Re-plumbing China: Leading to the World's First Water War?

Raj Mehta

A "water war" in the near term seems quite unlikely. This conclusion has been drawn after exhaustive trawling of viewpoints and perusal of research done by interest groups, think-tanks, non-governmental organisations (NGOs) and other players with stakes in water. It is influenced by the author's own experiences and his interpretation of the potential for conflict over water in the South Asian context, with special reference to India and China. The core issue of the declining availability of water and the increasing demand for it is, nevertheless, a very serious, as well as complex and interlinked issue. Any solution that is found will, therefore, have to be networked and international, rather than stand-alone. The dependence on water from the high Himalayas is such that China, and the South and Southeast Asian countries (the so-called lower riparian states) have little choice but to collaborate instead of getting involving in conflict.

One perspective of how water is likely to haunt us is a recent report in *The Economist* – citing official estimates – that *India will run short of water by 2050* (when the population is expected to peak at 1.7 billion), unless massive improvements are made"[1]. The status of China, especially north, central and east China in this respect is far worse. The sobering relevance as well as destructive potential of mishandled water is best illustrated by the grim fallouts of a relatively small scale July 2005 incident concerning China and India. A gigantic wall of water rushed down from the Tibetan highlands, towards the Indian border village of Sumdoh, nestling on the banks of the

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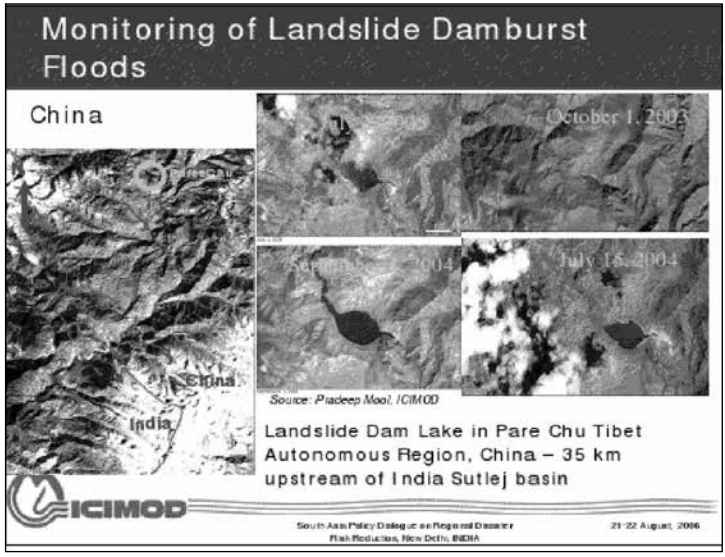
Pare Chu, a tributary of the Sutlej River. This occurred minutes after the huge landslide created lake, located 35 km upstream, burst its banks (or was made too, as circumstantial evidence suggests, by the Chinese authorities, fearing floods). The area is opposite the "Sugar Sector" of the Indian Army in the Kinnaur District of Himachal Pradesh. According to the Survey of India, in August 2004, Dehra Dun, the lake, had 114 million cubic metres[2] of water, was 60 metres deep and had a total area of 230 hectares, almost a year before it burst its banks.

The author visited Sugar Sector in March 2006 and, besides seeing an electrifying though grainy video of the advancing water wall shot by an alert Indian soldier who was on sentry duty, saw at first hand, evidence of the wanton destruction the torrent of water had left behind, not just at Sumdoh, but for hundreds of kilometres downstream. The massive, Rs 8,500 crore (Rs 8.5 billion) Nathpa-Jhakri hydroelectric plant across the Sutlej also suffered crippling losses. It is worth noting that, while the Chinese had taken due care to relocate all their villages along the Pare Chu Valley by constructing prefab huts further up the Pare Chu Gorge to minimise their losses (the author personally saw this damning evidence from a vantage point), the Indian side was caught off guard by the deluge.

Fig 1: The Pare Chu Lake as it Expanded in Size



China has fascinated but, equally, angered and distressed the author ever since July 1968, when the late Brig John Dalvi, the iconic author of the 1962 Sino-Indian War classic, *The Himalayan Blunder,* gave him the privilege of reading its riveting, heart-rending final proof. He has kept up his interest in China through his military service thereafter. As GSOI (Operations) in 33 Corps, in 1987-88, he spent a lot of time doing reconnaissance in the areas of Sikkim opposite Tibet and reading up on Tibet in its excellent library. Later, in 2001, he visited Bhutan during the National Defence College course. Posted in Military Operations as a brigadier in 2001-2003, he kept his interest in China alive and visited the Indo-Tibetan border at Ladakh, Sikkim as well as in Assam and Arunachal Pradesh.

The South Asian river basins, most of which have their source in the Himalayas, support rich ecosystems and irrigate millions of hectares of fields, thereby supporting some of the highest population densities in the world. The escalating water demands of an exploding China, and the South and Southeast Asian countries underscore the feeling that the issue is in need of a solution acceptable to a wide band of upper and lower riparian users. The subject is examined in this paper as follows:

- Overview of the Problem.
- The Nature of China's Water Crisis.
- Why is Tibet the Water Tank of Asia?
- China's Water Sharing Problems with its Neighbours.
- Options China can Exercise for Resolving its Water Needs and Attendant Hazards.
- Indian Views and Actual Practice in Water Harvesting/Management.
- Analysis of the Problem.
- Afterword.

Overview of the Problem

According to Phunchuk Stobdan,[3] an Institute for Defence Studies and Analyses (IDSA) expert on issues concerning national and international security in the Himalayan region, China, is hard-pressed to implement the Brahmaputra project as an answer to its growing water woes arising from demographic explosion, industrial upsurge, rapid expansion of cities, and greater demand for irrigated agriculture farming,[4]…more so since "90 per cent of Tibetan runoff flows downstream (unutilised) to South Asia and Southeast Asia." Claude Arpi,[5] the noted Tibetologist and Sinologist has written passionately and often about water issues, and is supportive of the viewpoint adopted by Stobdan, besides

being very well informed and critical of Chinese water mismanagement.

Brig Vikas Joshi[6] writes that the existing legal provisions for water sharing, at the international level, are characterised more by their weakness than their substance. In short, most agreements remain bilateral, monitored by joint commissions and the game is 'free for all', dominated by the upper riparian states. India, on its part, has an understanding through treaties with Pakistan and Bangladesh as an 'upper riparian' and with Nepal as a 'lower riparian'. With China, only a Memorandum of Understanding (MoU) on the Brahmaputra and Sutlej for sharing hydrological data related to floods and emergencies exists. Chinese thinking on the issue, he says, is reflected in the native Chinese adage, "upstream does not suffer" and supports the Chinese tendency to take unilateral action in matters of water exploitation.

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This viewpoint, is, however, seriously challenged by Romesh Bhattacharji.[7] Responding to the Stobdan article, he opines that there is nothing wrong if China improves its infrastructure as India is doing very much the same thing.[8] He says, "Mr. Stobdan alludes to the Pare Chu being responsible for the flooding in the Sutlej in 2000. Has he studied the course of the river? This river rises in India[9] from the SE of Bara Lacha La pass and enters Tibet at Chumur, Ladakh and is turned back into India near Shugar in Spiti. In 2000, a landslide in Tibet had caused the Pare Chu to dam up and this was responsible for the flood"[10].

More tellingly, he reveals, with some asperity that "80 percent of the waters of the Brahmaputra are added after that mighty river enters India."[11] This viewpoint is reinforced by Brig Gurmeet Kanwal, Director, CLAWS, New Delhi. Bhattacharji points out that our intelligence is appalling, as is evident from the fact that we (and, surprisingly, even favoured ally Pakistan) had no information of a dam that the Chinese made in 2004, on an Indus River tributary near Ngari Township.[12] This, he suggests, and "the ignorance of our intelligence men, is the real threat multiplier not a vague notion of intellectuals of (using) water as weaponry[13].

Fig 2: "Undetected" Dam over Indus Tributary near Ngari Town

Bhattacharji adds that the *Indian Express* report of October 15, 2009, on the Chinese building a dam on the Yarlung Tsangpo (Brahmaputra), thus, need not be viewed with alarm. When the Brahmaputra enters India, below Spur Top, it is a smallish river. After that, it picks up considerable waters from the Yangsang Chu at Jidu, the Siyom and the Sipi at Yembung and several others before it leaves the hills at Passighat. Around this place, it more than doubles its size with the waters from the Lohit and Dibang. After that, its right bank gets the Himalayan rivers like the massive Subansiri, the wide Kamala, the Rong, Kameng (Bharoli), Aie, Saralbhanga and about forty others. Its south bank too gets waters from rivers like the Burhi Dihing, Namdang, Dhansiri, Kalang, Kopili, Digaru, Bajbala and thirty others. "These make the mighty Brahmaputra the size that it is. Not Chinese waters"[14], he concludes. The Brahmaputra River manages to drop to about 1,000 feet and then to 500 feet in Assam state. The water flow before the river enters Arunachal Pradesh is about 60,000 cubic feet per second. The one million cubic feet per second flow of the Brahmaputra during the rainy season is due to the topography of the land.

Let us view the problem from a different but significant perspective. In an article that has caused great commotion amongst analysts throughout Asia, Capt Bharat Verma, who is the editor of the *Indian Defence Review (IDR),* as also a publisher, has listed out his perceptions on why he feels China will attack India by

2012. It may be noted that he does not list water as one of reasons of the ongoing friction[15] between the two countries. The studied Chinese response reproduced below Bharat Verma's article in the *IDR* also does not raise the issue of water as an issue.

Rohini Nilekani in her well reasoned article, "Is Water the Next Oil?" speaks of people's involvement, quoting a Chinese proverb ("Tell me, I forget. Show me, I remember. Involve me, I understand")[16] as the way forward to resolve the crisis. People must see themselves as not only part of the problem but also part of the solution. It is, therefore, incumbent on both the Chinese and Indian governments[17] to make radical, science-based policy changes as soon as possible. Unless they do so, devastating water shortages will result within decades for billions of their citizens.

It, thus, appears that there is indeed a water problem and a serious one at that, but one that suffers from equally serious misperceptions or mindsets or both, across the Chindia; in fact, across the global continuum.

The Nature of China's Water Crisis

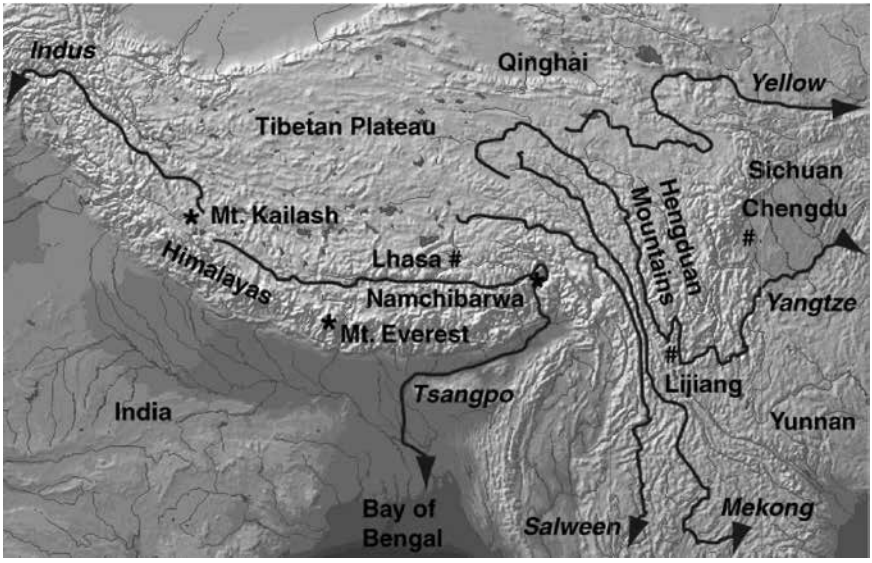
The most comprehensive and up-to-date macro level analysis and reference on the enormous water resource crisis confronting the People's Republic of China (PRC) is given in the book, *China's Water Crisis* by the iconic Ma Jun[18]. The author explores issues ranging from the inadequate flow of the Yellow River in the north to deforestation and excessive dam construction along the Yangzi (Yangtze) River in central China to the serious and persistent drought conditions in the cities of the southeast and the impact of pollutants on the water sources located in Tibet.

Li Jing, writing in the *China Daily*[19] has reported that, with pressures from rising water demand and limited supplies, combined with severe water pollution, China is faced with mounting challenges for supplying safe, clean water to its 1.3 billion residents, as well as maintaining sustainable development. In its report "Addressing China's Water Scarcity", which was released in January 2009, the World Bank urged China to reform and strengthen its water resource management framework. Liang Chao, writing for the *China Daily* reports that scarcity of water supply has affected more than two-thirds of China's over 600 cities.[20] China's water scarcity is also aggravated by extensive pollution. Every year, about 25 cu km of water becomes unfit for consumption as a result of pollution.[21] The China water crisis[22], thus, threatens stability and prosperity not only in the People's Republic of China but globally too.

Tibet: The Water Tank of Asia

The Tibet Autonomous Region (TAR)[23] is a province-level autonomous region of the PRC. It is the second-largest province of China by area (spanning over 470,000 sq mi/1,200,000 km^2) after Xinjiang. The TAR is located on the Tibetan Plateau, the highest region on earth. In Northern Tibet, elevations reach an average of over 4,572 metres (15,000 feet). As per Brahma Chellaney, the 10 major watersheds[24] formed by the Himalayas and Tibetan highlands give China access to vast natural resources.

Fig 3: Map of Tibet, Western China - South Asian Rivers



Within the boundary of Tibet, there are over 20 rivers whose flow coverage is over 10,000 sq km, and 100 rivers, whose flow coverage is over 2,000 sq km.[25] The Tibetan Plateau with 46,000 glaciers[26] at an average height of 13,000 feet above sea level is the earth's third largest ice mass. Kimberley Layton[27] says that China and India, along with eight other Asian nations and 47 per cent of the world's people, are heavily dependent on the Tibetan Plateau for water. She adds that six major Asian river basins begin in the Tibetan Plateau: the Indus (India, Pakistan); the Ganges (Nepal, India, Bangladesh); the Brahmaputra (India, Bangladesh); the Salween (China, Burma, Thailand); the Mekong (China, Laos, Thailand, Cambodia, Vietnam); and the Yangtze (China). Claude Arpi[28] writes that Tibet is without question "the most incredible water tank one can imagine."

China's Water Sharing Problems with its Neighbours

Dr RK Bolton writes that between Russia and China, rivalry over oil resources will pale in comparison to the question of water.[29] He writes, "Over the last decade, Kazakhstan and China have conducted a wide range of talks on the use of joint water resources. Beijing took every occasion to deny at the official level that China was building dams in the Irtysh River, which is shared by China, Russia, and Kazakhstan… Beijing's attitude on the issue of trans-border rivers clearly reflects China's manifest contempt for the principles of good-neighbourly relations."[30] Shahid Shah writes that the situation with Pakistan is no better.[31] China has built a dam at Senge-Ali but has not officially informed Pakistan, as there is no treaty between China and Pakistan over shared waters.

Let us now take the case of the Mekong River[32]. The Mekong River originates in Tibet, then flows through Myanmar (Burma), Laos, Thailand, Cambodia and Vietnam, before finally discharging into the South China Sea. China is engaged in an extensive programme of dam-building on the river. Nargiza Salidjanova adds that all countries on the Mekong River watershed, with the notable exceptions of China and Myanmar (Burma), belong to the Mekong River Commission (MRC). In developing the upper Mekong for navigation and hydropower projects – the Upper Mekong Navigation Improvement Project (UMNP) and the planned cascade of eight dams in Yunnan – China has acted unilaterally and without consultation with downstream nations. S Deabnath[33] writes that experts and environmentalists fear Bangladesh would turn into a desert in the near future as water flow of the Brahmaputra-Jamuna River, which is about 60 per cent of the total water flow, will fall drastically if China builds the dam on the Brahmaputra.

Options China Can Exercise For Resolving Its Water Needs and Attendant Hazards

Brief History[34]

Before narrating the history, it may be relevant to mention the Chinese psyche which has historically laid great value by the dreaming and commissioning of grand schemes under their *"Emperor"* of the time. Claude Arpi says that it is this mentality that led to the creation of the Great Wall; the Grand Canal…The Communists came into power in China in 1949. On October 1, from the rostrum of the Tiananmen Square, Mao announced his grand scheme to take the Great Leap Forward, followed by the Great Proletarian Cultural Revolution. Deng Xiaoping continued with his grand "To Become Rich is Glorious" scheme. In the

next generation, Premier Li Peng, undertook the Grand Three Gorges Dam. The current Emperor has now created the Grand South-North Water Diversion.[35]

1952: The Idea is Born:[36] The South-North Diversion plan (of which the Western is one of three diversions) was first mentioned by Mao Zedong, in 1952.[37]. Initially referred to as the Shuotian Canal, the brainchild of hydro geologist Guo Kai caught the attention of the military in 1988.

1986: Claude Arpi writes, "The gigantic project in July 1986 was envisaged to have a series of 11 dams around the 'Brahmaputra loop'… Later, it became a single mega power station with an installed capacity of 40,000 megawatts."[38]

1989: The "Preparatory Committee for the Shuotian Canal" was formed.

June 1996: The project was first reported in the Western media in *Scientific American* in June 1996.[39]

May 18-June 22, 1999: An official survey calculated that 600B m^3 per year of the Brahmaputra waters were being wasted in Tibet.

1999: Jiang Zemin announced the "*xibu da kaifa*" (Great Western Extraction) that would transfer huge volumes of water from Tibet into the Yellow River. It was now fully supported by 118 generals, and the Politburo.

2001: Approval accorded[40] by the Chinese government.

November 2003: India finally expressed concern[41] over China's plans to divert the Brahmaputra River.

November 2005: Strategy manual *Save China Through Water From Tibet* adopted by the People's Liberation Army (PLA), relevant ministries and directorates.

February 2006: Detailed planning for the "Tsangpo Project" approved by the State Council with the full support of Hu Jintao.

End June 2006: Studies concluded on the potential of the lower reaches of the Yarlung Tsangpo.

2008 Onwards: Construction on the South-North Diversion project and supporting infrastructure such as roads, railway, airfields and tunnels is purported to have commenced.

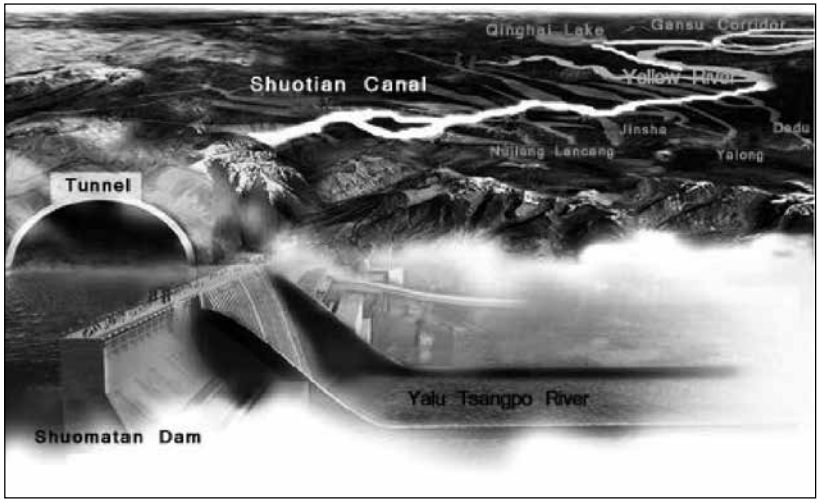
What the Western Diversion Plan Really Envisages

As per Claude Arpi, there are two[42] versions of the Great Western Diversion. Let us look at the first one. The Tsangpo project will have two components: one is the construction of the world's largest hydroelectric plant that would generate twice the electricity produced by the Three Gorges Dam. The hydroelectric plant on the Great Bend of Yarlung Tsangpo will dwarf all these projects with a planned

capacity of 40,000 megawatts (MW). The second component of the project will be the diversion of the waters of the Tsangpo which will be pumped northwards across hundreds of kilometres of mountainous regions to China's northwestern provinces of Xinjiang and Gansu. A reservoir for a 40,000 MW capacity dam would create a huge artificial lake inundating vast areas of virgin forest within the canyon and beyond. The reservoir would stretch hundreds of kilometres upstream of the Yarlung Tsangpo into the Kongpo region.

The second avatar of the project which got a lot of media coverage in the recent years is the Shuotian Canal. It is also linked with the Great Western Route. The name Shuotian comes from the contraction of the origin of the canal near Shuomatan on the Yarlung Tsangpo (near the town of Tsetang) and the city of Tianjing at the end.[43]

Fig 4: Superb Sketch Map of the Shuotian Canal Project.



Brig Vikas Joshi reinforces Claude Arpi's assessment (see Fig 4). Up to this point, the whole issue appears to be an internal matter of China[44] since it does not have any direct bearing on India. What are of concern to India are the second and third phases of the Western Route Scheme called The Great Western Route Water Transfer Project. The first phase is the creation of the Western Route. The second phase involves damming the Brahmaputra near Namche Barwa at the Great Bend and generating power. The third phase proposes diverting the water by pumping it back, using the power generated, into the Western Route of the diversion plan.

Fig 5: The South-North Water Transfer Project (SNWTP) Showing China's Western, Central and Eastern Water Diversion Projects[45]

The aim is to divert 200B m^3 (roughly 33 per cent) of the Brahmaputra's flow into China each year. That 33 per cent uses outdated 1990s' data and flawed design philosophy used in the Three Gorges Dam and, as then, ignores local and international expert advice. Despite denials from Beijing,[46] the state media continually refers to surveys and activity with oblique references to, for instance, the 141-km Bomi-Medog Highway linking the lower Brahmaputra Valley with Tibet's main East-West Highway 318. This is unusual expenditure considering Medog's population is less than 10,000 and mostly consists of Tibetans. Medog is 30 km north of the disputed border with India and has a heavy, and reportedly increasing, military presence. Roughly 20 km north of Medog is the site for the proposed storage dam, and new construction works in Medog suggest preparations for a major project or an unusual large military support base. MS Menon[47] writing in *The Tribune,* Chandigarh, confirms that the construction is indeed progressing.

Voices of Opposition[48]

In 2000, the Chinese Academy of Engineering (CAE) published its "Strategic Study on Sustainable Development of China's Water Resources in the 21st Century," The CAE report highlighted two potential areas of error in the proposed Great Western Route scheme. Firstly, the project only plans to channel water into the Yellow River, disregarding all inland rivers in north and northwest China. Secondly, northwest China has always been made up of arid or semi-arid zones, while areas south of the Yangtze River are wetlands, each containing its own adaptive ecological environment. Any change as promised by the project, would "violate the laws of nature."

"Grand as Guo's scheme sounds, it may prove to be a castle in the sky," CAE academician Wang Hao said. According to the plan, a 300-metre-high dam would have to be constructed on the Qinghai-Tibet Plateau at an elevation of over 4,000 metres, which is technically impossible. In addition, earthquakes,[49] rock falls, and mud flows, coupled with a lack of oxygen in the high, cold zones will render the work massively difficult. This analysis is reinforced by further research[50] done by Zeitler and his colleagues for the American Geophysical Union. A stunning indictment indeed, against creating a dam at the Great Bend. Wang Shucheng, current minister of water resources, has directly referred to Guo's plan as "impractical and fantastical."

The Guardian, UK,[51] was the first foreign news organisation to enter the pits and tunnels at Jiaozuo in Henan Province, which are at the centre of the South-North Water Diversion Scheme. More than twice as expensive as the Three Gorges Dam and three times longer than the railway to Tibet, the 50-year, $62 billion (£40.67 billion) project aims to channel a greater volume than the Thames along three channels – each more than 600 miles long – from the moist Yangtze basin up to the dry lands above the Yellow River. The reputed *Wall Street Journal*, in a 2008 report[52] says that China is delaying part of its plan to divert billions of tons of water to its parched north, amid concerns that the massive project could cause previously unexpected environmental damage. The four-year delay affects the central of three sections of the controversial "South-to-North" water diversion project.

China will also have to overcome fierce opposition from neighbouring countries that fear that the scheme could endanger the lives and livelihoods of millions of their people. International opposition may bar Beijing from World Bank loans for the project and prevent it from listing bonds and shares on world markets to fund the scheme. If, as its experts believe, China has to use nuclear

materials in order to blast the proposed 10-mile tunnel, the country will attract international opprobrium for breaching the Comprehensive Test Ban Treaty.[53]

Chellaney feels that the issue now is not whether China will reroute the Brahmaputra, but when.[54] Lt Col JS Kohli, writing in the *USI Journal*, says that the problem is now so clearly linked to global security that the US National Intelligence Council (NIC), the umbrella over all US intelligence agencies, has begun to monitor the situation. "The only solution seems to lie in bringing the matter to the negotiating table."[55]

Indian Views and Actual Practice in Water Harvesting/ Management

The prevailing feeling amongst most analysts examining the water conundrum that faces India is that we are being savagely wronged. That may not necessarily be the view emanating from Bangladesh, for instance. The fact closer to the truth may well be that nations are pursuing water and energy from the perspective of their national needs and not necessarily from the viewpoint of a bleeding heart. In this context, The *Business Standard*[56] of New Delhi reported that an American NGO, International Rivers, has released a significant report[57] (available as a PDF on the International Rivers website) which condemns the construction of new dams in the Himalayas. Aptly called "Mountains of Concrete," by Shripad Dharmadhikary, it says that climate change will reduce these dams to useless investments while these structures will reduce the 2,400-km arc of Himalayan ice into rubble.

The report asks for a critique of the Himalayan hydro power programmes spanning the six nations — Bhutan, Nepal, India, Pakistan, China and Afghanistan — which share the mountains. India alone, it says, is scheduled to spend over $60 billion on hydel power in the next two decades, the highest in the region. The report says that recent years have seen a renewed push for building dams in the Himalayas and massive plans are underway in Pakistan, India, Nepal and Bhutan to build several hundred dams in the region, with over 150,000 MW additional capacity proposed in the next 20 years in these four countries.

An example of the seriousness of Indian intent to harness its water optimally is available in its handling of the Siang River project.[58] It has cleared arguably the biggest and strategically very important hydroelectric project on the Siang River, a major tributary of the Brahmaputra, in Arunachal Pradesh. Slated to be completed in the next 15-20 years, the gigantic project would not only save Assam from catastrophic flooding that makes the state lose several hundred

crores of rupees every year but would also generate 10,000 to 12,000 MW of hydroelectric power, thereby becoming a key component for economic growth of the northeastern region. Arunachal Pradesh boasts of the highest potential for hydropower generation in the country. The total hydropower generation potential of the northeastern states and Bhutan is about 58,000MW. Of this, Arunachal Pradesh alone accounts for 50,328MW

Let us now look at the various dimensions of our water sharing problems with a lower riparian. Let us, therefore, examine the Ganges River dispute (India vs. Bangladesh) in broad outline.[59] The origin of the conflict dates back to 1951 when Bangladesh was part of Pakistan. India began plans for the construction of a mile-long "barrage" (a river flow obstruction) at Farakka, 18 km from the Bangladeshi border, to increase the diversion of Ganges water to the Bhagirathi-Hooghly River to flush silt and keep Calcutta Harbour operational during the dry season. It was thought that by increasing the river flow, the harbour could be kept from deteriorating from silt deposition. India began construction in 1962. In 1972, an Indo-Bangladesh Joint Rivers Commission was established to study the river flow and develop the river water on a cooperative basis. However, work on the Farakka Barrage continued, and it was finally completed in 1975. In 1996, a Ganges Water Sharing Treaty was signed that is supposed to last for thirty years.

How serious the issue is, can best be gauged from the paraphrased reactions, real or overstated, from Bangladesh[60] that follow. *The Guardian* from Dhaka says that "the ambitious Indian plans to link major rivers flowing from the Himalayas and divert them South to drought-prone areas are still on the drawing board, but the Bangladeshi government scientists have estimated that even a 10 percent to 20 percent reduction in the water flow to the country could dry out great areas for much of the year. More than 80 percent of Bangladesh's 20 million small farmers grow rice and depend on water that has flowed through India." Hafiz Ahmad, the water resources minister, says, "The idea of linking these rivers is very dangerous. It could affect the whole of Bangladesh and be disastrous. The North of Bangladesh is already drying out after the Ganges was dammed by India in 1976."

Analysis of the Problem

The author does not mind confessing that he has undergone a major learning curve during the period of reading up for, and writing, this article. His major discovery is that there has been a lot of media subjectivity and jingoism across the spectrum in looking at the water problem. The truth is sobering but not so

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alarming as to throw up visions of "water wars" as the only option for those who control water or those who expect their share of this precious resource from the upper riparian states blessed by geology and location to have water sourced from within their territorial boundaries.

The negatives that emerge from the study are many. We, in India, have abysmal intelligence and information networking, in both ground and satellite-based imagery on what China is up to, with its Tibetan water sources. If we have access to top class high resolution comparative satellite coverage courtesy the USA, Russia, or Israel, the Ministry of External Affairs (MEA) shows no signs of having benefited from the knowledge. Our own, much touted Indian Space Research Organisation (ISRO) capability did not come in handy when upstream rivers/lakes in Tibet burst their banks in June 2000 in Arunachal Pradesh, in the Spiti Valley in August that year and again in July 2005, in the same area. Till today, no authentic Indian source is on record with irrefutable hard evidence that the Tsangpo at the Great Bend is being dammed and diverted or that border infrastructure in its immediate vicinity to facilitate construction is being rapidly created. The storm that was created in the mainstream Indian media last year was about a Chinese dam on the Indus at Ngari Town (circa 1994), represented erroneously as a dam on the Tsangpo. Information is power and we will continue to wallow in self-pity, hyperbole, overstatement or obfuscation in our well patented MEA manner if we fail to address this grave shortcoming.

The next negative is the apparently serious misrepresentation of what the Tsangpo diversion will do to India. If it is true that the Tsangpo, when it enters India, is a small river that picks up 80 percent of its water after it enters Arunachal Pradesh, and accelerates from 60,000 cubic feet/second to one million feet/second, then the persistent hype about damming and diversion of the Tsangpo by the Chinese and its negative impact on India and the lower riparian, Bangladesh, needs to be viewed differently. Here, the larger issue of dams and diversions in the Himalayas, raised in this paper, by all countries that are users of Himalayan sourced waters begs to be addressed. These "Mountains of Concrete," as the

paper by Shripad Dharmadhikary points out so dramatically, need a major review. It is of course noteworthy that India is very much involved with major dam and diversion projects of its own, and especially so on the Siang and other rivers which finally feed Bangladesh. Ironically, Bangladesh is as much worried about the Indian intent to redistribute its water as both are about China's intent to divert 33 percent of the Tsangpo waters to feed its parched north.

The trademark unilateral decision-making system in China, where it feels that locational advantages in water sourcing mean that "upstream does not suffer" is part of its antiquated "Emperor" outlook that has no validity in today's world-is-a-global-village paradigm. Though reluctant to accept the reality, China cannot achieve world power status if it continues to ride roughshod on the sensitivities of the lower riparians. The fact that it has accepted hydrological data sharing (at cost) with reference to India may be taken as the first step to signing water sharing agreements — an achievement India can be justifiably proud of, with reference to both Pakistan and Bangladesh.

The trademark unilateral decision-making system in China, where it feels that locational advantages in water sourcing mean that "upstream does not suffer" is part of its antiquated "Emperor" outlook that has no validity in today's world-is-a-global-village paradigm.

This author is, of course, in no way doubting the possibility of diversion of the Tsangpo as may have been planned by the Chinese at the Great Bend. It is certainly a great negative indeed, if the Tsangpo Dam and diversion take place as intended. The issues of damages accruing on account of water shortages downstream, siltation, seismic instability, radiological spread if peaceful nuclear explosions (PNEs) are used as planned, and ecological imbalances have been brought out and do not bear reiteration. It is one issue to have a run-of-the-water project to generate power and quite another to farm out 33 percent water northwards, causing downstream desertification of an irreversible kind that Bangladesh in particular fears. The danger of flooding due to dam malfunction/tectonic stresses is a nightmare that is best avoided, given the height differential between the upper and lower riparians. Quite obviously, the issue needs transparency (for which hardcore evidence is needed), great inter-country networking and greater diplomatic skills well short of launching into diplomacy's last weapon: "water wars".

A big failing has been the near total absence of a world water database which is accurate, transparent and accepted without question worldwide, as the basis of assessing water issues for their objectivity across their entire spectrum.

Another negative is the well documented helplessness of the UN in legislating and thereafter monitoring internationally acceptable water sharing laws. Leaving the issue to the good sense of the upper riparian is tantamount to reneging on the responsibilities that accrue of this august body. A big failing has been the near total absence of a world water database which is accurate, transparent and accepted without question worldwide, as the basis of assessing water issues for their objectivity across their entire spectrum; from sourcing, discharge, degradation, siltation, to the impact that water related infrastructure has on the environment. This is one of the biggest stumbling blocks in water sharing as the players feel that the data offered by the opposing parties is 'loaded' in favour of one or the other player.

There is obviously no dearth of positives too. India leads here by example. Its honouring of the Indus Water Treaty with reference to Pakistan is quoted as an example worldwide, of how effective bilateral water management can take place notwithstanding that the countries are inimical to each other. India's acceptance of the Baglihar award by the UN appointed arbitrator is again lauded, as is its treaty with Bangladesh on Ganga water sharing. China can certainly take a cue here, and work towards similar treaties with all nine countries that receive water sourced in the Tibetan highlands.

Another positive is the clear understanding that India is really concerned only with the Tsangpo leg of China's water management schemes. What it does to its Yangtse, Yellow and Han as also those rivers descending into Southeast Asia is China's concern and does not merit India's interference or attention, beyond keeping itself informed. This is important because the media hype that surrounds our water sharing problems with China presumes that India is being specially if not solely targeted by China in this respect—far from it.

Another positive with reference to Chindia is that, at the worst of times, when the two have exchanged harsh words, water has so far not figured as an issue. All that has happened so far is that India has asked for details of the Tsangpo diversion/damming plans. That China has yet not responded is part of

its methodology of handling such issues, which is an area of improvement. K Subrahmanyam correctly opines in a recent article "Coping with China",[61] not confronting or competing with it is something that we have to learn since we have a mutual trust deficit. The writer quotes ex Naval Chief Admiral Mehta, who said in a seminar, that we should remove this deficit by proactively engaging China diplomatically, economically, culturally and in people-to-people contacts.

What, finally, seems patently clear, is that hype apart, it seems unlikely that in the special case of India and China, the issue of "water wars" is a distinct possibility. Quite to the contrary, there is a realisation at both ends that territorial and other differences in perception need to be set aside, to "enhance mutual trust and cooperation between China and India to tackle the various challenges they face".[62] On the eve of the East Asia Meeting (EAM) SM Krishna's China visit that commences on April 5, 2010, bodes well for both countries to focus on areas of convergence and leave contentious issues on the back burner.

Afterword

Dr. Hemanta R Mishra's[63] well meaning advice "*No use is the best form of land-use*" for parts of the Tibetan Plateau, though desirable, is hardly possible. What he does wisely suggest is a series of six questions targeted at better water management between users. Similarly, Willem Ferwerda,[64] director IUCN National Committee of The Netherlands, IUCN Commission Ecosystem Management, assisted by Esther Blom and Wouter Veening, suggests[65] the need to have a Regional Ecosystem Management Treaty between India and China. It is the only guarantee for a peaceful future in the region, he opines.

It is interesting to mention a problem solving approach adopted by Green Cross International (GCI), an international NGO founded in part by Mikhail Gorbachev. GCI has developed an initiative to work towards conflict prevention of international fresh water disputes. The objective of their conflict prevention strategy consists of four main components: awareness building, multi-sectoral partnerships, integrated assessment/management, and project implementation. The GCI approach is a reasonable one that appears suitable in the India-China context to serve as a framework for introducing remote sensing data into the solution of the problem. A possible solution is the organisation of a working group responsible for a centralised data bank that consists of representatives from countries, NGOs, and international organisations (IOs) such as the World Bank (due to its prior experience with the Indus River dispute) and South Asian Association for Regional Cooperation (SAARC). It is even conceivable to structure

India has taken steps towards commissioning desalination plants to meet the needs of people with no access to safe water.

the organisation within the framework of SAARC in order to make the riparians feel less pressured from outside players. It is in this context that Chellaney has suggested the building[66] of institutionalised, cooperative river-basin arrangements with downstream states.[67]

The need to look at viable alternatives for water creation and harvesting is pressing for both India and China. India has taken steps towards commissioning desalination plants to meet the needs of people with no access to safe water.[68] As one example of a plant, the recently installed Kudankulam Nuclear Power Project (KKNPP) in the Tirunelveli district in Tamil Nadu in south India has tremendous capacity: it produces desalinated water at a rate of 300,000 litres per hour. As India receives only about 100 hours of rain a year, these 100 hours must be used efficiently to catch and store water for the remaining 8,660 hours, using rain harvesting.

Another solution may lie in empowering NGOs and government organisations to network and assist in resolving the water crisis. Several good initiatives are available where success has been achieved by focussed groups/institutions. The Strategic Foresight Group (SFG) and Bangladesh Institute of Peace and Security Studies (BIPSS) recently co-organised the Second International Workshop on Himalayan Sub-regional Cooperation for Water Security in Dhaka.[69] The declaration from the meeting is available on the websites of the co-organisers, the Strategic Foresight Group and the Bangladesh Institute of Peace and Security Studies[70] and is an apt summation of what needs to be done to prevent "water wars".

The technology driven and innovative Chinese initiative by the iconic Ma Jun to survey water pollution online using an interactive digital map is something we can look at, given our pronounced failures in this direction. Ma Jun captured headlines by launching an unprecedented online[71] survey of water pollution in China. He collated and put pollution figures onto a digital map. Now users can not only use the digital map to locate where to eat and where to have fun, but also find out who is polluting Chinese rivers. The same logic, given India's famous *jugad* (innovative) approach, can be used to monitor water use in all its rivers, starting with Arunachal Pradesh.

Notes

1. B Shantanu, "Nightmare at Noon – What if I Had No Water to Drink?" December 1 2009, http://satyameva-jayate.org/2009/12/01/no-water-to-drink/
2. Claude Arpi, "The Mysterious Tibetan Lake", August 11, 2004, http://www.cifjkindia.org/carpi/carpi_020.shtml
3. http://www.idsa.in/profile/pstobdan
4. P Stobdan, IDSA Comment: "China Should Not Use Water as a Threat Multiplier", October 23, 2009, http://www.idsa.in/node/3338/7
5. Claude Arpi is a prolific writer, and has so far authored 12 books. His book *The Fate of Tibet* translated from French, is a great record of the fate of the Tibetans in Tibet under China and its relationship with India. Born in Angoulême, France, Claude Arpi decided to come and live in India, since his graduation in dental surgery from Bordeaux University. His interest in Tibet dates from the early Seventies when he first met the Dalai Lama in Dharamsala. He has spent a considerable amount of time researching the history of Tibet and China as well as the subcontinent. He is the author of *The Fate of Tibet* (Har-Anand Publications), *Tibet; le pays sacrifié* (Calmann-Lévy, Paris), *La politique française de Nehru: 1947-1954* (Pavilions Publications) and several articles on Tibet, China, India and Indo-French relations. Visit his website at http://www.cifjkindia.org/carpi/carpi_000.shtml
6. Brig Vikas Joshi, "China's Water Crisis, its Management and Implications for India", published in an Indian Army Service magazine. Received as forwarded email attachment. Further details of publication not known.
7. http://bameduniya.blogspot.com/ Romesh Bhattacharji describes himself as a 66- year-old retired, Delhi-based, narcotics and customs bureaucrat of the Indian Revenue Service. *Bameduniya,* he writes, means The Roof of the World. "In my blog I write about regions and matters dealing with people living from the south of the Shivaliks and Doars to north of the Pamir Knot i.e. *Bameduniya*- the Roof of the World. I have been a bureaucrat all my working life, but have always had time to breathe clean and fresh mountain air…and spend time taking pictures and writing travel and narcotics articles".
8. See comments on the P Stobdan article: "China Should Not Use Water as a Threat Multiplier", October 23, 2009, http://www.idsa.in/node/3338/7
9. This writer was pleasantly surprised to find that Romesh Bhattacharji is right in his assertion about the Pare Chu River. The Parang La (pass) at 5,600 metres forms the source of the Para Chu River, an amazing river system which rises to the north of the Parang La, in the Changthang region of Ladakh, travelling 30 km eastwards and turning sharply south to enter Tibet. After flowing 85 km through the Tibetan Plateau,

it changes its course westerly to reenter India near its confluence with the Spiti River at Sumdoh on the Hindustan-Tibet road, 33 km before reaching Tabo. The Parang La is the traditional trade route between the people of Spiti, Changthang and Tibet. The Pare Chu is the only river to have its source in India, flow into Tibet and enter the country again in Spiti. http://www.indiaprofile.com/adventure/changthang-treks.html http://www.infohub.com/vacation_packages/18436.html

10. Ibid.
11. Ibid.
12. http://tibetanplateau.blogspot.com/2009/03/pakistan-shocked-at-chinese-dam-on.html The picture clarity from Google is startling.
13. n. 8.
14. Ibid.
15. Bharat Verma, "Unmasking China: China will Launch an Attack on India before 2012," *Indian Defence Review* (New Delhi), Vol 24.3, July-September 2009, http://www.indiandefencereview.com/2009/08/unmasking-china.html
16. Rohini Nilekani, "Is Water the Next Oil?", *Yale Global Online Magazine*, May 31, 2007, http://www.globalpolicy.org/component/content/article/198/40381.html
17. "Tibet and China: Climate Crisis at the Earth's Third Pole." With Appreciation for the Indispensable Work of Lester Brown, http://www.ecobuddhism.org/buddhist-climate-project.php?id=4#top
18. Liu, Nancy Yang Liu and Lawrence R. Sullivan, *China's Water Crisis: Ma Jun*. Translation into English by the authors (International Rivers Network Book), http://www.eastbridgebooks.org/ChinasWaterCrisisMoreInfo.html

    Ma Jun**,** a leading Chinese investigative journalist, worked at the *South China Morning Post* from 1993 to 2000 where he produced his own reports and wrote many feature articles on the Chinese environment, eventually becoming chief representative of SCMP.com in Beijing. He is currently an environmental consultant with Sinoshere Corporation. *Zhongguo Shui Weiji* was published by the China Environmental Sciences Publishing House in late 1999. Nancy Yang Liu is a professional translator. Lawrence R. Sullivan is associate professor of Political Science, Adelphi University, USA. The book by Ma Jun has received rave reviews. A sampling is reproduced below:

    Reviews:

    "Some northern cities will simply be out of water in eight or ten years, Ma Jun, author of *China's Water Crisis*, the one great environmental book China has yet produced, told me over lunch in Beijing one day." – *Harper's Magazine December 2005*

    "Ma Jun's 1999 book *China's Water Crisis* may be for China what Rachel Carson's *Silent*

Spring was for the US – the country's first great environmental call to arms."

"A journalist turned environmental advocate, Ma has emerged as a powerful voice in China, raising the alarm about the potentially catastrophic consequences of heedless, unsustainable growth."

"One might wonder how an individual takes on the policies of China's tightly controlled one-party state apparatus without great personal risk, but Ma, 38, is surprisingly optimistic."

"'There is now more awareness of environmental rights and the rights of people as citizens,' he told the *New York Times* last year. 'For such a major problem, they believe they have the right to know about it and at least have their views heard. For the first time, there is some legal basis for public participation ... a major step forward.'"

"It won't happen without people of courage and vision. People like Ma Jun." -- *Time Magazine,* April 30, 2006 (Ed Norton writing Ma Jun's biographical note on his recognition by *Time* Magazine as one of the 100 most influential people in the world)

"[Ma's] fine empirical research on rivers, lakes, and mountains in the different regions presents a bleak panorama of the diminishing and deteriorating water pool of the country as a whole."

"Finally, though brief, his review of Chinese history — from the time of the old dynasties to Mao — to show the gradual onset of water problems is appreciated." – *Pacific Affairs*, Vol. 78.1, Spring 2005 (Jih-Un Kim, Webster University). For more details, please see http://en.wikipedia.org/wiki/China_water_crisis

19. Li Jing, "Water Shortage Threatens China", *China Daily*. Updated 2009-02-09. http://www.chinadaily.com.cn/bw/2009-02/09/content_7455321.htm
20. Liang Chao, "China Vows Efficient Water Usage", *China Daily*. Updated: 2009-02-15. http://www.chinadaily.com.cn/china/2009- 2/15/content_7477926.htm
21. Li, n. 19.
22. "China Water Crisis", http://en.wikipedia.org/wiki/China_water_crisis
23. "Tibet Autonomous Region", http://en.wikipedia.org/wiki/Tibet_Autonomous_Region Area http://en.wikipedia.org/wiki/Tibet
24. Brahma Chellaney, "China-India Clash over Chinese Claims to Tibetan Water," http://old.japanfocus.org/_Brahma_Chellaney- Brahma Chellaney, a professor of strategic studies at the privately funded Centre for Policy Research in New Delhi, is the author, most recently, of *Asian Juggernaut: The Rise of China, India and Japan*.
25. "Tibet Geography", December 12, 2008. Source: China Tibet Tourism Bureau, http://chinatibet.people.com.cn/96062/96107/6552538.html
26. n. 17.

27. Kimberley Layton, "Tibetan Waters: Coming Conflict? Former Intern, IPCS #2923, July 29, 2009, http://ipcs.org/article/india/tibetan-waters-coming-conflict-2923.html
28. Claude Arpi, "Born In Sin: The Panchsheel Agreement. The Sacrifice of Tibet," (Mittal Publications, August 2004,) http://www.phayul.com/news/article.aspx?id=7198&t=1&c=1
29. Dr RK Bolton, "Russia & China: The Approaching Conflict," http://ausfirst.alphalink.com.au/russiachina.html
30. Ibid.
31. Shahid Shah, "China Builds Dam on Indus in Tibet, Keeps Pakistan Uninformed," July 08, 2009, http://www.thenews.com.pk/daily_detail.asp?id=167900
32. Nargiza Salidjanova, "Chinese Damming of Mekong and Negative Repercussions for Tonle Sap", ICE Case Studies, No 218, May 9, 2007, http://www1.american.edu/ted/ice/mekong-china.htm
33. Suranjith Deabnath, "China Plans To Divert Brahmaputra Waters: Environmentalists Fear Huge Eco Disaster In Bangladesh," http://www.thedailystar.net/2007/05/08/d7050801128.htm
34. Arthur Thomas, "Diverting the Brahmaputra — Start of the Water Wars?" May 2, 2008. http://www.onlineopinion.com.au/view.asp?article=7310&page=0
35. "Water War in South Asia? Brahmaputra: Dam & Diversion," October 2003, http://www.claudearpi.net/maintenance/uploaded_pics/TheBrahmaputraDamDiversion.pdf
36. Shai Oster, "China Slows Water Project: South-to-North Plan Faces 4-Year Delay on Impact Concerns," *The Wall Street Journal*, December 31, 2008. Ellen Zhu in Shanghai and Gao Sen and Kersten Zhang in Beijing contributed to this article. This report suggests that Mao came up with the idea in 1952. The report filed by Jonathan Watts suggests that the date was 1962, http://www.internationalrivers.org/en/node/3705
37. Jonathan Watts, "China at the Crossroads Series - Thirst of the Cities Drives the Giant Drills to Water China's Parched North: Fifty-Year Project to Stem Depletion of the Yellow River Dubbed a Mega-Project too far by Critics," May 18, 2009. Report filed by the correspondent from Jiaozuo, north China. The video showing details of the construction site reveals that construction is seriously under way, http://www.guardian.co.uk/world/2009/may/18/china-water-crisis/print#history-link-box
38. n. 35.
39. "Peaceful Nuclear Explosions," *Scientific American Magazine*, June 1996, http://www.sciamdigital.com/index.cfm?fa=Products.ViewIssuePreview&ARTICLEID_CHAR=2D0B01AD-FC0F-45C4-B084-0A8DC1C060E
40. Oster, n. 36.

41. Tashi Tsering, "Let the Brahmaputra Flow," TRIN-GYI-PHO-NYA: *Tibet's Environment & Development Digest*, Issue 4, No 0104, January 12, 2004, TEW Editorial. http://www.tew.org/editorial-oped/trin-gyi-pho-nya/0104.html http://www.tew.org/editorial-oped/trin-gyi-pho-nya/1205.html
42. Claude Arpi, "Himalayan Rivers: Geopolitics and Strategic Perspectives," Issue: Vol 23.2, June 23, 2008, http://www.indiandefencereview.com/2008/06/himalayan-rivers-geopolitics-and-strategic-perspectives.html
43. Ibid.
44. Joshi, n. 6.
45. Ibid. Also see Ryan Hodum, "Conflict Over the Brahmaputra River Between China and India," ICE Case Studies No 205, May 2007, http://www1.american.edu/ted/ice/brahmaputra.htm
46. "Ex Water Chief: China Won't Divert World's Highest River to Thirsty North," May 26, 2009, http://chinatibet.people.com.cn/6665428.html
47. MS Menon, "China Aggressive on Tibetan Rivers". The writer is a former member-secretary, Indian National Committee on Irrigation and Drainage (INCID). http://www.tribuneindia.com/2007/20071226/edit.htm#8
48. "Controversial Plan to Tap Tibetan Waters," (*Southern Weekend)*, translated by Shao Da for China.org.cn, August 8, 2006), http://mdjnkj.china.com.cn/english/MATERIAL/177295.htm
49. Peter Zeitler[1], Anne Meltzer[1], Brian Zurek[1], Lucy Brown[1], Noah Finnegan[2], Bernard Hallet[3], Page Chamberlain[4], William Kidd[5] and Peter Koons[6].
    1. Dept. of Earth and Environmental Sciences, Lehigh University, Bethlehem, PA 18015, USA.
    2. Dept. of Earth and Atmospheric Sciences, Cornell University, Ithaca, NY 14853, USA.
    3. Dept. of Earth and Space Sciences, University of Washington, Seattle, WA 98195, USA.
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    5. Dept. of Earth and Atmospheric Sciences, University at Albany, Albany, NY 12222, USA.
    6. Dept. of Earth Sciences, University of Maine, Orono, ME 04669, USA.

    "Surface-Tectonic Coupling at the Namche Barwa – Gyala Peri Massif and Geologic Hazards Associated with a Proposed Dam onthe Yarlung-Tsangpo River in SE Tibet", http://www.nepjol.info/nepal/index.php/HJS/article/view/1348/1328

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The Yarlung-Tsangpo River leaves the SE Tibetan Plateau through a deep canyon that it slices across the Himalaya as it drops ~2000 m along an irregular hairpin reach ~100 km in length. We have been examining the geodynamic evolution of this region and have gathered considerable geophysical and geological data on this steep reach of the river and the surrounding Namche Barwa- Gyala Peri massif. In this region, petrological, geo-chronological, thermo-chronological, and cosmogenic-isotope data show that very rapid bedrock exhumation at rates of 7 mm/yr or more has exposed granites as young as 1 Ma, and this rapid exhumation has been underway for at least the past 3 m.y. Detrital-dating evidence shows that these high rates continue at present and that erosion within the massif contributes fully 50% of the modern suspended-sediment load in the Yarlung-Tsangpo at the point where it enters the Assam floodplain (roughly 100 Mt/yr of sediment are derived from the massif). The steep slopes in the massif fail by pervasive land sliding and suggest steady state topography where the high erosion rates are balanced by equivalent rates of rock uplift accommodated by numerous active structures. At a broader scale, GPS results show that steep three-dimensional velocity gradients exist across the region: in the easternmost Himalaya near Namche Barwa >50% of the Indian – Eurasian plate convergence is accommodated within a zone of high strain rates. The 1950 Assam earthquake (M8.6) was one expression of the high local strain rates, and caused considerable damage within the canyon area. Seismic results from our portable deployment show that the area beneath the massif and the Yarlung-Tsangpo canyon is exceptionally active, with over 1000 events ranging in magnitude from 1.0 to 5.6 (mb) taking place over a 15-month period. The events occur almost entirely in the mid to shallow crust and show a range of first motions.

Dynamical modeling and context provided by diverse regional data suggests that the metamorphic massif and steep reach of the Yarlung-Tsangpo at Namche Barwa have persisted for at least 3 m.y. Divergent low-temperature cooling histories within and upstream of the massif suggest that development of a coupled system and pinned knick point may have started at roughly 5 Ma.

For a decade, anecdotes and media reports have been circulating about a proposed dam in SE Tibet, on the Yarlung- Tsangpo knick zone. The fundamental purpose of the dam is generation of ~40,000 MW of hydropower to be used in diverting a portion of the impounded river to water-starved regions of northern China. It has been argued that any benefits that would accrue from improving water supply in the north would be offset by water-flow and sediment-flux impacts that would be felt downstream

in the Brahmaputra system in northeastern India and Bangladesh, as well as by the impacts that a dam and large lake would have on the pristine, ecologically and ethnographically diverse area around the Yarlung-Tsangpo canyon, an area of great significance to Tibetan Buddhists.

50. P K Zeitler, A S Meltzer, B Hallet, W S Kidd, P O Koons, "The Smithsonian/NASA Astrophysics Data System: Geologic Hazards Associated With a Proposed Dam on the Yarlung-Tsangpo River in SE Tibet," American Geophysical Union, Fall Meeting 2007, Abstract #H11C-0644, http://adsabs.harvard.edu/abs/2007, AGUFM.H11C0644Z
The proposed site is in the deep canyon of the Yarlung-Tsangpo where the river leaves the Tibetan Plateau across an immense *knick point* (sudden change in the river gradient), falling ~2,000 m along an irregular U-shaped reach ~100 km in length. The fundamental purpose of the dam is generation of ~40,000 MW of hydropower, to be used in diverting a portion of the impounded river to water-starved regions of northern China. Offsetting benefits that would accrue from improved water supply in the north, **debate has centered on the water-flow and sediment-flux impacts that would be felt downstream in the Brahmaputra system in northeastern India and Bangladesh, as well as the impact of a dam and large lake on the pristine, ecologically and ethnographically diverse area around the Yarlung-Tsangpo canyon, an area of great significance to Tibetan Buddhists.** We have been examining the geodynamic evolution of eastern Tibet, and have gathered considerable geophysical and geological data on the knick point region. The knick point traverses the Namche Barwa-Gyala Peri massif, one of the most geologically active regions on Earth…The 1950 Assam earthquake (M8.6) was one expression of the high local strain rates, and caused considerable damage within the canyon area. Seismic results from our portable deployment show that the area beneath the massif and the Yarlung-Tsangpo canyon is exceptionally active...**Any dam placed within the Yarlung-Tsangpo canyon would be at high risk, with the dam being prone to failure due to pronounced seismic hazards and focused deformation.** As it fills, water pressure behind the dam could help trigger shallow earthquakes and landslides, and the dam would be difficult to maintain given the high frequency of land sliding and extreme local bedrock exhumation rates that would lead to rapid siltation at the dam site. Further, this impoundment of the Yarlung-Tsangpo would greatly starve the sediment flux downstream in the Brahmaputra and ultimately Bay of Bengal systems.

51. Jonathan Watts, "China at the Crossroads Series - Thirst of the Cities Drives the Giant Drills to Water China's Parched North: Fifty-Year Project to Stem Depletion of the Yellow River Dubbed a Mega-Project too far by Critics," May 18, 2009. Report filed by the correspondent from Jiaozuo, North China. The video showing details of the construction site reveals that construction is seriously under way. http://www.

guardian.co.uk/world/2009/may/18/china-water-crisis/print#history-link-box

52. Oster, n. 36.
53. "Peaceful Nuclear Explosions," *Scientific American Magazine*, June 1996, http://www.sciamdigital.com/index.cfm?fa=Products.ViewIssuePreview&ARTICLEID_CHAR=2D0B01AD-FC0F-45C4-B084-0A8DC1C060E
    The magazine goes on to add (as quoted by Claude Arpi in his article listed in n. 92 below) that *The Scientific American* (June 1996) said that the US PNE programme was discontinued in 1973:
    "The largest excavation experiment took place in 1962 at the Department of Energy's Nevada Test Site. **The so-called Sedan test displaced 12 million tons of earth, creating the largest man-made crater in the world; it also generated a 'vast amount of fallout' that drifted beyond Nevada and over Utah, according to Derek S Scammell, a spokesperson for the Nevada Test Site. Explosions in oil and gas fields did indeed stimulate production, but in some cases they also made the fuel so radioactive that it could not be used.** The Plowshare program was discontinued in 1973 after the U.S. decided that the cons of PNEs--including criticism from the growing environmental movement--far outweighed the benefits." For full article, see: http://www.hindunet.org/saraswati/brahmaputra/scientificamerican.htm
54. Brahma Chellaney, "The Sino-Indian Divide Over Water," China's Hydra-Headed Hydropolitics, http://chellaney.spaces.live.com/blog/cns!4913C7C8A2EA4A30!1060.trak
55. Lt Col JS Kohli, "Brahmaputra: Dam and Diversion". *Journal of the United Service Institution of India*, Vol. CXXXVIII, No. 571, January-March 2008, http://www.usiofindia.org/article_Jan_Mar08%20_6.htm Lt Col J S Kohli, 20 JAT, is a serving army officer. He has served in Assam, Nagaland and Arunachal Pradesh. He is currently posted as GSO1 (China), REDFOR Branch, HQ ARTRAC.
56. Sreelatha Menon, "Mountains of Concrete," New Delhi, May 10, 2009, http://www.business-standard.com/india/news/sreelatha-menon-mountainsconcrete/357592/
    "Mountains of Concrete" is an insightful report that is worth reading at first hand. See: http://www.internationalrivers.org/en/node/4342
57. "Major Report Condemns New Dams in the Himalayas," May 21, 2009. The report appeared in the website peacefulsocieties.org. http://peacefulsocieties.org/NAR09/090521lepc.html Also see: http://www.internationalrivers.org/en/node/4342
58. Manan Kumar, "India Pre-Empts Chinese Design In Arunachal", April 1, 2009, http://www.expressbuzz.com/edition/story.aspx?Title=India+pre-empts+Chinese+design+in+Arunachal&artid=3CoV5eK0GKk=&SectionID=b7ziAYMenjw=&MainSectionID=b7ziAYMenjw=&SEO=DPR,+Siang+river&SectionName=pWehHe7IsSU=

59. Robie I Samanta Roy, "India-Bangladesh Water Dispute," ICE Case Study No. 78, May 9, 2007, http://www1.american.edu/ted/ice/indobang.htm
60. "Indian River Linking Project: India's River Diversion Plan: Its impact on Bangladesh," Reactions from Bangladesh on Indian Water Diversion, http://search.com.bd/articles/bangladesh-india-water-problem.html
61. K. Subrahmanyam, "Coping with China," *Dainik Jagran*, August 16, 2009 (English version).
62. Ashok Tuteja, "60 Years of Bilateral Ties: Delhi, Beijing to Move Closer," *The Tribune*, (Chandigarh) April 2, 2010, p. 24.
63. HCSS "Water on the Tibetan Plateau: Ecological and Strategic Implications," http://74.125.153.132/search?q=cache:A-eHKNH6600J:www.hcss.nl/en/download/1096/file/HCSS%2520Water%2520Forum%2520-%2520Outlines%2520Presentations.pdf+%22Tibet%27s+Waters+Will+Save+China%22&cd=5&hl=en&ct=clnk
Hemanta R Mishra, President, Board of Directors, The Bridge Fund. "The Global Significance of the Tibetan Plateau : Strategic Options to Address Environmental, Social, and Economic Security, in the Region."
64. "HCSS Water on the Tibetan Plateau: Ecological and Strategic Implications -
The importance of Ecosystem Management on the Tibetan Plateau for Regional Security," http://74.125.153.132/search?q=cache:A-eHKNH6600J:www.hcss.nl/en/download/1096/file/HCSS%2520Water%2520Forum%2520-%2520Outlines%2520Presentations.pdf+%22Tibet%27s+Waters+Will+Save+China%22&cd=5&hl=en&ct=clnk
65. Ibid.
66. Brahma Chellaney, "China-India Clash over Chinese Claims to Tibetan Water," http://old.japanfocus.org/_Brahma_Chellaney-
67. Brahma Chellaney, "The Sino-Indian Divide Over Water", China's Hydra-Headed Hydropolitics, http://chellaney.spaces.live.com/blog/cns!4913C7C8A2EA4A30!1060.trak
68. Rohit P Singh, "Latent Solutions to Water Scarcity in India," August 30, 2009, http://www.sramanamitra.com/2009/08/30/latent-solutions-to-water-scarcity-in-india/
69. "ASI Research Update: Preventing International Conflict Over Water," Conferences and Events, South Asia, Water Security. January 25, 2010, http://asiasecurity.macfound.org/news/entry/111asi_research_update_preventing_international_conflict_over_water/
70. "Dhaka Declaration on Water Security," http://www.strategicforesight.com/Dhaka%20Declaration.pdf

A summary of the declaration is reproduced below:

Strategic Foresight Group (SFG) and Bangladesh Institute of Peace and Security Studies (BIPSS) organised the Second International Workshop on Himalayan Sub-regional Cooperation for Water Security in Dhaka on 15-16 January 2010. This is part of a long-term process to build confidence and cooperation between countries that make up the Himalayan River Basin. This process is supported by the John D and Catherine T Macarthur Foundation, USA. Twenty-five distinguished water experts from India, Bangladesh, China and Nepal, including former ministers of water resources of India, Bangladesh and Nepal, participated in the workshop.

The following statement was made by the Conference:

1. Recognised the critical significance for water security of the Himalayan River Basin.
2. Recommended the formation of an experts committee to prepare a roadmap for data sharing and scientific exchange and to prepare guidelines for introducing transparency regarding relevant data.
3. Acknowledged the importance of a collaborative approach in addressing technical, scientific and other multi-disciplinary aspects of the complex issues involved.
4. Suggested the establishment of joint research projects involving all the countries represented to acquire, collect, generate and process appropriate up-to-date data for taking the process forward.
5. Recommended joint efforts for the exchange of data and information on flow of Himalayan Rivers in low season.
6. Recognised the need for political commitment of the Basin countries to driving forward collective approaches to the challenges.
7. Acknowledged the serious consequences of climate change for water security across the Basin countries and encouraged concerted collective action in addressing these.
8. Underscored the need to defend equal interests of all Basin countries especially the lower riparian ones.
9. Understood the potential for conflict over resources, if the problems are not resolved in a cooperative manner.
10. Recommended strongly integrated cooperative Basin management mechanism for the Himalayan Basin Area.

71. Naomi Li, "Tackling China's Water Crisis Online," http://www.chinadialogue.net/article/show/single/en/392-Tackling-China-s-water-crisis-online Naomi Li