infrastructure for shipping, proposed large dams (8), pollution and invasive species, spills and ship collisions	103 fish species (7 endemic, 10 diadramous including sturgeon), 88 freshwater molluscs (18 endemic), more than 18 amphibians, 65 Ramsar wetlands
USA and Mexico **Rio Grande-Rio Bravo**	water extraction (irrigation- 80%), water infrastructure, salinisation (salinity displaced 32 native fish) and invasive species	21 fish species (69 endemic), endemic birds, molluscs

---

References

1. Vörösmarty et al. 2010. Global threats to human water security and river biodiversity *Nature, 467* (7315), 555-561. 2. Wong et al. 2007. World top 10 rivers at risk: WWF international, Gland. Switzerland. 52p. 3. MDBA. 2010. Murray Darling Basin Authority. Guide to the proposed basin plan. Volume 1. Canberra, Australia. 4. Ahmad et al. 2010. Heavy metals in water, sediment, and some fishes of Buriganga River, Bangladesh. International Journal of Environmental Research 4(2): 321-332. The article is based on various sources and was compiled by Golam Kibria, Ph.D in November 2010 for http://www.sydneybashi-bangla.com (20) for community benefits. Views expressed in this article are those of the author and are not to be taken to be the views of any others including third parties. The information in this article may be assistance to you but the author donot guarantee that it is without flaw of any kind and therefore disclose any liability for any error, loss or other consequences which may arise from relying on any information in this article.