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Water For Food, Water For Life

by

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Water For Food, Water For Life*

Since this lecture is part of a series dedicated to water, I will try to give a complete flavour of this natural resource.

Water has also been called *amrit* in Indian mythology and is seen in many cultures as the nectar, or elixir of life. Earlier, when there were few large cities or industries, people were poor and their requirements were modest. Yet while the demand for water has risen in the recent past, it is important to bear in mind that since the time the earth was created, the total amount of water has remained almost the same except during the last few years when climate change has brought about certain variations, but little perceptible change, in the total amount of water available for human and ecological use.

We all know that sufficient water is not available for producing enough and quality food for all of humankind

We all know that sufficient water is not available for producing enough and quality food for all of humankind. Presently, there are about 6.5 billion people on the planet and we grew by almost twice during the last fifty years. The present world population is expected to further double in the next fifty years. The big question, therefore, is whether there shall be sufficient water to grow enough food for all of us in the future.

To answer this important question, the International Water Management Institute (IWMI), along with a consortium of about 700 top researchers in the world in

* Lecture delivered at the IIC on June 11 by Dr. Bharat Sharma as part of the series WATER: THE STUFF OF LIFE.

different fields, implemented a mega programme called 'Comprehensive Assessment of Water Management in Agriculture'. After taking in results and recommendations from different aspects of this global study, it is concluded that it is no longer possible to continue business as usual. However, on the optimistic side, the findings show that the world will be able to grow sufficient food only if we are able to make certain important changes in the way we manage our water resources.

Generally, our approach to water has been sectoral. This means that the city dweller thinks only of the water needed in his flat, his bathroom or kitchen; while a farmer thinks only about how much water he needs for irrigating his fields. Yet many others, who do not yet have a voice in society, need water as well. Presently, only a few NGOs or civil society organizations talk about these communities and people but the important fact to remember is that they also have a right to water. Over time, some become more vocal, some are even willing to wage wars, and there can be clashes or conflicts over water. In addition, there are other silent users of water – such as forests, birds, animals and fish, and their eco-culture. Their concerns are equally, and sometimes more, important for welfare of the humanity.

To calculate how much water we consume, it is estimated that, generally, for every calorie of food we consume, we also consume one litre of water. So if we take the world average to be calculated on the basis of how much water we consume daily with the food we eat, the average is around 2800 litres/ capita. In developed countries, as for example Europe and North America, people consume around 3400 litres of water/ capita. On the other hand, there are some countries, such as in sub-Saharan Africa or even south Asia, including India, where people consume only around 2200 calories/day/person. Naturally, once these areas also develop and start to demand their proper share of food and water, the world may face a grave shortage of water.

To calculate how much water we consume, it is estimated that, generally, for every calorie of food we consume, we also consume one litre of water

In the decade or fifteen years after 1975, huge investments were made by the World Bank and the national governments in irrigation schemes, but gradually the overall spending in this sector declined. It is only from 2005, if we take recent figures, that there has again been a renewed interest in this sector. However, the irrigated area has been growing throughout the period, mainly due to the contribution

of groundwater and rain-fed irrigation. During the 1950s and 60s, food prices were very high but with the advent of the Green Revolution, the actual global food prices declined substantially. This was one of the most significant contributions of the Green Revolution and it is only recently with rising food prices, that people have begun to see a spurt, especially in countries like India where food inflation is around 17-18 per cent. One major reason for the rise in food prices is that enough water and land is not being made available for production of the kind of food (vegetables, fruits, milk, eggs and poultry, livestock, processed food) required for changing lifestyle and diet patterns.

Another important fact to remember is that, presently, about 850 million people in the world are under-nourished because they do not have sufficient access to water

Moreover, since we have been using most of this water by either closing river basins or by not providing eco-system services, the living planet index, an indicator of the wellness and health of our planet earth, has been decreasing. This is a direct consequence of unplanned or unmanaged irrigation and over-utilization of water resources for purposes of pure consumption.

Another important fact to remember is that, presently, about 850 million people in the world are under-nourished because they do not have sufficient access to water and land and are deprived of proper food. If we take into account subsistence farmers and the rural landless, about 70 per cent of the poor people in the world (roughly one billion) are either under-nourished or have no access to water. Such people are able to manage just one meal a day, sometimes not even that. Pastoral folk, fishing communities and forest dwellers are most vulnerable to loss of water due to development and commercial activities. When water gets diverted to canals and dams and when ground water levels decline, their very survival is threatened. This leads to all kinds of social unrest, unemployment, loss of wages and, ultimately, even violence. Such a state of affairs cannot continue for very long because we all know the consequences of prolonged neglect. Moreover, when these marginalized communities are brought into the mainstream, their food and water requirements will also need to be factored into future estimates.

The way in which irrigation networks have been developed worldwide has led to certain 'closed river basins'. This term denotes a river system where no water flows to the ocean because all the available water has been exploited for human use. Whatever is done in that particular basin merely reallocates the water between different sectors and users. Some examples of closed river basins are the Yellow River in China, the Colorado in USA, the Syrdariya in Central Asia and the Murray-Darling in Australia. In India, the Indus, Kaveri, Sabarmati and Krishna river basins have become closed basins. This creates very serious environmental consequences because when these rivers reach their deltas, their water gets polluted or salinized. This weakens and eventually destroys the mangroves and the life they support as well as the fresh-water fish and aquatic and human life nourished by the river. Aquaculture, or the artificial cultivation of fish, will become important in the future as our rivers and natural habitats are destroyed by pollution. Similarly, since there is not much land left for grazing in open areas with the rapid growth of industries or cities or agriculture itself, even livestock will have to be produced in commercial set-ups, such as ranches or farms. All this will seriously impact the demand for water.

The second issue relates to the ground water overdraft. In India, vast regions in the north-west and south are already facing this serious problem. If we plot all the countries in the world, we can calculate how much ground water is being used. India uses more ground water than all the other countries in the world put together, including USA, China, Pakistan or Bangladesh. This has happened only since 1975 or so, when our consumption reached more than 250 cubic km per annum. At the same time, there is a general decline in our local and regional water tables. This situation is clearly unsustainable and the bubble of groundwater based economy may burst one day.

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If we compare the situation between 1993 and 2001, the areas serviced by surface irrigation (canals, tanks) in South Asia have declined from 22 million hectares to 17 million hectares even after spending 1 lakh crore rupees on surface irrigation. Several experts have pointed out that despite this heavy investment in infrastructure, management deficiencies have led to a decline in surface irrigation on one hand and to an unsustainable increase in pump irrigation on

the other. This process has gathered momentum since 1995 and is rapidly cannibalizing ground water reserves. As generally perceived, irrigation systems do not entirely support ground water irrigation and only about 12 per cent of India's wells are in command areas; the rest are all in open areas. These pose a different set of problems.

The existing data and projections tell us that, presently, the total crop water consumption is about 7,000 cubic km

Unlike in the developed world (Europe and North Americas), where there is little or no water scarcity, in the Asia and Africa region, we have either a 'physical scarcity' or an 'economic scarcity' of water. Physical scarcity of water means that very little water is available in that region. In such a situation, one can simply reallocate, or increase, the value of water. In a situation facing an economic scarcity of water, there is a lack of resources, or investments, or human capacity to procure the existing water. Bangladesh and eastern India, and the entire Ganges basin states do not have sufficient economic investments so that even though people there are literally floating on water they do not have adequate 'access' to that water.

How can water for food be developed and managed to help alleviate poverty and hunger? One solution to this overwhelming problem is to ensure environmentally sustainable water and agriculture practices and find the balance between food and environment security. If populations use water exclusively for producing food, then humanity is in serious danger of destroying the environment and eco-system.

The existing data and projections tell us that, presently, the total crop water consumption is about 7,000 cubic km. Of this, about 2,500 cubic km is due to crop evapo-transpiration; 1,600 cubic km is contributed by irrigation while the rest comes from rainfall. Further, if we do not make any productivity improvement then our requirements shall increase from 7,000 cubic km to more than 13,000 cubic km, which is really impossible. That is the worst case. However, if we do something remarkable in between – which shall form the next part of my talk – the world shall certainly be able to produce all the food required by its population and have additional water to meet the growing domestic, industrial, environmental, recreational and other requirements. Having briefly narrated the problem, I shall now try to put before you a set of agenda points, which Comprehensive Assessment describes as the policy agenda.

First, we must change the way we think about water and food. Presently, we think that either there are rain-fed areas or fully irrigated areas. We start from fully rain-fed systems to fully irrigated systems in smaller areas; where these are purely rain-fed, by field conservation and water harvesting and other practices. Next, we move to supplemental irrigation where farmers provide small irrigation at critical stages of crop growth or to tide over the failure of the rains. Ground water irrigation and surface water irrigation is provided in the irrigated areas. Drainage may be required under both rain-fed and irrigated areas. So if we take the total continuum – from pure rain-fed to fully irrigated systems – and direct all our efforts to address these different issues we can make a significant impact. It becomes easier to balance the deficit and surpluses in the larger ecosystems when viewed in a comprehensive and integrated manner than if each sector tries to solve this complex puzzle in a small, individual capacity.

Secondly, we have to look at the strong correlation between water and poverty. Governments and civil society organizations must provide water to poor people and those who can use it better. Around 70 per cent of the world's under-nourished population lives in rural areas where non-agricultural livelihood options are limited. So we need to make large investments for economic growth and create the kind of economic activity that makes water and food available to poor people, and encourages them to make better use of water. Ensured and secure access for such people by targeted investments in pro-poor technologies will go a long way in sensible and sustainable use of water. We must also encourage local management, since water is a local subject, and make major infrastructural investments to make this possible. In addition, informal and traditional irrigation – such as tanks and ponds – must be revived. Contemporary public instruments are needed for the improvement of market access and infrastructure. Unless we provide for all these, the real and adequate benefits may not reach the target population even if we provide water and improve agriculture.

Ensured and secure access for such people by targeted investments in pro-poor technologies will go a long way in sensible and sustainable use of water

Thirdly, we must significantly increase water productivity so that there is 'more crop per drop' or 'more value per drop of water'. This will also lead to a reduction in water needs because the same amount of water will produce more food and other services. We must also aim to increase economic water productivity, especially in the water-stressed

areas. This means that instead of just growing cereals and pulses, farmers need to be encouraged and trained to practise growing fruits, vegetables, flowers and aquaculture and livestock. Such alternatives will bring more income to the farmers, as well as nutrition to their families, and benefit the ecosystems.

Wherever water is used intelligently, it leads to an increase in the agricultural productivity levels

Countries, such as the USA, have achieved higher yields of maize, and reached a level of about 8 tonnes per hectare. China, too, has done exceedingly well in the past few years and reached a level of more than 5 tonnes per hectare for cereal crops. However, sub-Saharan Africa and South Asia including India are still at a level of 1 to 2 tonnes per hectare. Even under similar conditions and with similar technologies, there is a good chance that this can be substantially improved. Wherever water is used intelligently, it leads to an increase in the agricultural productivity levels. Using GIS and remote sensing data integrated with national census data on crop performance, IWMI conducted a study for the entire Indo-Gangetic basin, which included parts of Pakistan, India, Nepal and Bangladesh. In the case of rice productivity, very high productivity was observed only in a small area of this region, comprising Punjab, Haryana and western UP. But in large parts of Uttar Pradesh, Bihar and West Bengal and Bangladesh, there are areas that have extremely low productivity. The result is that India depends on small areas of high productivity of the country to produce most of the food for other areas as well. If the farmers of the low-productivity areas could be provided with necessary facilities, they could access all the water required for production systems which shall become more broad-based and sustainable.

Similarly, there are areas in Madhya Pradesh, Himachal, Bihar and Kashmir that produce merely 0.4 kg rice per cubic metre of water. In India, it is only Punjab that produces around 0.8 kg per cubic metre of water. If we provide all the other facilities, such as ground water, better seeds, and better technology and so on, then all the other areas can also potentially reach this level of productivity. These interventions will also reduce the total water requirements for food production. In the case of wheat production, if we take Punjab, which has total water availability of around 3.4 million hectare metre, the water that it draws up through ground water and other means is about 4.5 million hectare metre per annum. Naturally, there is an annual deficit of about 1.41 million hectare metre, which is met through over-

exploitation of ground water. This has led to rapidly depleting water tables and all the attendant problems. In short, we are producing food at the cost of diminishing and permanently depleting all the available water in the more productive regions of our country.

In India, 40 per cent of the agriculture is irrigated while the rest is rain-fed. The latter is also the segment where most of the country's nutritious cereals, pulses and oil seeds are produced and where most of our poor people live. This low productivity is related to poor access to water and also leads to the kind of surge in prices of pulses that occurred recently. We need to unlock the potential of rain-fed areas by improving and upgrading rain-fed agriculture. This is best achieved through proper management of the watersheds. With the low productivity watershed and proper treatment for development of the water resources, farmers are able to irrigate their farms, and communities are able to get the water to their houses, which can lead to a totally changed scenario. An example is Anna Hazare ji's Ralegaon Siddhi where help in providing a little water can go a long way in benefiting a community.

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Out of the total use of about 1,480 cu km, about 60 per cent is through rain water and 40 per cent is through irrigation. Several studies show that there is a direct link between poverty and water availability. When communities do not have access to water, they become really poor since they do not have sufficient resources to produce what is potentially possible. In the countries or regions where people have lower access to water, as in India, 20-35 per cent of people are poor in such regions. Similarly in those areas in Africa and other countries which do not have access to water, the poverty there is also more than 20-30 per cent and in certain areas, like large parts of sub-Saharan Africa, poverty is more than 50 per cent. So one of the easiest and smartest ways of reducing poverty is providing access to water to people so that they produce more; they can produce high value crops, they can raise livestock and can go for fisheries. And along with that when provided with good markets, populations can move up the value chain and can come out of the vicious circle in which poor communities are presently trapped.

A key action in the efforts to upgrade rain-fed systems is to encourage water harvesting in a sustainable manner, so that water is available for providing supplementary irrigation. In 2009, the Government of India set up a National Rain-fed Area Authority of India which is working to meet similar objectives. Meanwhile, people continue to remain vulnerable and poor or less resilient than those who do not suffer from this lack of access.

Our attitude towards water scarcity, like our attitude to climate change and energy, needs fresh thought

In a paper published recently in Agricultural Water Management Journal (2010), I have pointed out that in India one can identify 28 million hectares of rain-fed area as a priority area. This area has a surplus of 114 billion cubic metres of water and if we take just about 18 per cent of this water, we can increase the agricultural production of the region by about 100-128 million tonnes. This means we can bring about a 50 per cent increase in productivity at a very nominal cost (about 1 billion rupees/annum). Compare this to the investment required for other alternatives, such as of National River Linking Project systems, which involves more than Rs. 1200 billion for constructing the entire infrastructure.

My next suggestion is to adapt yesterday's irrigation to tomorrow's needs. Today, we need to think differently, we need to see problems afresh, manage them appropriately and take certain hard decisions. Our attitude towards water scarcity, like our attitude to climate change and energy, needs fresh thought. The earlier efforts at developing large irrigation schemes, such as the Bhakra, or Hirakud dams, were designed to cater for large but deficit irrigation, much smaller cities and fewer large industries. Today, our domestic and industrial requirements have substantially increased. Today's farmers do not want to depend on an irrigation system where they get water after fifteen days for just a few hours, because they do not practise that kind of agriculture any more. This is also a reason why the area under canal irrigation all over south Asia is declining. Today, a city dweller wants water whenever he turns on his tap. An industry requires water 24 hours a day every day of the year. So all those systems that were designed for different times and notions, need to be upgraded and adapted to present needs. Therefore, we must improve the performance of our old irrigation systems to reduce rural and urban poverty. The main problem is not with the physical infrastructure but with the management of these systems.

Let me give you a small example of an experiment that IWMI did in the Nepal hills, which we are also trying to also implement in Nagaland and in Sikkim. Hilly areas have very small sources of water. Once that source of water is tapped, an innovative multiple water-use system can provide drinking water to the rural communities and a small drip system can bring water to the vegetable farmers. Such a system meets both the domestic needs and the irrigation water needs of the whole community. In short, we need to find local solutions that meet most of a community's requirements from the small resource available with them.

The next important issue is the inter-relationship between important eco-systems services and agriculture. Agriculture does not operate alone: it reduces flood control and improves storage. It helps in ground water storage, and in providing water for other services. It also provides water cultural, religious and spiritual needs. You may recall that due to several development projects there was no water flowing in the Ganges at Haridwar and people went on a fast to alleviate the situation and persuade the government to reconsider planned projects. As a result some of the hydro-electric projects planned near Gangotri were abandoned. We live in a country where people do not attach significance only to the physical or economic value of water, but to its spiritual value as well. If the demands downstream are moderated and we make that water available for other services, then perhaps several demands that are either mute or have a small voice in society can also be heeded.

Economic water use needs to be tailored so that it takes care of other services, such as bio-diversity and nutrient cycling that maintain the condition of life on earth. If we neglect this aspect, several species may soon become extinct. We need to manage our bio-diversity to enhance a range of eco-systems beyond food and fibre. Water is not to be taken just for agriculture but for the other agro eco-system services as well, otherwise deltas will become salinized and mangroves will disappear. The poor people who are deprived of that water by upstream users must be compensated through this particular concept of 'payment for environmental services'. So if we are not allowing them to use water, these communities need to be compensated through some better designed instrument. It is important to manage bio-diversity and all stake holders must go for informed and transparent negotiations and decisions.

We live in a country where people do not attach significance only to the physical or economic value of water, but to its spiritual value as well

The next major agenda item is to 'Reform the Reform Process'. Ever since our independence and during the British period itself, India has been undergoing a reform process but now there is an urgent need to reform this process. We need to make a qualitative improvement so that poverty, hunger, gender inequality, environment degradation, and the associated maladies can be tackled seriously. Our shortcomings have occurred not because of technical failings but due to the failure of political, policy and institutional interventions, and these have to be remedied.

We need to make a qualitative improvement so that poverty, hunger, gender inequality, environment degradation, and the associated maladies can be tackled seriously

The country needs to have wide-ranging sectoral reform, craft solutions and institutions to meet local needs. No simple engineering blueprints can do that. Policies outside the water sector (such as the changing diet patterns of different sections of the society, trade for agriculture, agriculture subsidies and energy subsidies that farmers use for abstracting ground water, among others) have a huge influence on the utilization of water sources. From the water-shed, we need to move to the problem-shed. Let us take the example of the Ganges basin, where Nepal, Bangladesh and India are all stakeholders. If all of them operate independently of each other, we will perpetually face another Kosi flood situation that devastated Bihar in 2008. All three countries must consider that this is not only an engineering watershed, it is also a problem shed for all of them. The states need to have serious negotiations, to find joint solutions. Issues relating to water do not need to be addressed in isolation yet water agencies, donor agencies and national organizations base the discussions and dialogues on narrow, sectoral or nation-centric perspectives. The stakeholders must identify the boundaries and networks of the problem. It is only in the absence of such negotiations that it has become common to hear that future wars will not be waged over oil or energy but over water. High stakes lead to a powerful resistance. People and states perceive the problem in their own way and want the solution to deal with that particular situation. Unless we have an informed knowledge about the entire issue, we cannot make informed calculations of cost and benefit or the cost of inaction. In India, several such negotiations do not happen because, to a certain extent, India is considered a black box for comprehensive water data. All the developed countries of the world provide access to any data on river flows, on

ground water and other related areas, but in India it is virtually impossible to get any meaningful data on water. This is a real problem. Despite a Supreme Court ruling that this data should be made publicly available, it is impossible to know how much water is flowing in the Ganges. Random data is available at a certain point, or at a certain location, but even the best researchers in the country cannot help you with the total numbers. Things may open up in the near future but unless you know what you have, it is very difficult to plan for the future.

The last policy agenda is that we need to make some difficult choices. Unless something dramatically different is done, the water situation in 2050 will be very challenging. Without productivity improvement as I explained earlier, almost double the present amount of water will be required to produce sufficient food. If we take the stand that globally, we will improve only the rain-fed scenario, or that we just go for water harvesting, our water requirements will be around 1750 cu km. If we improve all the irrigation systems, the global water requirements will be about 1600 cu km. And if we take the trade scenario, that is another way of solving the problem, we produce more food where it is prudent to produce it and then transfer that food to other parts of the world, such as the Middle East or even Australia, the water requirements shall be around 1450 cu km. But if the world adopts a comprehensive assessment and management scenario, we manage rain-fed systems and the existing irrigation systems and trade scenario and the associated opportunities, the world can meet all its future food needs with just 1300 cu kilometres of water.

If we take the stand that globally, we will improve only the rain-fed scenario, or that we just go for water harvesting, our water requirements will be around 1750 cu km

A good example is Gujarat, where the government came out with the 'Jyotirgram Yojana'. Before this scheme, all the villages and tubewells in the state were fed directly from electric lines so that whenever the power failed, not only did the whole village became dark; there was no electricity available for running the water pumps either. So the state rewired the entire rural landscape and separated the agricultural lines from the domestic lines. Today, the lines can supply sufficient electricity to the agricultural farms when needed and thus cut down wasteful misuse so that farmers do not pump water if it is not required in the fields. Domestic power supply to the rural people—that is, to women for domestic needs or watching TV, to children for studies, to

rural industries etc. – is available as in the urban areas. This scheme has reduced ground water use by more than 25 per cent, significantly improved the life of women and villagers. The 'Jyotirgram Yojana' is an example that can be replicated in other parts of the country as well.

Whether we will consume all the water that we have now or whether we want to leave some water for the next generation needs to be considered

We also need to take different chances and harvest the opportunities now, not later. If the nation wants to make investments for production, for adapting to climate change, water storage for agriculture, water for environment, one needs to consider upstream and downstream impacts, productivity and equity in this generation or the next generation. Whether we will consume all the water that we have now or whether we want to leave some water for the next generation needs to be considered. We must reflect on our consumption patterns and their impact, the number of non-vegetarian diets or how much of both kind of diets we really need and can produce. These wider issues may be decided by using the appropriate tools, assessing the trade-offs through water accounting and water footprints, consideration of the environmental impacts, compensating for environmental services and through well-articulated public debates and dialogues.

The last point that I wish to present is that apart from all these concerns there are certain other exogenous issues that I have not discussed. But if we look at the South Asian region, which is really vulnerable, inhabited by poor people and which suffers from water and food shortages, we must remember that it will be further impacted by climate change and that food production can decrease by as much as 15-25 per cent in this part of the world. There are certain regions in North America or in Russia or parts of China and others that may gain by climate change but for certain regions in South Asia which are already vulnerable, if we do not take certain serious steps right now, we will be in real difficulty. There are solutions and the time has come to apply them now before it is too late.

I shall like to conclude with a quote from Prof. Norman Borlaug that 'Humankind in the 21st century will need to bring about a Blue Revolution to complement the Asian Green Revolution of the 20th century… New science and technology must lead the way.'

We did produce a vibrant system that once provided us food security, but only in a very small part of the country. Now, with new science and technology, policy and institutions and targeted investments, we must lead the way to use our water resources to produce enough and quality food for all, and to ensure a healthy, productive and dignified life for the entire country.

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