DOWNLOAD PDF AVERTING THE WATER CRISIS IN AGRICULTURE

Chapter 1 : Water and food security | International Decade for Action 'Water for Life'

Another method is water management for rainfed agriculture. Rainfed agriculture is the most common method of agriculture in developing nations. According to the book, Rainfed Agriculture: Unlocking the Potential, 80% of the land farmed around the world is rainfed and it "contributes about 58% to the global food basket" (xiii).

Charts Welcome to the updated Financial Sense! We hope you enjoy the new experience. We have changed payment processors, so any existing renewals will need to be re-subscribed after expiration. You will receive an email when this happens. Visit your Subscriber Features to find updated information. Watch this video for a quick overview or send us a message using the Contact page. The reverberations of this crisis have already had global implications, notably encouraging the Arab Spring. Further, as the crisis worsens, national, regional, and global political and economic instability will grow. China has an age-old imbalance. Its agricultural core is in the North whilst its water resource is in the South. As of , North China holds two-thirds of Chinese agriculture but only one fifth of its water. The rise of Mao in and an interventionist political ideology has cemented this chronic structural issue in the Chinese economy. Climate change exacerbates this situation. The core of the project is a km canal stretching from the Yangtze to Beijing. By facilitating massive water transportation, China is reinforcing an artificial economy. It is encouraging water-intensive industry and agriculture and promoting a downward spiral of strengthening an insatiable demand whilst failing to combat system inefficiencies. Long term, this project, combined with state-induced low water prices, climate change, and population and economic growth, will perpetuate economic and water scarcity in Northern China. China has made strides to find innovative solutions to its water issues. The Water Pollution Prevention and Control Action Plan, announced in , set targets to improve specific polluting industries and has had some success; 50, offending companies have shut down or halted operations. Nonetheless, critics have questioned the effectiveness of enforcement. Ma Jun, Director of the Institute of Public and Environmental Affairs, said many factories did not comply and local governments carried out the easier aspects of the legislation rather than tackling larger, more complex problems. However, these are small solutions to a very major problem. Experts predict that, if China carries on with business as usual, water supply will outstrip demand by Implications Water security issues will have a severe impact on domestic economic stability in the long term. Businesses should contemplate a future of water price hikes, supply disruptions, pollution, and increased regulation, and seek the opportunities presented by innovative business solutions to solve Chinese water-security issues. This has already occurred. This caused a doubling of global wheat prices. The dry throat of the Chinese dragon may induce more than just a sneeze.

Chapter 2 : #WaterCrisis: 21 Indian cities to exhaust groundwater supplies by

We need a sustainable solution, and we need one fast, before a serious water crisis hits us again. For starters, it is a good idea to declare some zones as ecologically critical areas, where water quality and environmental pollution is monitored and strictly kept in check.

But beneath that are stagnant, even declining levels of welfare for many households. The future looks even more daunting. Asia must grow more food using less land, water, and labor, while overcoming new threats from climate change. Rice availability and food security have long been synonymous in the region, and we have concluded that the way forward in Asia will be through a "rice lens," with all of the broader dimensions incorporated through that lens. Four areas require immediate attention. First, we need to raise and sustain the productivity of rice farmers. These solutions must be coupled with a change in the way Asians grow their rice, namely through improved land preparation, water management, pest control and other environmentally benign technologies. Second, countries and donor organizations should increase investments in the agricultural sector. Agricultural productivity is the essential foundation to broader gains in the rural economy and to overall economic development that reaches the poor. These investments should target improvements in agricultural infrastructure and reforms in the policy environment which connect smallholder farmers to larger markets. A "pro-poor and pro-women growth" strategy that incorporates these investments is the only sustainable route out of poverty and hunger. Third, food safety net programs must be expanded at the national level. We must design "pro-growth" safety net activities by investing in better health, nutrition and education programs. The returns, especially for the rural poor, are very high and have been proven to achieve faster, and more equitable, economic growth. Women deserve a special mention because they often take on leadership roles in farming in many local communities. Steps must be taken to ensure that they have access to land and water resources, agricultural technology, financial services, extension services, and marketing facilities. Finally, a center for the coordination of food security activities should be established within an existing Asia-based institution to ensure the provision of the public goods outlined above. The center should monitor the food challenges in Asia and help resolve problems that extend beyond the borders of individual countries. All of this will require new money. But a relatively modest investment, if targeted effectively, could have a significant impact on hunger and poverty. Where will the funding come from? Innovative public-private partnerships should be at the forefront of this effort. In aggregate, the entire agribusiness system that provisions the global food economy is the largest industry in the world. Virtually all of the funding for this system comes, of course, from food consumers. Other funding sources--foundations, international financial institutions, philanthropic individuals--will be crucial for moving forward the food security agenda. Countries in Asia must also begin to contribute to global agricultural research, rural revitalization and safety net enhancement. Donors can and should help, but to sustain the gains most of the action--political and financial--has to be home grown. Swaminathan, Chairman of the M. Swaminathan Research Foundation, and James D.

Chapter 3 : Averting Food Crisis: Improving Smallholder Agriculture - Farming First

"The only way to meaningfully conserve water in agriculture is to not grow crops, plain and simple. And the only way to make that happen is to make it worth a farmer's while financially.

By David Molden , Charlotte de Fraiture , Frank Rijsberman With ever more water needed to raise crops to feed the burgeoning global population, efforts to produce more food with less water are critical to averting a crisis. With so much talk about a global water crisis, about water scarcity, and about increasing competition and conflicts over water, it would be easy to get the impression that Earth is running dry. You could be forgiven for wondering whether, in the not-too-distant future, there will be sufficient water to produce enough to eat and drink. But the truth is that the world is far from running out of water. There is land and human resources and water enough to grow food and provide drinking water for everyone. Around the world there are already severe water problems. The problem is the quantity of water required for food production. People will need more and more water for more and more agriculture. Yet the way people use water in agriculture is the most significant contributor to ecosystem degradation and to water scarcity. Added together, these problems amount to an emergency requiring immediate attention from government institutions that make policy, from water managers, from agricultural producersâ€”and from the rest of us, because we are all consumers of food and water. The crisis is even more complex than it first appears to be because many policies that on the surface appear to have nothing to do with water and food make a bigger difference to water resources and food production than even agricultural and water management practices. But people who make these decisions often do not consider water to be part of them. Water professionals need to communicate these concerns better, and policymakers need to be more water-aware. In early , the Comprehensive Assessment of Water Management in Agriculture, which explored ways to cope with this crisis, was released. The assessment gathered research and opinions from more than researchers and practitioners from around the world. They addressed these questions: How can water be developed and managed in agriculture to help end poverty and hunger, promote environmentally sustainable practices, and find a balance between food and environmental security? The Comprehensive Assessment provides a picture of how people used water for agriculture in the past, the water challenges that people are facing today, and policy-relevant recommendations charting the way forward. Food and environmental communities joined efforts to produce the assessment, which was jointly sponsored by the United Nations Food and Agricultural Organization, the Convention on Biological Diversity, the Consultative Group on Agricultural Research, and the Ramsar Convention on Wetlands. A summary of the assessment is available at http: Many in the developed world are complacent about the supply of water and food. Global food production has outpaced population growth during the past 30 years. For one thing, agriculture must feed another 2 to 3 billion people in the next 50 years, putting additional pressure on water resources. Yet for millions of rural people, accessing enough food, enough water, or both is a daily struggle. Rain may be plentiful for some farmers, but in many places it falls when it is not needed and vanishes during drought. The Indian rural development worker Kalpanatai Salunkhe put it succinctly: For example, using biofuels may be a way to reduce greenhouse gases, but growing the crops to produce them demands additional water. Increased reliance on biofuels could create scarcity by pushing up agricultural water use. India can ill afford these additional water resources. Trade has the potential to markedly reduce water use. Yet trade policies rarely if ever take water into account. As a first step, trade officials could consider the water implications of trade. Subsidies and economic incentives lead to better soil and water management. Countries set subsidy policies as an economic incentive. If farmers have access to cheaper fertilizer or water, or the prospect of higher prices for their crops, they will invest in better practices. Subsidies in countries such as the United States allow cheaper food to be exported and drive down the prices of commodities such as corn and wheat. Farmers in Africa and poor countries elsewhere then have trouble competing with these artificially low prices. Local, national, and international policymakers should carefully consider the water implications of their actions along with local politics. How much water do we eat? The water-food-environment dilemma starts with everybody because everybody eats. The water people need for drinking is essential, but it is only

about 0. Why does food production need so much water? It is largely because of the physiologic process of plant transpiration. This evaporation is part of the process of photosynthesis, in which a plant manufactures its own energy from sunlight. Evaporation also helps cool the plant and carries nutrients to all its parts. In addition to transpiration, some liquid water is turned to vapor through evaporation from wet soils or leaves. Crop yield is roughly proportional to transpiration; more yield requires more transpiration. It takes between and 4, liters of evapotranspiration ET, the combined process of evaporation and transpiration to produce just one kilogram of grain. When that grain is fed to animals, producing a kilogram of meat takes much more waterâ€"between 5, and 15, liters. Thus, vegetarian diets require less water 2, liters of ET daily than do high-calorie diets that include grain-fed meat 5, liters of ET daily. The bottom line is that although people individually need just 2 to 5 liters of drinking water and 20 to liters of water for household use every day, in reality they use far more: On average, each of us requires about 1, cubic meters of water each year for food, or about 3 cubic meters 3 tons, or 3, liters! For country-level food security, about 2, to 3, calories must reach the market in order for each of us to consume about 2, calories. Thus, about one liter of water is required per calorie of food supply. Water for crops comes either directly from rain or indirectly from irrigation. Growing food with rainwater has much different water and land-use implications than does intensive irrigation. Meat produced on rangeland uses much less water than industrial meat production in feed-based systems. In addition, although both grazing and industrial livestock systems need water, the soil moisture in grazing land cannot be piped into a city and therefore does not reduce the domestic water supply, although it does reduce the amount of water available to the natural ecosystem that is being grazed. The importance of meat to water consumption and livelihoods is quite different in developed and developing countries. Animal products are extremely important in the nutrition of families who otherwise consume little protein. They are also precious to African herders and farmers who use livestock for transport, for plowing, for living food storage, and often for a walking bank account as well. In the developed world, by contrast, most livestock production is for meat and comes from industrial feed-based processes. About 40, cubic kilometers contributes to rivers and groundwater. The remainder evaporates directly from soil. People withdraw 3, cubic kilometers from rivers and aquifers for cities, industries, and agriculture. Agricultural irrigation takes most of that: Rainfall supplies plenty of water for food production. But often it fails to rain in the right place or at the right time. Limits have already been reached or breached in several river basins. The present boom in groundwater use for irrigation that began in the s is occurring because this water is easy to tap with cheap pumps and the supply is reliable. But for millions of people, the groundwater boom has turned to bust as groundwater levels plummet, often at rates of 1 to 2 meters per year. Groundwater is declining in key agricultural areas in Mexico, the North China plains, the Ogallala aquifer in the U. Patterns of water use are also changing in response to changes in the amount of grazing land and the productivity of fisheries. Further expansion of grazing is unlikely to be available to support expanded meat and milk production, so more livestock will have to come from industrial feed-based systems. That will require more water, especially for feed production. Ocean and freshwater fisheries have in many cases surpassed their limits, yet consumption of fish and fish products is booming. So in the future, more fish products will come from aquaculture, which requires yet more fresh water. Physical water scarcity also occurs in areas with plenty of water, but where supply is strained by the overdevelopment of hydraulic infrastructure. Another million people live where the limit to water resources is fast approaching. All of these people are beginning to experience the symptoms of physical water scarcity: Economically water-scarce basins are home to more than 1. In these places, human capacity or financial resources are likely to be insufficient to develop local water, even though the supply might be adequate if it could be exploited. Much of this scarcity is due to the way in which institutions function, favoring one group while not hearing the voices of others, especially women. Symptoms of economic water scarcity include scant infrastructure development, meaning that there are few pipes or canals to get water to the people. Even where infrastructure exists, the distribution of water may be inequitable. Sub-Saharan Africa is characterized by economic water scarcity. Water development could do much to reduce poverty there. Both economic and physical water scarcity pose special problems that can be particularly difficult to deal with. But, as we have said, water problems also occur in areas with adequate water. Institutionsâ€"laws, rules, and a supportive organizational

frameworkâ€”are key to mitigating water problems. Where there is inequitable water distribution or ecosystem degradation, water problems can be traced back to ill-adapted or poorly functioning institutions. Rarely is there an overriding technological constraint. In developed areas, more grain is grown for feeding animals than for feeding people. The reverse is true in sub-Saharan Africa, where grains are a major part of the human diet. With economic development, the trend is toward much more meat in the diet, as in East Asia. There, average annual meat consumption is expected to double, from 40 to 80 kg per person, by With growing incomes and changes in diet worldwide, food and feed demand could double by the year If there is no increase in water productivityâ€”the amount of water it takes to produce a unit of foodâ€”water consumed by agriculture must double as well. The environmental impact of that massive human demand for water would be stunning.

Chapter 4 : Global water outlook to : averting an impending crisis :: IRC

A World Bank report stated that China was using ten times more water per unit of production than the average industrialised country, and that pollution has made the water in 19% of main rivers and 35% of reservoirs useless for agriculture and industry.

If not tamed through viable policy measures and mass-scale across-the-board awareness for water conservation and its sane use at all scales, the grueling crisis is bound to devour the very foundations of socio-economic sustainability. Besides, overall sustainability of economic growth lives of people and their livelihoods are already at stake. In the face of the population growth, changes in land-use practices, persisting unsustainable farming practices, inefficient use of water in industrial and domestic sectors, and the potential change in climatic conditions, traditional water supply solutions are not sufficiently robust to provide adequate security of supply into the future. In December , a U. Because, demand for water in the country has exceeded the available amount during a year due to over-exploitation of the water resources available in any form. Besides, available water resources have become significantly contaminated and not fit for use. The Day aims at drawing attention of the global community on the unprecedented significance of the freshwater to the sustainability of lives of all sorts of living beings and the mother earth itself and advocating for the sustainable management of freshwater resources. We must realize that water is the essential building block of the life. Yet, it is more than just a necessary need to quench thirst or protect health. Water is equally vital for creating jobs and supporting economic, social, and human development in a sustainable manner. Shifting weather patterns, erratic and decreasing rainy days, rapidly melting glaciers, shrinking river flows and depleting groundwater resources combined with galloping population in the country have already worsened the risk of the impending water crisis. Such underground reserves usually are replenished naturally by rain and melting snow. Any decline in the groundwater recharge could have a severe impact on water available for drinking, sanitation and hygiene in a country where over 1. The persistent deterioration of surface and groundwater sources, on which people rely for their livelihoods, drinking, sanitation and daily domestic needs, means that water and sanitation pressures will simply grow from bad to worse. According to Pakistan Water Gateway, a non-governmental water-research portal, groundwater levels in the country are dropping by three feet annually. For instance, using the sprawling city of Lahore in northeastern Pakistan as an example, the Gateway notes that 20 years ago water used to be extracted from a depth of between 20 and 40 feet. Today, wells must reach feet to get sufficient amounts of use-able water. However, the government need to enforce polices measures to regulate the indiscriminate groundwater extraction by creating water protection zones and introducing water-saving technology in the agriculture sector to boost food security. The international standard is days. Water experts suggest that the country requires a minimum storage capacity of 40 percent or 46 MAF of around million acre-feet of water available in the Indus river system annually. This gives Pakistan a stored water supply, adequate to meet its needs, of just 30 days. Above all, efficient and climate-smart integrated water management in agriculture, industrial and domestic sectors is indispensable to overcome the fast approaching water crisis. This calls for integration of urban and rural water systems with appropriate uses for rainwater, groundwater, surface water, wastewater, storm-water and potable water. Long term planning and water-sensitive design is vital to providing the integrated approach. This can increased susceptibility to flood events and urban heat island impacts and massive degradation of environment, waterways, coastal areas and other natural assets. Nevertheless, without further investment in new sources of water, water efficiency programmes for efficient use of all water resources, the country is unlikely to achieve water, food and energy security to meeting water, food and energy needs of the present and future generations for decades to come. The country desperately needs more reservoirs to increase its water storage capacity and launch of conservation awareness campaigns, the introduction of less water thirsty crop varieties and more efficient irrigation technologies and practices.

Chapter 5 : Agricultureâ€"Meeting the Water Challenge | Water Institute

With the demand for water expected to double by , there simply won't be enough to go around. That's a frightening prospect in a country where 90 percent of groundwater withdrawals are used for agriculture, and where a quarter of the population is hungry.

During the Green Revolution of the s to s, billions of dollars had been spent building large-scale irrigation systems. These contributed, along with new fertilizers , pesticides and high-yielding varieties of seeds, to helping many countries produce greater quantities of food crops. In , the Rio de Janeiro Earth Summit gave credence to this approach by recommending that water management be decentralized , with farmers and other stakeholders playing a more important role in managing natural resources. Wider perspective[edit] By the mid s, competition for water resources was rising, thanks to a larger global population, expanding cities and increasing industrial applications. A new approach was needed that would consider it within a river basin context, encompassing competing users and the environment. IIMI began developing new fields of research, on topics such as open and closed basins , water accounting , multiple-use systems, basin institutions, remote sensing analysis and environmental flows. Although it was becoming evident that water could no longer be considered an " infinite resource ", as had been the case in the s when there were fewer people on the planet, no one knew just how scarce the resource was. This prompted IWMI to try to find out. Its research culminated in publication of Water for food, Water for life: A comprehensive assessment of water management in agriculture. The report defined physical water scarcity , as being where there are insufficient water resources to meet the demands of the population, and economic water scarcity as where water requirements are not satisfied because of a lack of investment in water or human capacity. That equates to 40 per cent more than can be provided by available water supplies. According to the Institute, the following actions are required: The state faced the dual problem of bankrupt electricity utilities and depleted groundwater storage following the introduction of electricity subsidies to farmers from around The situation arose because the subsidies enabled farmers to easily pump groundwater from ever-increasing depths. The Asian Development Bank and World Bank both indicated that governments should cut the electricity subsidies and charge farmers based on metered consumption of power. However, when some state governments tried to do so, the farmers formed such powerful lobbies that several chief ministers lost their seats. A different solution was clearly required. They should then provide farmers with a high-quality power supply for a set number of hours each day at a price they could afford. Eventually Gujarat decided to include these recommendations in a larger programme to reform the electricity utility. A study conducted afterwards found its impacts to be much greater than anticipated.

Chapter 6 : International Water Management Institute - Wikipedia

Averting a California Water Crisis Francis Chung, P.E. in which 90% of the supply supports agriculture, about 70% of SWP water is used for cities and industry.

Facts brief on Water and Food Security. World Hunger Map According to the MDG Report for , the proportion of people in the developing world who went hungry in remained stable at 16 per cent, despite significant reductions in extreme poverty. The MDGs are interlinked; progress in one goal supports progress in others. Supporting sustainable agriculture and rural development helps increase food production and reduces poverty and hunger. Food and nutritional security are the foundations of a decent life, a sound education and the achievement of the Millennium Development Goals. What is food security? The World Food Summit of defined food security as existing when all people , at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet dietary needs for a productive and healthy life. The world population is predicted to grow from 6. Agricultural products move along extensive value chains and pass through many hands â€" farmers, transporters, store keepers, food processors, shopkeepers and consumers â€" as it travels from field to fork. Producing 1 kilo of rice, for example, requires about 3, litres of water, 1 kilo of beef some 15, litres, and a cup of coffee about litres. This dietary shift is the greatest to impact on water consumption over the past 30 years. In , the surge of food prices has driven million people into poverty and added 44 million more to the undernourished. In developing countries, 43 percent of the farmers are women. Female farmers are considered as efficient as men; however, they do not perform as well because they do not have access to the same inputs, services and productive resources â€" including water. The way that water is managed in agriculture has caused wide-scale changes in ecosystems and undermined the provision of a wide range of ecosystem services. The external cost of the damage to people and ecosystems, and clean-up processes, from the agricultural sector is significant. It is predicted that South Asia and Southern Africa will be the most vulnerable regions to climate change-related food shortages by Information brief on Water and Agriculture in the Green Economy. The environmental food crisis: The Revision, Highlights. What can be done? In order to achieve a global food and nutritional security, commitments and investments are needed to produce more nutritious food with less water: Innovative technologies are required to ensure a greener and more sustainable food production. They are needed to improve crop yields; implement efficient irrigation strategies; reuse of drainage water and use of water resources of marginal quality; produce smarter ways to use fertilizer and water; improve crop protection; reduce post-harvest losses; and create more sustainable livestock and marine production. Agricultural development in the least developing countries LDCs lies mainly in the hands of smallholders, a large majority of whom are women. Therefore, new institutional arrangements are needed that centralize the responsibility for water regulation, yet decentralize water management responsibility and increase user ownership and participation. From production, post-harvest handling, processing, retailing, consumption to distribution and trade, efficient water and food recycling strategies can be addressed. It can help secure environmental water requirements when reuse of treated water is not culturally acceptable for other uses. Facts Brief on Water and Food Security. UN initiatives that are helping to raise the issue The objective was to raise awareness on the relationship between water and food production and promote more sustainable food production and consumption patterns. It sought both to alert the world of the adverse global situation in water and food security, and to encourage decision-makers to seize opportunities to address global challenges. Through showcasing success, it aimed at encouraging decision-makers to initiate and sustain reforms and forward-looking approaches. The reader provides basic references for easy reading and some of the latest and most relevant United Nations publications on the issue. Links are provided when the publication is available online. The issue of water and food security is addressed all along the report and chapter 2. Managing systems at risk. Risks and tradeoffs are examined, and options reviewed for managing these without harm to the resource base. Chapter 1 analyses the current status of land and water resources together with trends. It assesses the biophysical and technical aspects of the resources and their use, and presents projections for the year Chapter 2 reviews current institutional arrangements, and

assesses socio-economic and environmental impacts of current land and water management. Chapter 3 reviews current and future threats to land and water and their implications for a series of major systems at risk. Chapter 5 assesses the institutional responses at local, national and international levels, with an analysis of lessons for the future. Finally, Chapter 6 draws conclusions and advances policy recommendations. Further on, it identifies causes of food losses and possible ways of preventing them.

Chapter 7 : Never an Empty Bowl: Averting a Food Crisis in Asia | HuffPost

in order to be able to meet the future challenges to avert the imminent water crisis in our country. Averting a Water War through use of water for agriculture.

Water challenges and solutions Of the vast amount of water that covers the blue earth, 2. That is a mere teaspoon in a full bathtub when compared to the total amount of water on earth. Now think about the competing demands on this finite resourceâ€"drinking, hygiene, agriculture, energy, and industry in a world of 9 billion people by It quickly becomes clear that without better water management strategies today, the world is headed for a crisis that will affect every aspect of life. Already, 80 countries suffer from water shortages that threaten health and economies while 40 percent of the worldâ€"more than 2 billion peopleâ€"does not have access to clean water or sanitation [1]. In some countries access to public water tanks is allowed only once every 45 days, often resulting in rural conflicts over water. But global water scarcity has a critical impact on food security. Of this, 40 percent on global average can come from irrigated agriculture. New factors such as increasing world population and improved affluence will further strain water resources. In addition, the uncertain effects of climate change on drought, floods, and agricultural productivity will exacerbate the situation. If we continue to apply current water management practices, by the global agricultural sector will need to double the amount of water used to feed the world [2]. With finite freshwater resources on the one hand, and increasing demand, both in quantity and variety of uses, on the other, the need for water resources protection and management has never been greater. The question is how do we meet this challenge without increasing fresh water withdrawal to feed the world? Increasing water efficiency on the farm Our best option is to implement solutions that have the potential of increasing the efficiency, equity and sustainability of water use. Resource efficient methods and technology will allow farmers to grow more food with less water while protecting biodiversity. In many parts of the world, mismanagement is depleting freshwater resourcesâ€"the blue water in rivers, lakes and groundwater storesâ€"which in turn has threatened freshwater biodiversity and permanently changed patterns of water flow. But this is higher in areas such as the Middle East and northern Africa, where up to 90 percent of freshwater withdrawals are used to irrigate crops [3]. Flooded rice paddies traditionally use on average about 2, liters of water to produce 1 kg of rough rice. As agricultural water scarcity increases, there is a growing need for water saving technologies such as aerobic rice varieties that grow well in unflooded fields; and more efficient irrigation regimes that do not require field flooding the entire growth period. Such practices have shown water savings and increased yields. About 40 percent of water used in irrigation is wasted through unsustainable practices such as field flooding. Modern irrigation systems can drastically reduce the amount of water used in farming by efficiently delivering water directly to plants. This reduces the amount of water lost through surface evaporation by 30 to 70 percent depending on crop and weather conditions. Irrigation holds the most promise for increasing food productivity and security, provided it is managed efficiently. Steady irrigation combined with optimum delivery of fertilizers, seed care, crop enhancement and crop protection products can make fields more productive, even with a reliable supply of rain and is crucial to maintain productivity in times of drought. The second part of the equation comes from the rainfall that infiltrates and remains in the soil, called green water. This is the largest fresh water resource and the basis of rain-fed agriculture. While farmers cannot control how much it rains, they can do a lot to retain rain in the soil. Heavy rain cannot penetrate parched and crusted soil and just runs off the surface. However, the yields from irrigated farms are often higher than from solely rain-fed agriculture. Thus, farmers must integrate a combination of rain-fed and irrigated agricultural methods to optimize the yields of crops for the water used. Even with optimum soil and water management, farmers will still lose crops to drought and heat if they do not have the best seeds and crop protection to carry them through inevitable dry spells. Researchers have developed new crop varieties which are more water efficient and tolerant to heat and drought through advances in breeding and biotechnology. In the past, breeders have slowly improved crop varieties by crossing pairs of plants that exhibit desirable qualities. Now this slow and labor-intensive method is getting a helping hand from molecular biology. Researchers are saving time by examining plant DNA for

clues to predict which plant crosses are most likely to be successful in producing a given trait. Genetic modification is another tool used to improve seeds in such a way that they can produce the same or more yield with less water. Some products have a beneficial effect on root systems, allowing plants to make the most of available water and cope better in dry periods. Plant regulator products are designed to help prevent crop loss when plants grow too tall and collapse. They also provide additional benefits by reducing water needed to grow crops. Integrated approach to address the water challenge There is no silver bulletâ€”no one answer to addressing the global water challenge. But an integrated approach using the technologies outlined here and tailored to the local conditions, crops, and farmers can maximize water use efficiency. As a result, farmers will not only produce more food but also become stewards of the land, protecting against rain run-off, soil erosion, water stress on plants, flooding, and desertification of arable land. Desertification, which occurs in arid areas from various factors, including climate variation and human activities, degrades land to the point it can no longer grow crops. Plants treated with crop protection product that helps sugar cane plants grow longer, stronger roots are able to access and use water more efficiently. Treated plot of sugar cane, on left, has deeper, stronger root system which helps the plants survive drought. Untreated plot on right is unable to withstand drought stress. In comparison, trying to increase water supply often requires energy-intensive measures such as desalination, which are vastly more expensive than the efficiency measures outlined here [4]. To better manage the competing demands for water, agricultural policies will have to make water efficiency a priority. This will require investment in research to develop innovative water-efficient technologies in addition to drought tolerant seeds, new crop protection products, and optimized irrigation systems for specific crops. But the best and most innovative technology is useless if farmers cannot afford it, see no advantage to it, or do not understand it. Governments, NGOs, and public-private partnerships should facilitate implementing technology on the farm where better water management is critical for food production and the environment. This includes access to affordable credit and financial risk-management mechanisms, such as insurance for weather-related crop losses. Already the benefits of this model can be seen in partnerships between developed country governments, international organizations, and private companies which are helping small farms with access to finance, guaranteed markets, technical assistance, and insurance. Enabling individuals and communities to understand their options for managing water, to choose from these options, and to take responsibility for their choices could positively alter the way the world uses its limited water resources.

Chapter 8 : The Environmental Food Crisis | GRID-Arendal

As agricultural water scarcity increases, there is a growing need for water saving technologies such as aerobic rice (varieties that grow well in unflooded fields; and more efficient irrigation regimes that do not require field flooding the entire growth period.

Chapter 9 : Averting a water crisis | Dhaka Tribune

Water is key to food security. Crops and livestock need water to grow. Agriculture requires large quantities of water for irrigation and of good quality for various production processes.