placed in Appendix II by CITES (Convention on International Trade in Endangered Species).

Dhole has been well studied and conservation issues have been identified in central and southern India but no information is available from the eastern region. Recent genetic studies show two haplotypes coming closely in northeastern India[1] but no data is available regarding the extinct subspecies of this region. In this region, studies on the dhole are few due to the remoteness, cerebral malaria, frequent landslides and unfriendly nature of people[3].

In eastern part of India, dholes are rather rare[4], with the exception of the Garo hills area of Meghalaya (Assam) where they are common. Arunachal Pradesh has rich faunal and floral diversity and has been recognized as one of the 34 biodiversity hotspots[5] as well as a global ecoregion. Around 26 indigenous communities are involved in active hunting of wildlife for food, medicinal and cultural purposes[3]. The wild dogs are already extinct in eastern parts of Arunachal Pradesh whereas they are on the verge of extinction in other parts of Arunachal. Dholes are frequently sighted[6] in Itanagar Wildlife Sanctuary and Namdapha[7]. In 2006, the Wildlife Institute of India camera trapping group confirmed dhole population in Pakkae Tiger reserve in western Arunachal Pradesh and lower Subansiri and Tawang. Due to the livestock deprivation, local people kill the dholes[6] by trapping and poisoning. Conservation is a major concern due to the heavy dependency on forests by local people especially by shifting cultivation and hunting. Hence there is an urgent need to study, conserve and protect this species in the eastern Himalayan range.

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# Recharging the floodplain

Vikram Soni *et al.*[1] explain a scheme for large-scale natural water storage in the Yamuna floodplains near Delhi.

If the water is made to percolate in the aquifer by construction of several barrages and tens of kilometres of bunds, then it cannot be called a 'natural' water storage scheme. That apart, the idea as presented seems workable only because the authors have ignored the following.

- They have completely overlooked/ignored the 1994 MoU for sharing of the waters of Upper Yamuna, i.e. Yamuna from its origin up to Okhla. The Mean Annual Flow (MAF) up to Okhla has been estimated as 13 bcm and keeping aside 0.32 bcm for environmental flows and 0.68 bcm as inevitable flood flows, the remaining 12 bcm has been allocated amongst the six party states, viz. Uttarakhand, Himachal Pradesh, Uttar Pradesh, Haryana, Rajasthan and Delhi.
- Thus, irrespective of what the actual flood flow at Okhla presently is, the unallocated flood flow at Okhla is only 0.68 bcm. (Even this would be claimed by the environment, as a necessary annual flushing pulse.) An allocation based on MAF can be actually used only by storing the entire monsoon flow. At present there are no storages in the upstream catchment, and therefore some states are unable to utilize fully their allocated share. Three storages are planned upstream of Delhi, Renuka, Lakhwar-Vyasi and Kishau. When these are constructed, the upstream states will be able to store and use more water, as per their allocated share.
- The progress on construction of these storages; the usual arguments for and against the storages; their costs vis-à-vis cost of presently suggested scheme; all these issues are irrelevant in the present context, as none of them can alter the water sharing MoU.
- Soni *et al.* propose to 'create several barrages with embankments from the entry point of the Yamuna river into Delhi, at Palla, through Wazirabad till Okhla'. Essentially, they propose to create a reservoir about 50 km long and 4.5 km wide (2 km on either bank + width of the river). The impact of such a reservoir on local drainage; its environmental impacts – like malaria; displacement of people living within 2 km from river bank; none of this has been evaluated.
- A crucial issue is – unless matched by 100% interception and tertiary level treatment of the sewage produced by Delhi, Gurgaon, Yamuna Nagar, Kurukshetra, Panipat, Sonipat, etc., this reservoir will become a 200 sq. km cesspool of dirty water that will pollute the aquifer forever.
- Another reason the scheme seems workable is, because although Soni *et al.* have estimated the benefits, they have not estimated the cost of 'several of such barrages', bunds, resettlement and rehabilitation, cost and source of energy to pump out this water, etc. With no costs and only benefits, any thing looks attractive.
- Finally, the valuation of the stored water at Rs 6000–9000 crore using the tanker rate per $m^3$, and thereby concluding that their scheme will save Rs 6000–9000 crore, is absurd. People often confuse between cost of water and cost of its supply. In tanker supply, the main cost is for the capital cost and operational cost of the tanker, the cost of water itself is negligible. (Even nil, if the tanker draws supply from a private tubewell.) Source of water and mode of its supply are two

entirely different things. If the water stored in the flood plain is supplied through tankers, then the same Rs 6000–9000 crore will have to be spent then also with no saving. And if it is to be supplied through piped system, then the same piped system can be used to replace the tankers even now, using the same water that is supplied in tankers now.

• However, if this be the acceptable manner for computing 'saving', then it would be better to use the market rate for bottled water which at Rs 12 per litre costs 100 times more than tanker water. Then the same scheme can 'save' Rs 600,000 to 900,000 crores!!

1. Vikram Soni, Gosain, A. K., Datta, P. S. and Diwan Singh, *Curr. Sci.*, 2009, **96**, 1338–1342.

The views expressed here are the author's personal views, and not to be taken as the views of his employer.

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## *Response:*

• The CGWB data recorded in their hydrographs shows that in 2008 when there was partial flooding in the Palla area the floodplain groundwater level came up by 3 m over the average recorded in the previous years.

Given these facts, the scheme of floodplain or basin recharge by the best means (e.g. inundation between barrages or by running overflow channels) to spread the monsoon discharge to cover the floodplain and flow back to the river, would result in substantial augmentation of groundwater recharge and extractable water. The scheme has been completely misunderstood. No reservoir is to be created. Once the floodplain aquifer is so recharged it will look exactly as it does now with no surface water on it.

Barrages are just one suggestion for basin recharge from monsoon discharge, and just one barrage may be adequate. The Delhi Jal Board has already formulated a scheme for a barrage about 3 km downstream of Palla. The backflow of this barrage will reach till 20 km upstream. This will help recharge a large area of the floodplain. Flood channels can be run out of the barrage and made to run along the inner pushta embankment to cover recharge for the remaining floodplain downstream. We need to find the most benign solution.

The CGWB data shows that even without surface recharge, the continuous and extended aquifer of the floodplain and river is recharging the dewatered aquifer effectively. Further dewatering will not cause much decrease in the groundwater level. This will allay any ecological concerns and is promising for increasing the yield in our scheme.

• The paper is not addressed to policy matters of interstate agreements on sharing of flows. The recharge needed for the Yamuna floodplain is not more than 0.3 bcm and can easily be accommodated in Delhi's share.

Interstate agreements, obviously, cannot arrest the whole monsoon flow – it would be ecologically disastrous. They need to be revised.

Delhi is getting water from far away and at great expense from Tehri Dam and the Sutlej–Beas system. Clearly the local solution of using the floodplain as a plausible natural storage that can store excess monsoon water for 6 million people without any ecological damage seems far more sensible. It can be seen as an alternative to both dams and river linking which also stores monsoon water but at huge ecological damage.

• Yes, we have noted that the scheme will work only if treated discharge goes into the river. Water treatment of sewage discharge is essential, regardless, unless we want to kill all our rivers and other water sources. Again, this is not the main issue in the paper.

• The cost of good water can easily be assessed as recycling cost. We have got quotations from private companies, which give an average cost of secondary recycling as ~Rs 100/kilolitre. This is all recorded in the paper.

If a 10,000 litre private tanker of good water costs Rs 1200 today, then the costs of supply – depreciation, extraction and transport will cost about Rs 300, leaving Rs 900 as the cost of 10 kilolitres of water.

The comment that we have not given costs for the scheme is correct. But a little consideration will show the costs of one barrage or channels and a tubewell grid are one time costs and small compared to even the annual benefits of Rs 6000 crores of water every year.

It is rather imaginative of Pandit to suggest, 'However, if this be the acceptable manner for computing "saving", then it would be better to use the market rate for bottled water which at Rs 12 per litre costs 100 times more than tanker water. Then the same scheme can "save" Rs. 600,000 to 900,000 crores!!'

• There are already many tubewells and Ranney wells in place and many water headworks, like Sonia Vihar, Chandrawal, etc. along the floodplains. The water we get from the floodplain will be piped to these stations and automatically supplied from these.

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