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Yemen's Water Crisis

Review of background and potential solutions

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ABSTRACT:

The following document presents background information on Yemen's water crisis, identifies international assistance efforts, and describes potential solutions introduced from a variety of sources. The primary factors contributing to water scarcity are population increase, qat production, and illegal drilling of wells. Broader influences are lack of government capacity and climate change. The World Bank and GIZ are the major donors addressing the issue, focusing largely on capacity building and infrastructure improvement projects. Solutions identified include strengthening state institutions, improving agriculture and irrigation efficiency, and increasing water management information capacity.

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Table of Contents

Contents

Review	2
Primary factors	2
Population and water availability.....	2
Agriculture and qat	2
Illegal wells and infrastructure	3
International assistance	3
World Bank	3
GIZ	4
JICA	4
IDB	4
IFAD.....	4
UNDP.....	5
Private Sector	5
Potential solutions.....	5
Strengthen state institutions	5
Improve agriculture efficiency	6
Develop information resources.....	6
Bibliography	7

Review

Primary factors

Water shortages are frequent in Yemen and Sana'a may be the first capital to run out of water.¹ Growing water scarcity is exacerbating the country's existing social, economic and political instability. *Foreign Policy* identified the country as a "perfect storm of state failure" and ranked the country 18th in its 2009 Failed State Index, citing shrinking water reserves as a significant contributor to its tenuous condition.² A recent study from Sana'a University reports that 70-80% of conflicts in rural areas are related to water, and that the wells in Sana'a may run dry by 2015 based on current consumption levels.³ The country's population of 22.2 million (2008 estimate) is rapidly growing thereby increasing strain on water supplies while human development levels remain low, making it difficult to increase adaptive capacity and resilience to water shortages and other climate change related impacts.

Population and water availability

The country is predisposed to water shortages due to the limited rainfall and groundwater it receives. Fifty years ago, Yemen's water supply was about 1100 m³ per person per year, already near the WHO's recognized "water poverty line" of 1000 m³ per capita. By 1990, water availability dropped to 460 m³ per capita, and is now estimated to be 120 m³ per person, or about 2% of the global per capita average.^{4, 5} The current national population growth rate is about 3.5% annually,⁶ 4.9% in urban areas,⁷ and upwards of 7% in Sana'a, making it the fastest growing capital in the world.⁸ Immigrants from neighboring Somalia make up a substantial portion of the population increase. Yemen's government estimates that 2 million Somali refugees have come to the country since the start of Somalia's civil war, with 43,000 immigrants having arrived from Somalia and Ethiopia in the first four months of this year.⁹

Agriculture and qat

Irrigated agriculture is a substantial driver of water scarcity, accounting for about 90% of groundwater consumption.¹⁰ A disproportionately high amount of agriculture is devoted to the production of water-intensive qat, a plant whose leaves are a narcotic used by 80% of the population. Though qat occupies only 15% of cultivated area in Yemen, it consumes roughly 70% of groundwater extracted.¹¹ While Yemen's government acknowledges that qat production should decrease in light of water scarcity, qat provides a livelihood to many rural farmers. Qat production has increased 13-fold (from 8000 to 103,000 ha) between 1970 and 2000, while grape production increased only two-fold (from 10,000 to 23,000 ha) over the same time.¹² Production of the lucrative crop is

¹ Boucek, Christopher. 2009. Yemen: Avoiding a Downward Spiral. *Carnegie Papers* no. 102.

² *Foreign Policy*. 2009. The Failed States Index 2009.

³ Kasinof, Laura. 2009. At heart of Yemen's conflicts: water crisis. *Christian Science Monitor*.

⁴ World Bank. 2002. *The Republic of Yemen – economic growth: sources, constraints and potentials*.

⁵ World Bank. 2009. *Yemen: reducing serious water stress*. Water in Middle East and North Africa.

⁶ CIA. 2009. Yemen. The World Factbook.

⁷ UNSD (United Nations Statistics Division), 2011. Yemen.

⁸ Mcleod, H. and Vidal, J.. 2010. Yemen threatens to chew itself to death over thirst for narcotic qat plant. *Guardian*

⁹ Darem, Faisal. 2012. Yemen takes in record number of refugees from Horn of Africa. *Sabahi*.

¹⁰ Al-Asbahi, Qahtan Yehya A.M. 2005. Water Resources Information in Yemen. UN Statistics Division.

¹¹ Mcleod, H. and Vidal, J.. 2010. Yemen threatens to chew itself to death over thirst for narcotic qat plant. *Guardian*

¹² MPIC (Ministry of Planning). 2003. Implementing the poverty reduction strategy in rural areas. Yemen's Rural

largely controlled by Yemen's tribal leaders, politicians, and military officials. With the interests of the country's powerful leaders at stake, the government makes little concerted effort to reduce qat production despite the urgings of international groups.¹³ Existing irrigation infrastructure is only about 30-40% efficient and while improved irrigation systems are in use, they only account for 4% of irrigated land.¹⁴

Illegal wells and infrastructure

Illegal wells are a significant contributor to Yemen's water crisis. As water becomes increasingly scarce, additional wells are drilled as a short-term solution. Yemen's previous minister of water estimated that 99% of all water extracted is unlicensed and that 800 drilling rigs are operating illegally. (In contrast, there are just three rigs in Jordan, and India has 100, despite a population 50 times that of Yemen.)¹⁵ Weak government institutions are ineffective at preventing illegal drilling and in many cases government officials are guilty themselves of drilling illegal wells. The current minister of water, Abdelsalam Razzaz, claims that nearly all government and tribal leaders have illegal wells for personal use.¹⁶ Additionally, poor infrastructure and leaky wells can result in water losses of up to 60% in urban areas.¹⁷

International assistance

World Bank

Through the International Development Association (IDA), the World Bank has invested with Germany and the Netherlands in projects supported by the Yemen Social Fund for Development and other activities as part of Yemen's national water sector strategy. IDA funded projects helped improve irrigation efficiency to save 50 million m³ of water on 41,000 ha; increased reliability and monitoring of urban water infrastructure, reducing unaccounted-for-water by 10-15%; supported institutional reform to bring together government water-related institutions; and develop seven-year National Water Sector Strategy and Investment Plan.¹⁸ Below is a sample of IDA-supported projects since 2000, provided by the World Bank's website¹⁹:

- Urban water reform: Sana'a Water Supply and Sanitation project (US\$24 million, 2003-2009) and Urban Water Supply and Sanitation project (US\$150 million, 2002-2010)
- Demand-driven approaches: Rural Water Supply and Sanitation Project (US\$40 million, 2000-2009) and Yemen Social Development Fund (US\$75 million for phase III, since 2004)
- Basin planning: Support to the National Water Resources Authority in establishing representative basin committees armed with accurate information on water balance and projections made by computer simulation basin models based on the meteorological and groundwater data collected by field staff. Sana'a Basin Water Management Project (US\$24 million; 2003-2009)

Development Strategy.

¹³ Logan, Joseph. 2012. Rampant water "pillage" is sucking Yemen dry. *Reuters*

¹⁴ Al-Asbahi, Qahtan Yehya A.M. 2005. Water Resources Information in Yemen. UN Statistics Division.

¹⁵ Boucek, Christopher. 2009. Yemen: Avoiding a Downward Spiral. *Carnegie Papers* no. 102.

¹⁶ Logan, Joseph. 2012. Rampant water "pillage" is sucking Yemen dry. *Reuters*

¹⁷ Kasinof, Laura. 2009. At heart of Yemen's conflicts: water crisis. *Christian Science Monitor*.

¹⁸ World Bank. 2009. *Yemen: reducing serious water stress*. Water in Middle East and North Africa.

¹⁹ *Ibid.*

- Improved water use efficiency: Groundwater and Soil Conservation Project (US\$55 million; 2004-2011) and Irrigation Improvement project (US\$21 million; 2000-2008)
- Committed US\$90 million to a multi-donor Water Sector Support project (WSSP; US\$340 million, 2009-2014) that supports the government's national water strategy.

The World Bank has support 53 water-related projects in Yemen for a total of USD\$1.3 billion.²⁰

GIZ

German and Yemen governments have partnered together for over 20 years on technical improvements in Yemen's water sector, primarily focusing on urban areas. Since 2006, the German government has partnered with Yemen on the Yemeni – German Water Sector Program. The program has five approaches: "(1) consolidation of sectoral reform; (2) human resource development; (3) development of autonomous, commercial water and sanitation utilities; (4) decentralisation of water resource management; and (5) strengthening local actors in arid zones to promote sustainable water use."²¹ Thanks to the program, cost recovery by water utilities has increased, additional connections have been installed and service is more reliable, sanitation and wastewater treatment has improved, and local-level water saving measures are being implemented.

JICA

JICA supported the Yemeni government's *National Water Sector Strategy and Investment Programme (NWSSIP)* (2005-2009), which proposed a set of measures addressing water sector issues and promotes the conservation and better management of water resources. Between 2005 and 2007, JICA conducted "The Study for Water Resources Management and Rural Water Supply Improvement in the Republic of Yemen" which framed a plan for introducing rural water supply projects, as well as formulated the action plan for water resource management for Sana'a Basin which is at risk of water depletion. More recently, JICA announced implementation of its *Project for Rural Water Supply In Yemen* (2009), which is based on the study mentioned above. JICA's activities also include rural water supply projects focusing on new construction and rehabilitation of 19 sites in five governorates: Sana'a, Ibb, Taiz, Almahwet and Dhamar. About 150,000 people are expected to benefit from this project.²²

IDB

The Islamic Development Bank (IDB) partnered with the British government on the £1.2 million joint pilot Water and Sanitation Project to improve access to sustainable water and sanitation for 36,000 people in Al-Howta in 2008-2011.²³ The IDB is also instituting a US\$21 million water availability enhancement project to improve infrastructure and management in Sana'a.²⁴

IFAD

Three of IFAD's six current projects in Yemen support improved agricultural irrigation and access to water. Approaches include improvements in livestock practices, rainfed

²⁰ World Bank. Projects & Operations: Water projects in Yemen.

²¹ GIZ (German Society for International Cooperation). Institutional development of the water sector.

²² JICA. Water Resource Management.

²³ DFID (Department for International Development). 2010. Evaluation of DFID Country Programmes: Yemen.

²⁴ Embassy of The Republic of Yemen. 2010. IDB approves carrying out \$52 mln projects in Yemen.

agriculture, rural infrastructure, and community based natural resource management. To date, IFAD has supported over US\$250 million in water-related projects in Yemen.²⁵

UNDP

UNDP has provided technical and financial assistance to develop the Hadhramout and Tuban-Abyan Water Basin management plans, which will improve water access to over a million people in the three governorates.²⁶ The organization also funds the National Programme on Integrated Water Resources Management, a US\$3.4 million project to strengthen the National Water Resources Authority, improve water resources information collection and management, enhance local governance of water resources, and raise awareness on water use and management.

Private Sector

In 2009, for the first time, the General Investment Authority in Yemen called on the country's private sector to compete for projects to desalinate seawater in order to help resolve the current issue of water scarcity, as well as the future fear of drought. The authority maintains there is a need to establish and encourage "small to medium-sized desalination projects" in Yemen, primarily as a short-term response to increased demand for water, and to ensure that Yemen can benefit from the latest in desalination techniques. The aim is to further the acquisition of knowledge and expertise on how to establish and operate desalination plants. In early 2010, a Yemeni-Saudi firm began implementation of a water desalination station in the western port city of Hodeida. The \$31 million project is considered the largest of its kind and is anticipated to help reduce random well drilling in the province.²⁷

Potential solutions

Strengthen state institutions

It is commonly agreed by international organizations, academics, and Yemeni water officials that increasing state capacity is critical to addressing the water crisis.^{28, 29, 30} Farmer sheikhs, the Ministry of Agriculture and Irrigation, and large land owners are identified as the stakeholders most opposed to water management policies as well as holding the most power to influence those policies.³¹ The current Water Minister identifies weak government institutions as the major factor in creating and perpetuating the water crisis.³² The National Water Resources Authority (NWRA) has been described as 'dogged by a top-heavy and rather inert headquarters and lack of management vision or capability'.³³ Strengthening the NWRA would help tighten restrictions on illegal drilling of wells and improve implementation of national water plans.³⁴ Projects from both the

²⁵ IFAD. IFAD operations in Yemen.

²⁶ UNDP (United Nations Development Programme). 2010. UNDP Results: Yemen

²⁷ Yemen Post. 2010. \$31-Million Desalination Project Underway in West Yemen.

²⁸ Zeitoun Mark; Allan Tony; Al Aulqi Nasser; et al. 2012. Water demand management in Yemen and Jordan: addressing power and interests. *Geographical Journal*.

²⁹ Worth, Robert F. 2009. Thirsty Plant Dries Out Yemen. *New York Times*.

³⁰ World Bank. 2009. *Yemen: reducing serious water stress*.

³¹ Zeitoun Mark; Allan Tony; Al Aulqi Nasser; et al. 2012. Water demand management in Yemen and Jordan: addressing power and interests. *Geographical Journal*.

³² Logan, Joseph. 2012. Rampant water "pillaging" is sucking Yemen dry. *Reuters*.

³³ Ward C, Beddies S, Hariri K, Yaffiei S O, Sahoo A and Gerhager B. 2007. Yemen's water sector reform program – a poverty and social impact analysis. Republic of Yemen, GTZ, World Bank.

³⁴ Zeitoun Mark; Allan Tony; Al Aulqi Nasser; et al. 2012. Water demand management in Yemen and Jordan: addressing power and interests. *Geographical Journal*.

World Bank and GIZ have significant components to build institutional capacity at local levels (in rural areas where local commissions are more influential) and national levels. Another proposed method to reduce illegal drilling, albeit less substantial, is to implement taxes, licensing processes, or customs duty on well drilling rigs.³⁵

Improve agriculture efficiency

Reducing or exporting qat production could have a substantial effect on reducing water stress. Both Yemeni water officials and international groups have proposed exporting qat production to Ethiopia while its importation and distribution, and resulting economic benefits, could be managed by the current group of large producers.^{36,37} Stakeholder consultations identified the following strategies as important to improving water availability for agriculture:

- Improved irrigation efficiency (drip irrigation, irrigation infrastructure);
- Improved indigenous methods water use (small dam construction);
- Alternative crop production, including return to traditional crops;
- Improved water distribution systems; and
- Wastewater reuse for irrigation and aquifer recharge.³⁸

Develop information resources

Water researchers identified remote sensing and GIS techniques as having the potential to improve water resource management. Government capacity to effectively process and use water-related data is currently low. However, with adequate training and resources, data collection and analysis can help monitor current water resources and anticipate shortages. Remote sensing data from satellites provides more reliable estimates of water resources and reduces reliance on potentially uncooperative stakeholders for data collection.³⁹ Improved information capacity may provide the National Water Resources Authority and Ministry of Water and Environment with more influence among other government ministries. Information dissemination to local water associations is also important, as many management activities occur at decentralized levels.

Given security concerns and corruption, it is recommended that donors should provide strict oversight or execute projects themselves instead of directing funds to government offices.⁴⁰

³⁵ Boucek, Christopher. 2009. Yemen: Avoiding a Downward Spiral. *Carnegie Papers* no. 102.

³⁶ *Ibid.*

³⁷ Logan, Joseph. 2012. Rampant water "pillaging" is sucking Yemen dry. *Reuters*.

³⁸ Haidera, et al. 2011. Water scarcity and climate change adaptation for Yemen's vulnerable communities. *Local Environment*.

³⁹ Moore Scott, Fisher Joshua B. 2012. Challenges and Opportunities in GRACE-Based Groundwater Storage Assessment and Management: An Example from Yemen. *Water Resources Management*.

⁴⁰ Boucek, Christopher. 2009. Yemen: Avoiding a Downward Spiral. *Carnegie Papers*.

Bibliography

Al-Asbahi, Qahtan Yehya A.M. 2005. Water Resources Information in Yemen. UN Statistics Division. International Work Session on Water Statistics, Vienna, June 20-22 2005.

http://millenniumindicators.un.org/unsd/environment/envpdf/pap_wasess3a3yemen.pdf

Al-Saqqaf, Emad. 2012. Water: The challenge that faces Yemen. *Yemen Times*, May 30. <http://reliefweb.int/node/500447>

Boucek, Christopher. 2009. Yemen: Avoiding a Downward Spiral. *Carnegie Papers* no. 102. Washington, D.C.: Carnegie Endowment for International Peace. http://carnegieendowment.org/files/yemen_downward_spiral.pdf

CIA. 2009. Yemen. The World Factbook. <https://www.cia.gov/library/publications/the-world-factbook/geos/ym.html>

DFID (Department for International Development). 2010. Evaluation of DFID Country Programmes: Yemen. Evaluation Report EV706. <http://www.oecd.org/dataoecd/5/14/45012078.pdf?contentId=45012079>

Darem, Faisal. 2012. Yemen takes in record number of refugees from Horn of Africa. *Sabahi*, May 24. http://sabahionline.com/en_GB/articles/hoa/articles/features/2012/05/24/feature-01

Embassy of The Republic of Yemen. 2010. IDB approves carrying out \$52 mln projects in Yemen. Embassy of The Republic of Yemen in the Netherlands. <http://yemen-embassy.nl/Article.aspx?id=cc92f789-d0eb-434e-b18f-df6b3db2a035>

Foreign Policy. 2009. The Failed States Index 2009. *Foreign Policy* [online], 22 June. http://www.foreignpolicy.com/articles/2009/06/22/the_2009_failed_states_index

GIZ (German Society for International Cooperation). Institutional development of the water sector. <http://www.gtz.de/en/weltweit/maghreb-naher-osten/jemen/21858.htm>

Haidera, Mansour; Alhakimi, Saif Ali; Noaman, Abdulla; Al Keksi, Alkhatib; Noaman, Anwar; Fencl, Amanda; Dougherty, Bill; Swartz, Chris. 2011. Water scarcity and climate change adaptation for Yemen's vulnerable communities. *Local Environment* vol. 16, no.5, pp. 473-488.

IFAD (International Fund for Agricultural Development). IFAD operations in Yemen. <http://operations.ifad.org/web/ifad/operations/country/projects/tags/yemen>

JICA. Water Resource Management. <http://www.jica.go.jp/yemen/english/activities/water.html>

Kasinof, Laura. 2009. At heart of Yemen's conflicts: water crisis. *Christian Science Monitor*, November 5. <http://www.csmonitor.com/World/Middle-East/2009/1105/p06s13-wome.html>

Logan, Joseph. 2012. Rampant water "pillaging" is sucking Yemen dry. *Reuters*, March 28. <http://www.reuters.com/article/2012/03/28/us-yemen-water-idUSBRE82R0RZ20120328>

McLeod, H. and Vidal, J.. 2010. Yemen threatens to chew itself to death over thirst for narcotic qat plant. *Guardian*, February 26. <http://www.guardian.co.uk/environment/2010/feb/26/yemen-qat-water-drought>

Moore Scott; Fisher Joshua B. 2012. Challenges and Opportunities in GRACE-Based Groundwater Storage Assessment and Management: An Example from Yemen. *Water Resources Management* vol. 26, no. 6, pp. 1425-1453. <http://josh.yosh.org/publications/Moore%20&%20Fisher%202012%20-%20Challenges%20and%20opportunities%20in%20GRACE-Based%20groundwater%20storage%20assessment%20and%20management-%20an%20example%20from%20Yemen.pdf>

MPIC (Ministry of Planning). 2003. Implementing the poverty reduction strategy in rural areas. Yemen's Rural Development Strategy.

UNDP (United Nations Development Programme). 2010. UNDP Results: Yemen. <http://www.undp.org/content/dam/undp/library/corporate/results/english/Results-yemen-2010-EN.pdf>

UNDP. 2012. National Programme on Integrated Water Resources Management (IWRM) - Project Fact Sheet. http://www.undp.org/ye/env_fact1.php

UNSD (United Nations Statistics Division). 2011. Yemen. New York, NY: United Nations Statistics Division. <http://data.un.org/CountryProfile.aspx?crName=Yemen>

Ward C, Beddies S, Hariri K, Yaffiei S O, Sahooley A and Gerhager B. 2007. Yemen's water sector reform program – a poverty and social impact analysis. Republic of Yemen, GTZ, World Bank. Washington DC. <http://www.tc-wateryemen.org/documents/downloads/EnglishFullReport.pdf>

World Bank. 2002. *The Republic of Yemen – economic growth: sources, constraints and potentials*. Washington, DC: The World Bank.

World Bank. 2009. *Yemen: reducing serious water stress*. Water in Middle East and North Africa. <http://go.worldbank.org/SOS3F9MVY0>

World Bank. Projects & Operations: Water projects in Yemen. <http://web.worldbank.org/external/projects/main?pagePK=223716&piPK=95917&theSitePK=40941&menuPK=225435&pagenumber=1&pagesize=10&sortby=BOARDSORTDATE&sortorder=DESC&category=advsearch&query=ALL&status=ALL®ioncode=ALL&countrycode=RY§or=AI&majorsector=W§orboard=ALL&majorthemeid=ALL&themeid=ALL&network=ALL&procline=ALL&proclinetype=ALL&lendinstrtype=ALL&lendinstr=ALL&goalid=ALL&metathemeid=ALL&startyr=ALL&endyr=ALL&env=ALL&match=all>

Worth, Robert F. 2009. Thirsty Plant Dries Out Yemen. *New York Times*, October 31. <http://www.nytimes.com/2009/11/01/world/middleeast/01yemen.html?pagewanted=all>

Yemen Times. 2010. Private sector considers desalination to save Yemen from drought.

Yemen Post. 2010. \$31-Million Desalination Project Underway in West Yemen. Yemen Post, April 10. <http://www.yemenpost.net/Detail123456789.aspx?ID=3&SubID=1758>

Zeitoun Mark; Allan Tony; Al Aulaqi Nasser; et al. 2012. Water demand management in Yemen and Jordan: addressing power and interests. *Geographical Journal* vol. 178, pp. 54-66.

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