

The benefits of sustainable water use in Libya

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Abstract

In order for Libya to develop, it needs to address the water scarcity issue. Satisfying public water demand while simultaneously protecting the ecological support functions of freshwater systems will be one of the most critical and important challenges of the country's future. Water scarcity has spread rapidly in many areas of the country as population and consumption levels have increased against the available supply of renewable fresh water. This paper proposes a nationally formulated approach with a clearly defined strategy. It illustrates a clear definition of the goals of the water resources strategy gives as "to significantly improve the living condition of the Libyan people in a sustainable manner". To carry out such water resources strategy there is a need to determine set of outputs that can contribute to this overall goal through the realisation of a timeframe of preparation period, a short-term goal and a long-term goal. It is also derive these strategic outputs from our analysis of the issues and problems that Libya has been facing. The output will advance the long-term goal of the water resources strategy, to maximise benefits through the sustainable management of water resources, and in doing so, will contribute to the significant improvements in the Libyan living conditions.

Background

Water resources are distributed unevenly on the Earth's surface. While the world as a whole may arguably have sufficient water to support its inhabitants, it is not equally the case for countries and regions everywhere. In Libya, lack of water resources is a common predicament and has become an increasing constraint on the country's economic development, particularly with respect to food production, the biggest water user. In an effort to make up for this shortfall, Libya has been exploiting its non-renewable fossil water, thereby depleting its resource base and undermining its long term economic development and food security.

Over the years, tremendous efforts have been made to combat water scarcity and increase food supply through irrigation ^[4]. Despite these efforts, however, the productivity resulting from irrigation in Libya remains low simply because of its scarce water resources. Moreover, there are limited possibilities for expansion of irrigation, so that the growth in the rate of food production has been unsustainable ^[5].

In contrast to disappointing food production, the growth of population and hence of food demand has been rapid in the country. As a result, an increasing portion of food supply has to rely on imports. Those imports have substituted for the water that would otherwise be needed for food production locally.

A growing scarcity of fresh water relative to human demands is now evident in Libya. Two of water's most fundamental functions – its role as a prerequisite for life, on the one hand and its use as a commodity or economic resource on the other - are increasingly in conflict. In many locations, extracting more fresh water for agriculture, industry or cities now places the sustainability at risk. Finding ways to satisfy human water demands while at the same time protecting the life-support functions of freshwater systems now ranks among the most critical and difficult

challenges of the future. It is a challenge that spans science, technology, policy and politics, and is one that demands new partnerships that cross disciplinary and professional boundaries.

Dimensions of Challenges

The geographical location of Libya in the arid region where more fresh water is needed to sustain the current national population of over six million is one of the biggest challenges for the future. Because rainfall is not sufficient and is limited to only the coastal areas, Libya is heavily dependent on groundwater resources. The clearest indicator of such unsustainable use is over-pumping of groundwater, a practice now widespread in many food-producing areas and large cities. For example, groundwater withdrawals exceed recharge levels throughout the northwest, important food production area.

Another sign of excessive of water use is that many major aquifers located in areas where irrigation water is most needed are now affected by sea-water intrusions. These include the area around the city of Tripoli in the north west of the country, where the shallow aquifers have already been extracted and the salt water has started to spread in many locations of the coastal strip.

With many aquifers having been over-tapped to meet current water demands, stresses on fresh water systems will worsen markedly as population and consumption levels increase. Two major dimensions of the water-scarcity challenge stand out: (1) maintaining food security in the face of water constraints on agriculture, and (2) preventing a downward spiral in the health of the aquatic environment.

With a high water deficit in northern part of Libya, the country is threatened by more pronounced shortage in the future in a way that could constrain economic development, food security and social stability, unless drastic measures are taken. In this regard, there is a need to address future challenges through local water management.

Water and Food Security

Food production is a very water-consumptive activity. Growing the food needed to feed the population in future could require an even larger volume of additional water will need to be extracted from groundwater systems if that water is to be delivered to farms and managed inefficiently. In the light of the future water-use, it will be difficult to supply this much additional water on a sustainable and ecologically sound basis.

In recent decades, as urban water demand increased, cities began to pull water away from agriculture. A portion of this greater urban demand will be met by transfer from agriculture. The manner in which this farm-to-city reallocation of water is managed could determine the nation's ability to feed itself.

In order to achieve food security, a policy of self-sufficiency is still popular. This excellent aim, however, is beyond reach with either the current or the foreseeable available water resources. The simplicity of the food-security policy contributes to the expansion of irrigation but does nothing to minimise food waste. Other possible ways of bridging the gap in food demand must be explored. For example, more reliance on food imports and sea food will certainly minimise the pressure on the water resources that have already been suffering depletion.

In addition, water use efficiency can be achieved by two groups of approaches. First, technical efficiency can be achieved by using more efficient technologies, such as drip irrigation instead of water spreading for irrigation or more efficient scheduling of water applications both by improvements in water distribution systems and the use of crop and

soil sensing systems linked to computer-controlled water distribution. Domestic water use can also be made more efficient by installing more water efficient equipment to reduce the volume of water used per capita. These practices are sometimes called 'productive efficiency'.

A second form of water use efficiency is achieved via the application of principles to do with allocation. Applied to water, which in Libya is everywhere limited, this idea is simply expressed in the form of a question: which activity affords the best return on the use of water? The approach is relevant at the level of the farm, where the return on a high value crop for an international market would be more than that of another crop.

Groundwater Protection and Sustainability Development

National water consumption has already increased since the 1970s. To meet this rising demand, engineers have constructed several dams and many desalination plants, wastewater treatment plants and large transportation schemes. Since 1980, thousands of kilometres of pipes have been laid to transport groundwater between water basins. But while the government built these dams, desalination plants and the Man-made River pipelines to meet the legitimate goals of water supply, water engineering has failed to protect the groundwater basins from seawater intrusion in the coastal areas.

The primary destroyer of the northern basins is the drilling wells to mine the groundwater, a practice which causes the flow of salt water into these basins. These changes in turn impact on plant and soil and their interrelationships.

The Libyan society is thus faced with a monumental management problem. There are tens of billions of dollars worth of hydraulic infrastructure in place, which is literally killing the environment. Most notably, the groundwater around Tripoli city is to some degree at risk of seawater intrusion. The shallow groundwater aquifers have already been affected and as the wells are being deepened the intruding saltwater quickly makes contact with deep groundwater reservoirs.

As noted above, the aim of the extension of cropland is to achieve food security. This aim may indeed be achieved and some profits might be gained for a very short period. But in the long term it only will put great pressure on the groundwater aquifers, resulting in the destruction of the existing irrigated area. The consequences for both the environment and the economy will be serious.

Goals, Proposed actions and Outputs

Meeting the water challenges in Libya for the future will require a nationally formulated approach with a clearly defined strategy and hierarchy of objectives. This approach involves formulating a strategic goal, as well as setting out purposes to contribute to that goal. To satisfy the goal, it should be recognised that other sectors must provide tangible benefits which contribute to the improvement of Libyan living standards.

The national goal can be defined as "to improve significantly the living condition of the Libyan people in a sustainable manner". Water resources strategy outputs can contribute to this overall goal through the realisation of a preparation period, a short-term goal and a long-term goal. These can be defined as follows:

- **Preparation period:** The devising of a comprehensive water resources strategy supported and managed by capable institutions, which provides tangible benefits to people in line with the fulfilment of basic needs.
- **Short-term goal:** The implementation of a comprehensive water resources strategy, providing substantial benefits to people in fulfilment of their basic needs as well realisation of other benefits of water use in a sustainable manner.
- **Long-term goal:** The maximisation of the sustainable benefits of water use in the country.

To achieve these goals, we suggest nine strategic outputs, as listed below:

- Functional, effective seawater intrusion management systems.
- Importation of high consumptive water crops.
- Adequate supply of and access to quality potable water for all inhabitants.
- Optimisation of economic uses of water by industry.
- Appropriate and efficient irrigation available for optimal use of irrigable land in a sustainable manner.
- Enhancement of water related data acquisition and information systems.
- Adequate legal framework functioning and adapted to changing circumstances.
- Regional/bilateral cooperation for mutual benefit.
- All institutions functioning effectively.

These strategic outputs have been derived from an analysis of the issues and problems that Libya has been facing. Each output requires the successful implementation of a set of activities encompassing physical, managerial, economic and institutional aspects. Below, each is categorised with reference to one of three water resources aspects:

- **Security** (Outputs 1 and 2)- security of water;
- **Users** (outputs 3 to 5) – types of water use (e.g. domestic water supply; industry and irrigation).
- **Mechanisms** (outputs 6 to 9) – mechanisms that enable the benefit of sustainable water use to be realised, enhanced and maximised. These mechanisms include regional cooperation, water-related information and metering systems, appropriate frameworks and appropriate institutional support.

Together, these outputs will advance the long-term goal of water resources strategy, to maximise benefits through sustainable water management of these resources, and in doing so, will contribute to the significant improvement of Libyan living conditions. Table (1) summarises the strategic goal, purposes and outputs developed for various time frames.

Table 1: Summary of Strategy Output

Goal			<i>Living conditions of Libyan people significantly improved in a sustainable manner</i>		
Time frame			3-Year Preparation period	5-year Strategy	10-Year Strategy
Purpose			Devising of comprehensive water resources strategy, supported and managed by capable institutions, to provide tangible benefits to people in line with the fulfilment of basic needs.	Implementation of comprehensive water resources strategy, providing substantial benefits to people in fulfilment of their basic needs as well realisation of other benefits of water use in sustainable manner.	Sustainable benefits of water use in the country maximised.
Outputs	security	Groundwater protection	Institutional reformation for groundwater protection and management.	Effective measures adopted to manage groundwater extraction.	Effective groundwater management to prevent seawater intrusions.
		Food security	Institution authorised for trade agricultural products	Effective measures adopted to import crops.	High-consumptive water crops imported.
	users	Municipal water supply	Planning for expansion of access to water supply and sanitation.	Increasing sanitation and drinking water coverage; service level and quality improved.	Adequate supply of and access to quality potable water for all inhabitants
		Industrial water supply	Economic activities for industrial water uses established.	Economic use of water and water bodies by industries enhanced.	Economic uses of water by industries optimised.
		Irrigation	Irrigation systems development and continuation for sustainable management,	Reliable irrigation service established on the basis of sustainability.	Appropriate and efficient irrigation available for optimal use of irrigable land in sustainable manner.
	mechanisms	Information systems	Functional water-related system established.	Water-related system functioning.	Water-related information system enhanced.
		Policy & legal	Appropriate policy and legal framework, including equitable water use rights, established.	Adequate legal framework functioning	Adequate legal framework functioning and adapted to changing circumstances.
		Regional cooperation	Regional/bilateral cooperation framework normalised.	Effective mechanism for regional/bilateral cooperation functioning.	Regional/bilateral cooperation for mutual benefit achieved.
		Institutional mechanisms	Appropriate institutions established	Institutional mechanism for integrated management functioning.	All institutions functioning effectively

Conclusions

Satisfying public water demands while simultaneously protecting the ecological support functions of freshwater systems will be one of the most difficult and important challenges of the country's future. Water scarcity has spread rapidly in many areas of the country as population and consumption levels have increased against a fixed supply of renewable fresh water.

- Meeting the challenges water scarcity poses to food production, environmental protection and political and social stability will require new approaches to using and managing water.
- Greater effort will be needed to reserve water for the maintenance of the environment and, where necessary, to return water to natural systems to restore their functions.
- Concerted efforts will also be needed to slow the growth in human demands for water.
- Creative new ways of obtaining both commodity and ecosystem benefits from the same volume of water will also be needed. Developing and implementing these options will require new partnerships and alliances that draw upon the expertise of professionals from many fields.

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