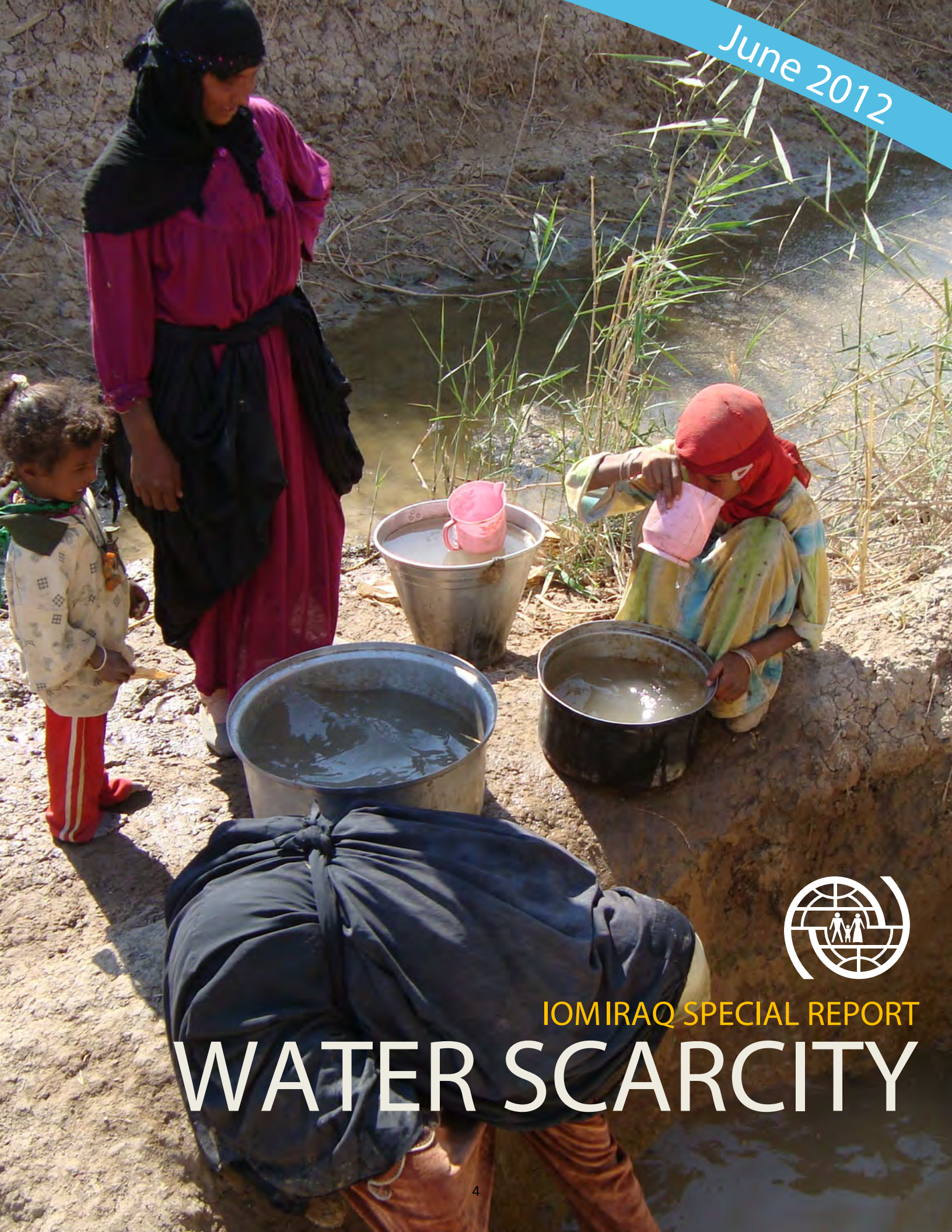


June 2012



IOM IRAQ SPECIAL REPORT

WATER SCARCITY

IOM-IRAQ SPECIAL REPORT

Water Scarcity



Since March 2011, IOM Iraq has been conducting a water scarcity assessment to measure the impact that lack of water, high salinity, and poor water quality have had on the lives of vulnerable families throughout Iraq. IOM monitors regularly consult local councils, mayors, mukhtars, and other religious and community leaders in order to ascertain indicative information such as water sources and quality, access to water, and the manner in which a lack of sufficient water affects agriculture and other water-reliant industries. In their assessment of 27,830 vulnerable families, field monitors have found that water scarcity is having a significant impact in the areas of health, livelihood, and day-to-day household management for vulnerable families throughout Iraq.



For some vulnerable families, rivers and lakes are the main source of water.

Background

A combination of armed conflict, sanctions and neglect of infrastructure, in addition to a lack of environmental awareness and education, have been undermining Iraq's water resource management system for a considerable period of time. 20% of households in Iraq currently use an unsafe drinking water source and a further 16% have reported having supply problems.¹ The situation is much worse in rural areas where only 43% of households have access to safe drinking water and where water for agriculture is often scarce and of poor quality.² There is a widespread lack of information and training in advanced irrigation and water treatment techniques, particularly in rural areas.³ Indeed, of the 290 locations assessed in Iraq where agriculture is the community's primary source of income, 54% rely on traditional flood irrigation, a method that wastes a great deal of water, severely damages soil and increases already high salinity levels. The resulting reduction in cropland coverage, devastating to the agricultural community, has dramatically increased rural-urban migration, putting even more pressure on urban water supplies that are already insufficient for a rapidly increasing population.

Recommendations

- Continue addressing local water-related needs by increasing the region's capacity to effectively absorb returnee and IDP communities through projects such as IOM's Community Assistance Program. These ventures should focus on providing access to adequate sources of clean water by increasing the capacity of current water treatment compact units, rehabilitating pumping stations, extending the water network and associated systems, and rehabilitating school sanitation units.
- Disseminate information aimed at improving hygiene and water usage awareness through targeted awareness campaigns.
- Initiate projects that focus on providing farmers with access to sufficient irrigation water. This should include dredging of existing canals, repairing water pipelines and pumps, and the distribution of new, less water intensive irrigation systems in conjunction with appropriate training sessions on their effective and efficient use.
- Rehabilitate further Karez well networks in the northern governorates, address the need for more Artesian wells throughout Iraq and initiate a general awareness campaign on the efficient utilization of irrigation water.
- Encourage broad-based cooperation on water issues, nationally amongst Iraqi agencies and organizations and internationally to promote relations with surrounding countries such as Syria and Turkey that are facing similar water-related issues.

1. IAU Water in Iraq Factsheet, October 2011

2. Ibid.

3. *National Development Plan*, 66.

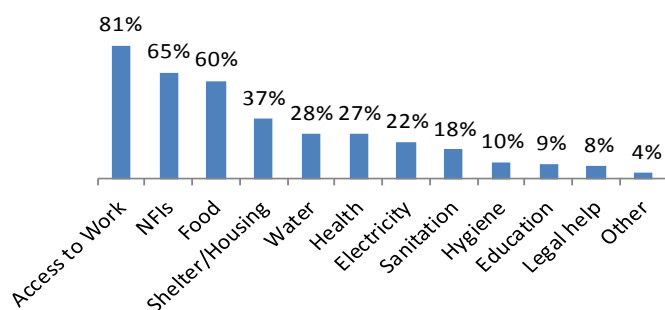


Causes and Effects of Water Scarcity throughout Iraq

The causes of Iraq's current water scarcity are complex. The region has been officially dealing with drought conditions since 2007¹ and, although they have been receding since 2009, multiple consequences are still being felt.

Since the onset of drought, 40% of cropland in Iraq has suffered a significant reduction in productivity and livestock has been devastated. This has forced 20,000 rural inhabitants to leave their agricultural communities in search of sustainable supplies of drinking water and better livelihoods.² This has put even more pressure on already insufficient urban supplies struggling to cope with a population which trebled in number to 30 million between 1970 and 2007.³

Priority needs of assessed vulnerable families, March 2011 to March 2012



As a result of the significant difficulties faced by vulnerable families with regards to quality and insufficiency of water supplies, access to water is now cited as a priority need by 28% of those families assessed throughout Iraq.

Water Quality: Do you have access to at least one source of water that is safe for drinking purposes?

Yes: 4844 Assessed Vulnerable Families (50%)

No: 4890 Assessed Vulnerable Families (50%)

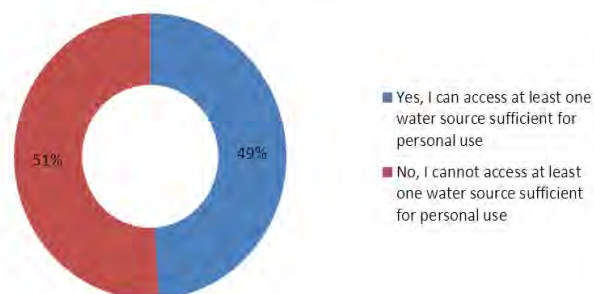
As Iraq relies on precipitation falling outside its borders for more than half of its water, it is particularly susceptible to climate change and the water-related activities of surrounding countries.⁴ Consequently, damming and water storage projects pursued by Syria and Turkey have had considerable, detrimental effects on conditions within Iraq.⁵



Evidence of receding water levels

Among families assessed by IOM Iraq monitors, one third reported insufficient access to water considered safe for both drinking and washing. Water is not only often of poor quality, but also of insufficient quantity for the requirements of vulnerable families. 51% of assessed vulnerable families report that the water available to them is not sufficient for their personal daily needs.

Is your access to water sufficient for personal use?
(percentage of assessed vulnerable families)



¹ UNDP Iraq, *Drought: Impact Assessment, Recovery, and Mitigation Framework* (Jan 2011), p.8, <http://www.iq.undp.org/UploadedFiles/Sections/b78606de-ca61-464a-afcc-97d659eab03b.pdf>.

² IAU Iraq, *Water Factsheet*, (March 2011), <http://www.iauiraq.org/documents/1138/Water%20in%20Iraq%20Factsheet-Final.pdf>.

³ Ibid. ⁴ Ibid.

⁵ Republic of Iraq Ministry of Planning, *National Development Plan 2010-2014*, p.67, www.iauiraq.org/documents/1159ndp24th.pdf.



Distance to Available Water Source and Reliance on Water Tanks and Trucks

A significant number of assessed families in locations suffering from water scarcity rely on sources other than the municipal water grid for their water needs. All 18 governorates rely to some extent on alternative supplies such as water tanks brought in by trucks for their daily water needs. This is particularly true of Ninewa, Diyala, Basra, Baghdad and Anbar. Water trucks are often privately owned and operated, and water provided by them is generally too expensive for vulnerable families, as monitors in both Thi-Qar and Anbar have reported.

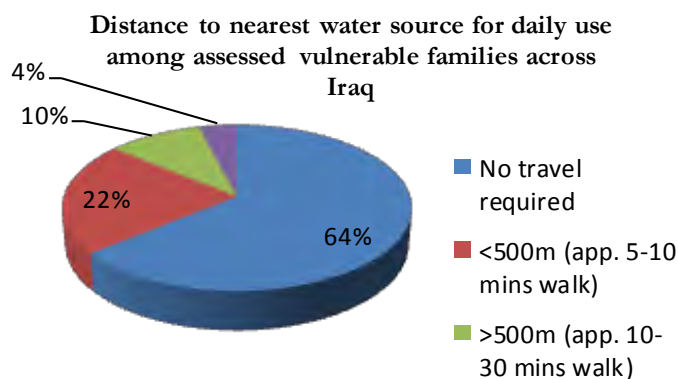


Fig. 1



Members of an IDP community waiting to offload a water tank

Those families who are in a position to afford water from tanks and trucks often experience difficulties coping with the distance that must be covered in order to retrieve it. 36% of assessed vulnerable families report having to walk at least some distance to access water for daily use, and 14% are forced to walk for more than 10 minutes on a regular basis for water (see fig. 1 above). In the governorate of Qadisiya, for example, IOM Iraq monitors report that vulnerable IDP and host community families in the village of Hay Al-Sinae are only able to access water from the main line that is more than 500 meters from their homes. Storing and treating water can often be a significant issue for those not connected to the public water grid. Monitors consistently report a lack of water purification facilities and sanitary storage equipment among vulnerable families, who often have to store water in buckets, cans, or other household containers that are not fit for purpose.



Utensils used to bring water from a river in Missan



Drawing water from tanks in Muthanna



Pollution And Salinity Problems in Available Water Sources

In addition to challenges related to distant water sources and safe water storage, vulnerable families also face significant problems with pollution and salinity. These two issues are intimately linked and are affected by both human action and climate change. Pollution enters the water network as a result of bad waste management practices and neglected or poorly maintained canals.

Furthermore, the use of drainage water in agricultural irrigation, in combination with traditional flood irrigation techniques, leads to water logging, rising groundwater and, subsequently, higher levels of pollution and salinity. 8% of the rural Iraqi population¹ and 24% of IOM-assessed vulnerable families use public or private wells as their main source of water. However, they often lack the means to filter that water and are thus exposed to pollutants. Monitors in the governorates of Babylon, Missan, Muthanna, and Qadissiya have reported considerable evidence of polluted or highly saline water obtained from privately dug wells being used as drinking water.



Children in Qadissiya filling buckets from a private well.

The quality of water used for drinking and agriculture in Iraq still violates Iraqi National Standards and WHO guidelines.² Leaking sewage pipes and septic tanks contaminate the drinking water network with wastewater and, furthermore, just 18% of wastewater is treated, with the rest released directly into waterways.³

The use of rivers, streams, and lakes, or the illegal siphoning of water from open pipes, therefore carries a significant risk of exposure to pollutants. 12% of assessed vulnerable families cite using one of these as their main source of water. Dependence on polluted water sources is strongly linked to high rates of water-related health issues including dehydration, diarrhea, and skin infections in many assessed vulnerable locations.

Young children are particularly susceptible to these dangers. Indeed, of the almost 884,000 cases of diarrhea recorded in 2010, 57% were children under the age of five.⁴ This statistic has surely contributed to Iraq's high infant mortality rate which in 2006 stood at 41 of every 1000 children in Iraq dying before the age of 5.⁵



Members of a female-headed household in Babylon collecting water for their daily use

1. IAU Water in Iraq Factsheet, October 2011

2. Ibid

3. Ibid

4. Ibid

5. Ibid



Tensions due to Water Scarcity in Iraq

Local Conflict over Water

On the local level, competition for scarce water resources is often leading to conflict. Monitors in the governorate of Baghdad have reported incidents of tension or verbal arguments related to water access in 38 different locations during the assessment period, often occurring every day. Some locations in the governorate of Salah Al-Din even saw incidents of physical violence related to water. Improved access to water across Iraq is thus essential, not only for the well-being and health of individuals but also for the stability and development of vulnerable communities.



Ethnic Tensions over Water



Vulnerable families in Kirkuk must often walk considerable distances to collect drinking and irrigation water

The issue of water scarcity has the potential to increase levels of tribal and ethnic tension within Iraq. Examples include the Kurdish Regional Government's ongoing dam building project, which currently involves the construction of 11 dams with a further 28 at the design stage,¹ and Iran's tributary diversion and damming activity.

The consequences of these conflicts of interest are already being felt in Kirkuk where the diverse population includes ethnic Arabs, Turkmen and Kurds. Arab farmers have accused Kurdish officials of ruining their crops by closing release valves to the Dukan dam in Sulaymaniyah during the winter months when water intensive crops such as wheat and corn are grown.

Some farmers have reportedly been forced to set aside one third of their land and cultivate only small patches near artesian wells due to an inability to transport scarce water supplies over greater distances. Sheikh Burhan Mezher, head of Kirkuk's agricultural department, has noted that thousands of people, driven to unemployment, blame their situation on Kurdistan.²

Iraqi farmers recently blocked border crossings from Iran, east of Baghdad, to protest against Tehran's diversion of the Al-Wind River that irrigates one of Iraq's largest agricultural areas. "The protesters prevented 360 pilgrims from entering Iraq and distributed leaflets stating that the drying of the Al-Wind river is a mortal blow to the environment,"³ said Mohammed Othman, farmers' leader and mayor of the nearby town of Khanaqin. "Iran has diverted 15 tributaries to the Tigris since 2006 alone,"⁴ observed Casey Walther who, until January, was the UNESCO water projects coordinator in Iraq.

¹ See http://www.upi.com/Business_News/Energy-Resources/2012/01/27/Iraq-water-crisis-could-stir-ethnic-clash/UPI-56601327698003/

² See <http://www.google.com/hostednews/afp/article/ALeqM5hNTr6MIUalCrIko8PO3SVyYqV20A?docId=CNG.e879b80d1011df0465e895c1c65e4e6d.91>

³ See <http://www.aliraqi.org/forums/showthread.php?t=103048>

⁴ See http://www.upi.com/Business_News/Energy-Resources/2012/01/27/Iraq-water-crisis-could-stir-ethnic-clash/UPI-56601327698003/#ixzz1kkYuuOFg

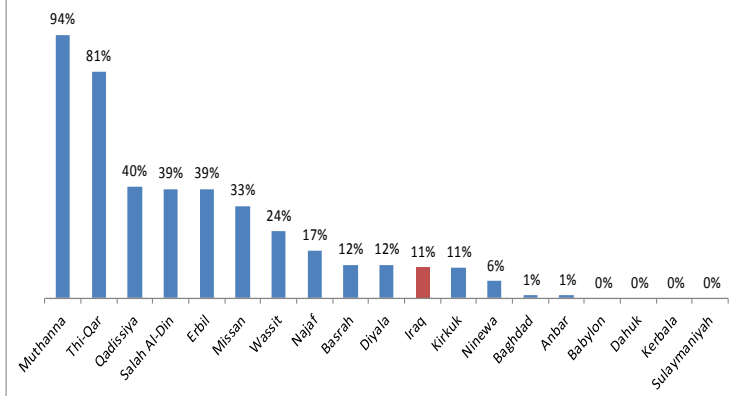


Displacement due to Water Scarcity in Iraq

Some governorates have been particularly badly affected by drought in terms of the effects that water scarcity has had on levels of displacement. Muthanna and Thi-Qar are examples of governorates in which numbers of IDPs citing drought as a reason for displacement far exceed those citing other contributory factors, such as conflict and lack of employment opportunities (see sections on water-related issues in the south-central governorates p. 8,9 and 10). The devastating effects of water scarcity are, however, not just being felt in governorates which display comparatively high levels of drought-induced displacement. In Kirkuk, for example, where IOM monitors report that 11% of assessed IDP families have cited drought as a

reason for displacement within or from the governorate (equal to the Iraq-wide average), the agricultural community is struggling to cope with the conditions. 63% of assessed farmers in Kirkuk have reported death amongst their livestock due to water scarcity, 23% have been forced to sell and 86% of arable farmers felt it necessary to change the crops they cultivate in favor of ones that require less water. 51% of these farmers are still utilizing water-intensive, traditional flood irrigation.

Percentage of Assessed IDPs Citing Drought as a Reason for Displacement from the Governorates of Origin Below



Boys in Diyala collect water from a stagnant pond

In Diyala, where monitors have reported a drought-induced displacement level of 12% (only just above Kirkuk and Iraq as a whole), a combination of heightened security concerns and water scarcity have made conditions particularly difficult for vulnerable IDP communities that are struggling to cope with a lack of both drinking and agricultural irrigation water. The security situation has made it very difficult for relief operations to provide fresh drinking and agricultural water to outlying villages. Furthermore, dams erected in Iran have reduced the flow of the Harran river to a trickle, forcing villagers to rely on water extracted from wells which is often highly saline and unsuitable even for livestock. Hundreds of families have reportedly been displaced from villages such as Tuhmaya, located near the Iranian border, which is now said

to be almost completely deserted.¹ The Department of Agriculture in Diyala has recently announced that, due to a combination of drought, damming projects and sidelined agricultural plans, about 200,000 acres of agricultural land has been either destroyed or badly damaged, leading to high levels of rural to urban migration.² IOM monitors have reported significant levels of well-water dependency within vulnerable communities in Diyala. 95% of assessed farmers reported that they had been forced to sell livestock due to water scarcity and 99% had been forced to convert to crops that are less water dependent. 58% of assessed arable farmers are still utilizing traditional flood irrigation.

¹ See http://www.rferl.org/content/Drought_Iranian_Dams_Force_Iraqi_Farmers_To_Abandon_Crops/1842000.html

² See <http://www.dinarrumor.com/showthread.php?33121-Vast-agricultural-areas-affected-by-desertification-in-Diyala>



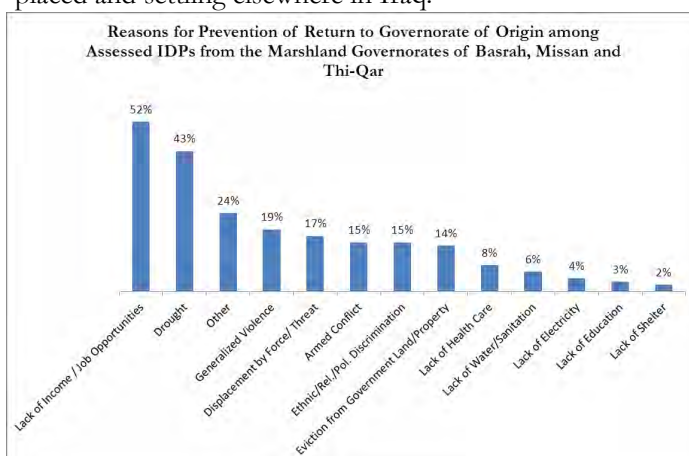
IOM monitoring of displacement from the Marshes

Once covering an area of approximately 20,000 km²,¹ by the latter part of the 20th century between 300,000 and 500,000 people were reported to be living in and around the Marshes. The livelihoods of the members of this population depended on the continuing health of the marshland ecosystem which provided a productive, fertile environment suitable for fishing, agriculture and livestock husbandry. Material for building was also available and an abundance of fresh drinking water made it effectively self-sufficient. As a result of upstream damming and a systematic campaign of targeted draining in the 1980s, over 90% of the original marshland area was desiccated. This has led to significant levels of rural to urban migration² and the drought conditions of recent years have only exacerbated the situation.



Evidence of desiccation in the marshland environment near to the village of Hamedeyyah.

In the marshland governorates of Basra, Missan and Thi-Qar, a major factor preventing IDP families from returning to their original communities is water scarcity and high salinity and/or pollution levels. IOM monitoring staff have assessed just over 150 IDP families who were displaced from the southern marshlands during the nineties, mostly due to marshland drainage and a subsequent lack of job opportunities. In addition to this population, another sample of 50 IDP families displaced during the eighties due to conflict were interviewed. 43% of assessed vulnerable IDP families from the Marshland governorates have cited water scarcity as a reason preventing their return. This figure puts it just behind a lack of income or employment opportunities and significantly in advance of several other significant factors such as conflict, discrimination, lack of suitable shelter and a lack of electricity. As previously discussed, a lack of employment opportunities and drought are intimately linked due to the predominance of agriculture as a means of income in the Marshes. It is estimated that more than 75,000 individuals fled across the border to Iran with a further 100,000 being internally displaced and settling elsewhere in Iraq.³



IOM staff have identified and interviewed returnee families in all three Marshland governorates and report that their return had largely been prompted by difficulties faced in their location of displacement and not solely due to a genuine desire to return to their original communities. Other cited influences include a general improvement in the security situation and the lure of government grants. Many interviewed returnee families continue to live in particularly difficult conditions and share similar challenges to those experienced by their host communities.

Most state their priority needs as access to sufficient water, employment opportunities, sufficient supplies of food and non-food items, adequate housing, and sanitation. Most members of the communities assessed in these locations are either illiterate or have only been educated at the primary level. Many have skills related to farming, animal husbandry and fishing and therefore, due to the devastating effects of water scarcity on these industries, lack a sustainable income source.

^{1/2/3} United Nations Integrated Water Task Force for Iraq, Managing Change in the Marshlands: Iraq's Critical Challenge (2011), <http://iq.one.un.org/documents/Marshlands%20Paper%20-%20published%20final.pdf>.



Water-Related Issues in the South-Central Governorates

The pre-eminent water-related issues in the south-central governorates are those of low river water levels and high levels of salinity and pollution. These factors have led to significant difficulties in terms of satisfying the demand for both drinking and agricultural water supplies. Monitors in the governorates of **Basra, Muthanna, Missan, Thi-Qar, Wassit and Qadissiya** have all reported severe water scarcity in terms of a general lack of river water, often indicating salinity levels of up to 60% in addition to sulphur levels which rise above that recommended for human consumption. Many communities have no access to the municipal water grid and, where they do, it is often of limited supply or contaminated. Alternative sources of water such as public and private wells, rivers and lakes are themselves often contaminated or highly saline and therefore unsuitable for either personal or agricultural use. Water can often not be extracted and transported due to a lack of pumps and pipe networks and the water is often left untreated in the absence of purification and desalination facilities. Distance to the nearest available water source is often also an issue. Monitors in Thi-Qar have indicated that some villagers, having no access to the water grid, are forced to travel 3km to the nearest river in order to obtain supplies.

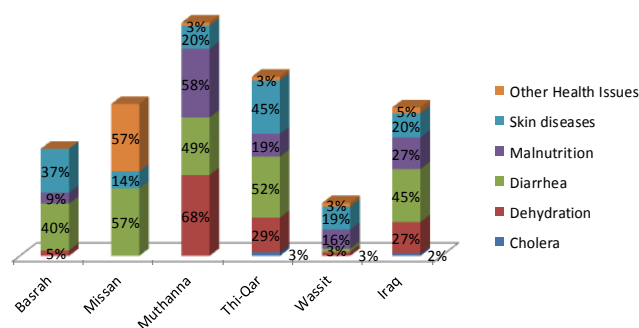
Water and Health

These issues have contributed to the current high levels of water-related health problems amongst assessed vulnerable communities. From the chart (below) it can be seen that the rate of water-related health problems is often well above the average for Iraq in the south-central governorates. Particularly notable are levels of dehydration in Muthanna (68%) compared to an Iraq average of 27%. Diarrhea is also a problem in Missan (57%) and Thi-Qar (52%), both significantly higher than the Iraq average of 45%. Instances of skin diseases are higher than in the whole of Iraq in two of the five southern governorates, reaching 45% in Thi-Qar compared to an average of 20% throughout Iraq.



Children from IDP families using a broken water pipe as a source of water for drinking and cooking

Percentage of assessed water scarce locations reported as having water-related health problems



The chart shows the percentage of all assessed locations in each governorate citing a water-related health problem. Some locations may have cited more than one problem.

Monitors have reported that many villages are having to deal with a combination of standing water and a build-up of untreated waste. This is due to a lack of suitable drainage and/or non-functioning sewage systems and a lack of any functioning waste disposal service. In tropical and subtropical regions there is a close link between the presence of excess water (due to lack of adequate drainage) and the transmission of water related vector-borne diseases.¹ Vectors, such as rats and mosquitoes are more prevalent in these areas, attracted to either waste material or the damp conditions, increasing the potential of infection for children playing in the area or for villagers using water sources for drinking, cooking and washing purposes.

¹ FAO Corporate Document Repository, Chapter 7-Health issues related to drainage water management, see <http://www.fao.org/docrep/W7224E/w7224e0b.htm>

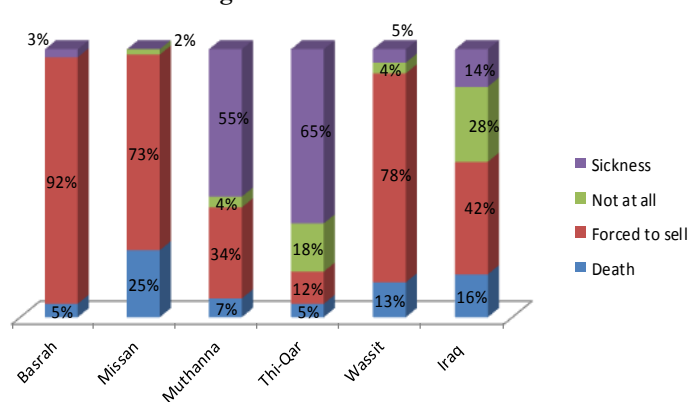


The Effects of Water Scarcity on Agriculture and Irrigation

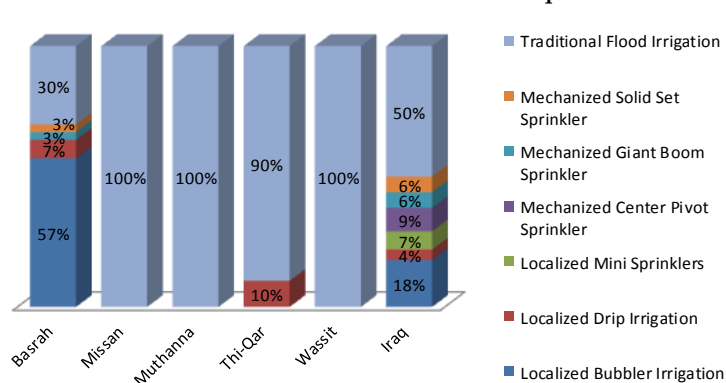
The combination of high salinity and pollution has led not only to increased levels of water-related health problems within the human population but has also often had devastating consequences for livestock. Monitors in Muthanna have reported that, in some villages, up to 90% of livestock have died as a result of scarce and low quality water supplies. Agriculture, animal husbandry and fishing, the three most prevalent industries in the region, have all been badly affected by water scarcity and low water quality, leading to increased levels of unemployment. In assessed agricultural areas identified as water scarce, many farmers have been forced to change their crops to varieties that require less water, as in Missan (100% of assessed farmers), Basra (99%) and Wassit (96%). In Basrah, Missan and Wassit, the percentage of assessed farmers forced to sell their livestock and, presumably, look for another means of income was significantly above the figure for Iraq as a whole. Sickness levels amongst livestock in Muthanna and Thi-Qar were also particularly high, indicating an urgent need for greater access to sufficient supplies of clean water in order to improve both health and levels of employment.

It can be seen from the chart (right) that agricultural communities in Missan, Muthanna, Thi-Qar and Wassit are all still predominantly using traditional flood irrigation methods. This method is known to not only use large quantities of irrigation water, but also to significantly degrade the quality of the soil and increase levels of salinity (see Annex 1 for a more detailed assessment of irrigation methods). It can also be seen from the chart (below) that all six governorates rely on surface water as their main source. With water levels in rivers and canals particularly low within these governorates, farmers are finding it increasingly difficult to transport irrigation water from these sources to agricultural land without digging expensive irrigation canals or investing in equally expensive pumps and pipe networks in order to facilitate water transfer. In addition, continuing with these methods would not only be inefficient, in terms of costs related to both equipment and labor, but would not address the chief concern within the agricultural and wider community, that of water scarcity. Even if the costs of canals or pumps could be met, large amounts of water, which are already in great demand for both personal and industrial use within Iraq, would be wasted, only adding to the drain on the country's limited supplies.

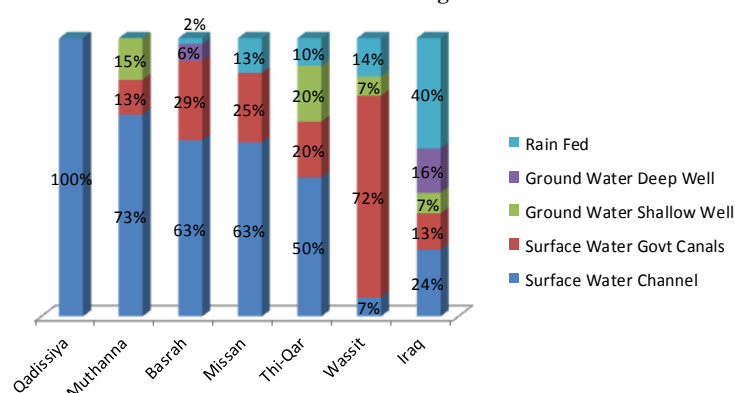
Effects of water scarcity on livestock in assessed agricultural communities



Irrigation methods used by assessed agricultural communities in south-central Iraq



Source of irrigation water among assessed agricultural communities in the south-central governorates

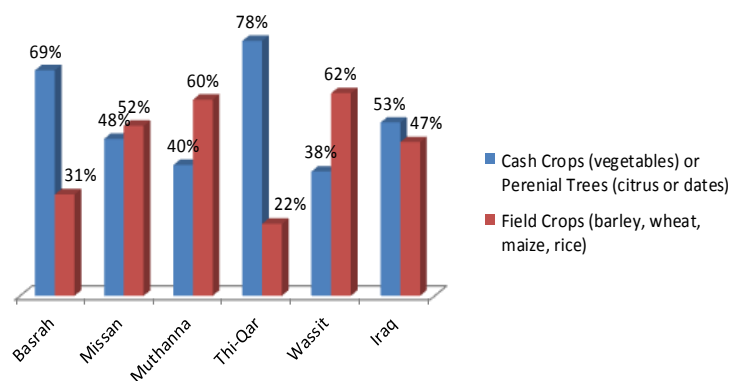




The Effects of Water Scarcity on Agriculture and Irrigation (cont.)

If Basra is taken as an example, we can see that the governorate's agricultural community uses a much wider variety of irrigation methods than those in other south-central governorates. Only 32% of assessed agricultural communities within the governorate still use traditional flood irrigation compared to 100% in Missan, Muthanna and Wassit. Farmers have started to use more modern techniques such as localized bubbler irrigation, drip irrigation and sprinkler systems which require much less water to effectively irrigate crops. This transfer has taken place in conjunction with a trend towards the cultivation of cash crops such as vegetables and perennial fruit trees. These crops require more localized irrigation and are therefore well suited to the techniques mentioned above. They are more profitable for the farmer and much more efficient in their demand for water.

Percentage of assessed agricultural communities specializing in cash or field crops in the south-central governorates



Special Focus: The effects of water scarcity on agriculture in Rotah Al-Helijyah



Local people gather in a traditional reed-built house

In Rotah Al-Helijyah, within the Al-Qurna district of Basra, monitors have reported that returnee families are struggling to cope with the effects of drought, particularly the low levels of river water in the area. These conditions prevent farmers from effectively transporting water to agricultural land for irrigation purposes. The traditional irrigation methods often used by these farmers are particularly water intensive and therefore rely on the regular movement of large quantities which are not available or not transportable without the use of large and expensive water pumps. These pumps require regular maintenance and consume large amounts of fuel. An alternative solution would be to dig deep irrigation channels from the river source to agricultural lands, however, this is also an expensive undertaking. Neither of these solutions would alleviate demand on already scarce water supplies and it is therefore recommended that alternative remedies are developed. More modern methods of irrigation would provide a more effective and longer-term strategy to combat the drought-related problems currently being faced by the farmers of Rotah Al-Helijyah. Monitors have also reported that a consequence of the drought has been an increase in levels of unemployment, due to a general reduction in the occurrence of work opportunities within traditional agricultural, animal breeding and fishing industries. Any reduction in water consumption would assist in the revitalization of all three of these sectors allowing the potential for employment growth.

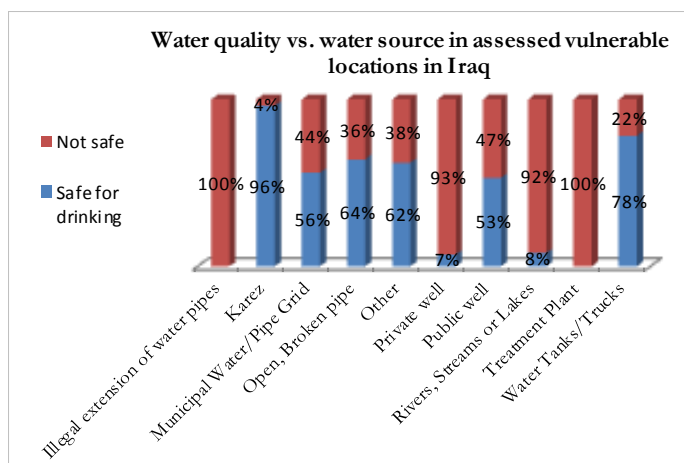


Water-Related Issues in North-Central Iraq

The most challenging water-related issues affecting the governorates in north-central Iraq are the lowering of the water table as a result of a significant decrease in the amount of expected rainfall, and a subsequent rise in the level of water salinity and pollution. One of the most significant water-related problems common to all of the northern governorates is a widespread lack of well water which has become insufficient for either personal or agricultural use in many areas. Monitors in **Erbil, Ninewa, Kirkuk, Sulaymaniyah, Dahuk** and **Salah Al-Din** have all reported problems experienced by members of vulnerable communities who, in the absence of well water, have either no or very limited access to municipal water. Monitors in Kirkuk have reported that any water that is available from depleted wells is often high in salinity and therefore unsuitable for either drinking or agricultural use without desalination. It can be seen from Fig.1 that, in relation to all other sources of water, Karez wells display the highest levels of water safety. A UNESCO-commissioned survey, carried out in 2009, identified 683 of these subterranean aqueduct-supplied wells throughout the governorates of Dahuk, Ninewa, Erbil, Kirkuk and Sulaymaniyah.¹ (For a more detailed discussion of Karez wells see p.14).



A widow receives water from a water tank in the village of Adibahg in Kirkuk



Access to Municipal Water

In Ninewa, some villages are reported to receive grid water only every seven to ten days and in others this frequency falls to once per month. Other villages have no access at all, particularly in more remote, higher altitude locations where significant levels of kidney disease have been identified. Monitors in Kirkuk have noted that in one village, 30% of villagers rely on water taken from a broken pipe whilst the remaining 70% obtain water from trucks. In Erbil and Dahuk, monitoring staff have noted that, due to a paucity of well water, villagers are often forced to travel up to 2km in order to obtain water from lakes and rivers. This source of water is often contaminated and left untreated as many villages have no access to water filtration and purification equipment. 50% of assessed vulnerable families in Kirkuk reported that water sources were insufficient for personal use while this figure rose to 66% in terms of business use.



A boy drinking water from a makeshift water pipe in Dahuk

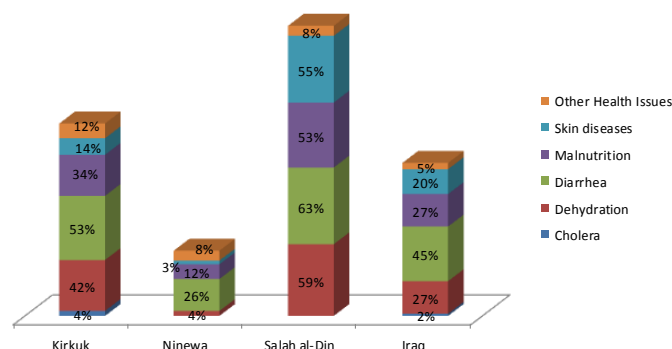
¹ Lightfoot, Dale. 2009. UNESCO Survey of Infiltration Karez in Northern Iraq: History and Current Status of Underground Aqueducts, p.3



Water Scarcity and Health in North-Central Iraq

As can be seen from the chart (right), water-related health problems are not as prevalent in north-central Iraq as in the south-central governorates. However, there are some notable exceptions indicating that water scarcity is a contributive factor to health problems among vulnerable populations in the north. In Kirkuk and Salah Al-Din, percentages of locations reporting dehydration, diarrhea and malnutrition are significantly above those for Iraq. Instances of skin diseases in Salah Al-Din are also significantly higher than the country average. As previously mentioned, monitors have reported that communities often have little or sporadic access to clean municipal water sources and are often forced to either use well water which is often high in salinity and/or pollution or to travel, often significant distances, in order to retrieve water from river and lakes.

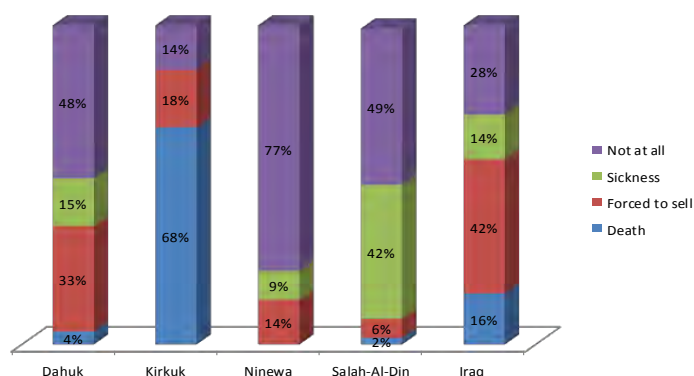
Percentage of assessed water scarce locations reported as having water-related health problems



The above chart shows the percentage of all assessed locations in each governorate citing a water-related health problem. Some locations may have cited more than one problem.

The Effects of Water Scarcity on Agriculture and Irrigation

Effects of water scarcity on livestock in assessed agricultural communities in north-central Iraq



In the absence of water filtration and purification facilities, scarce and contaminated water sources are likely to contribute not only to the degradation of human health, but also to that of livestock which, as can be seen from the chart (left), have been severely affected. In Kirkuk, for example, 68% of assessed agricultural communities reported that water scarcity had led to the death of livestock. In Salah Al-Din, 42% reported livestock sickness as a result of a paucity of water. 86% of assessed agricultural communities confirmed that, as a result of water scarcity, they had been forced to change the type of crops they cultivate to ones that require less water.

As in the south, these conditions compromise local industries and therefore levels of employment. As livestock fall victim to death or sickness and crops can no longer be cultivated due to a lack of available water or an inability to transport the little water available from rivers and lakes to arable land, farmers leave the industry in order to find alternative sources of income. This not only affects levels of agricultural production but also compromises employment opportunities, contributing to displacement from the governorate as families look elsewhere for better living conditions.

As can be seen from the chart in Annex 4 (Fig.1), although the use of traditional flood irrigation is not as widespread as in the south-central governorates, its use among assessed agricultural communities in Dahuk (100%) and Ninewa (81%) is still significantly above the average for Iraq, which is itself high at 50%. Some of the other northern governorates are converting to more modern and less water intensive methods of irrigation, often (but not always) concurrent with a tendency towards cash crops such as vegetables and perennial trees (Annex 4 –Fig.3) which are more suitable for drip and sprinkler techniques (see Annex 1 for more details). It can also be seen in Annex 4 (Fig.2) that the northern governorates rely predominantly on rain-fed or either deep or shallow ground irrigation water sources. For these reasons, the trend towards less water intensive crops and irrigation methods should be continued in addition to the implementation of projects aimed at reviving and rehabilitating the widespread network of Karez and other types of wells in the region.



SPECIAL FOCUS: IOM's contribution to the Karez development project in northern Iraq

As a contributing partner, working in cooperation with UNESCO and the Iraqi Ministry of Agriculture and Water Resources, IOM took part in a 21-month project (April 2008 to March 2011) which aimed at increasing the water supply to rural areas of Erbil, Dohuk and Sulaymaniyah, through the rehabilitation and conservation of the traditional Karez water management system. (For a more detailed discussion of the Karez well system see UNESCO Survey of Infiltration Karez in Northern Iraq: History and Current Status of Underground Aqueducts, unesdoc.unesco.org/images/0018/001850/185057e.pdf).



All 20 of the Karez systems targeted by the project were re-stored and, in a report delivered in March 2011, IOM confirmed that, as a result of the restoration of 15 Karez, approximately 1500 people from 286 households now had increased access to water for irrigation, livestock and/or drinking water. It was also noted that, if the water discharge of all 15 Karez was added up, the total post-rehabilitation discharge had been doubled from 286,848 liters per day to 469,728 liters per day. The report went on to state that, due to the ongoing severe drought of 2010/2011, the full potential of the Karez was still not being felt but that, once groundwater tables had been fully replenished, discharge would be considerably greater.¹

In addition to these encouraging results, the rehabilitation of 10 further Karez was initiated in March 2011 in the Halabja district of Sulaymaniyah. This project is being supported by the US Commander's Emergency Response Program (CERP) and, due to the discovery of land mines in the area, in coordination with the Mines Advisory Group (MAG). Landmines are often an additional concern for villagers already having to deal with difficult conditions. A team of experts from MAG was brought in to deal with several landmines which were thought to have been washed down into the Karez site from a nearby mountain. After a full demining operation had been carried out, a wall was constructed to prevent any further landmines from reaching the site before rehabilitation work was continued on the water system. A local Karez owner, Mr Kamaran, commented that "IOM and MAG have doubly benefitted our village. Now we have both fresh water and an area safe from landmines". The demining and Karez rehabilitation operation was then followed by the organization of a MAG-led Mine Risk Education training session in Halabja city on 10th May.



This session was attended by four IOM staff and 16 members of the local community, as well as a member of the military and aimed at the further education and protection of all those working and living in those areas under the threat of landmines and other explosive materials. "We sincerely appreciate MAG's assistance with demining our Karez site and educating our staff and members of the community on the risks posed by mines" said IOM Project Manager Lucie Dupertuis.

1. See http://www.unesco.org/new/fileadmin/MULTIMEDIA_FIELD/Iraq/pdf/Reports/Quarterly/Fiche%20A5-21%20Karez%201st%20Quarter%202011.pdf



Previous IOM projects and points for further action

Previous implementation of IOM's **Program for Human Security and Stabilization (PHSS)** has assisted in the training of over 2,328 Muthanna rice farmers in the System of Rice Intensification (SRI) which aims at decreasing input costs and increasing yield. Funding from the German government and PRM during PHSS II allowed IOM to provide various farmer training courses to 818 beneficiaries from rural communities. These courses included agriculture and animal husbandry, greenhouse construction and advanced irrigation. During PHSS III, IOM was able to offer farmer training to a further 255 beneficiaries across the governorates of Anbar, Diyala, Kirkuk, Missan and Sulaymaniyah. Since 2004, IOM has initiated, developed and successfully completed 33 Community Assistance Projects in the agricultural sector and a further 135 that have focused on improving water and sanitation.

IOM is currently involved in several water scarcity-related projects in the south-central governorates. As part of the mission's **Humanitarian Assistance to Vulnerable Populations in Iraq** initiative, IOM Iraq has provided vulnerable farmers in Missan and Basrah with targeted assistance, ranging from training in advanced irrigation techniques and water conservation to the construction of greenhouses. An example of this initiative is that of Sabeeha Ali Karem. A widowed mother of six children, Sabeeha had been a farmer in a remote village in Missan before drought destroyed her crops. Missan, once a thriving center for agriculture in the south of Iraq had been a very productive environment for farmers like Sabeeha until years of drought, conflict and lack of investment made it impossible for them to continue. IOM Iraq provided her with a greenhouse which she now shares with her cousin. "The greenhouse has been a blessing to me" said Sabeeha, "Of course there is still work to be done, even with the greenhouse. I have to wake up very early and spend long hours in the field. But now I know that at the end of the season my sweat and hard work will produce a good harvest. Inshallah this year I will have three or four tons of eggplants."



Sufficient access to clean water is an urgent priority need amongst vulnerable IDP, returnee and host communities. The quality of the water that they are exposed to on a daily basis often violates both Iraqi National Standards and WHO guidelines and the health of community members is being severely compromised, particularly in areas where water is scarce. These problems are exacerbated in agricultural communities by the deteriorating health of livestock and crops as a result of low quality and insufficient supplies of water. Many farmers have been forced to abandon their vocation and their community in order to locate more favorable conditions, only adding to levels of rural/urban migration and unemployment. While acknowledging that factors influencing water scarcity are difficult to control, solutions are available that could contribute to the alleviation of these conditions. Further rehabilitation of alternative sources of clean water, such as Karez and Artesian wells, would improve access for many vulnerable communities until municipal water systems are established. The distribution of equipment necessary for the purification and de-contamination of existing supplies would reduce the prevalence of water-related health problems and would aid in improving the health of communities that currently have no choice but to expose themselves to contaminated water. The promotion and implementation of more advanced, less water-intensive irrigation techniques would drastically reduce water consumption and contribute to an urgently required reduction in the Iraq-wide demand for already limited water resources. In light of these conclusions, IOM will continue to initiate and implement water/agriculture-related projects such as those already carried out through PHSS, greenhouse projects and CAPs.



ANNEX 1: IRRIGATION

Alternative Irrigation Systems for the Reduction of Agricultural Water Usage

Throughout history the irrigated agriculture of Iraq's central and southern region has been menaced by salinization. Salinity was already recorded as a cause of crop yield reductions some 3,800 years ago. The water table of southern Iraq is saline and so close to the surface that it only takes a little injudicious over-irrigation to bring it up to root level and destroy the crop. High groundwater tables affect more than half of the irrigated land.¹

In 1970, half of the irrigated areas of central and southern Iraq were found to be degraded due to waterlogging and salinity. The main causes of this degradation are thought to have been the absence of drainage facilities and traditional flood irrigation techniques which, as can be seen from the charts below, are still being practiced to a significant degree today.

Irrigation Techniques Used in Assessed Locations Throughout Iraq Where Agriculture is the Main Source of Income

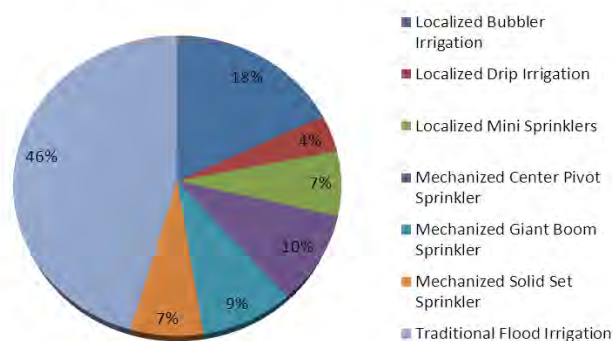


Fig. 1

Irrigation Methods used by Assessed Agricultural Communities by Governorate

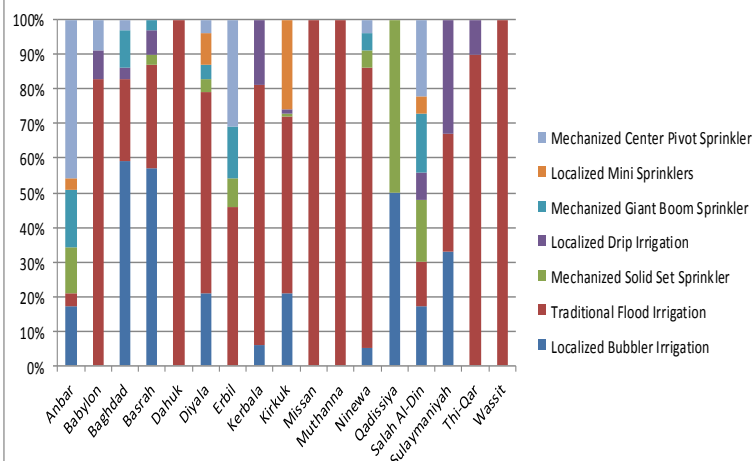


Fig. 2

Traditional flood irrigation methods are still being used in almost half of assessed locations (Fig. 1). It can also be seen in Fig. 2 that several governorates, particularly those in central and southern areas, where degradation due to high salinity levels and poor drainage are most significant, are either exclusively or predominantly using these inefficient and destructive techniques. Pakistan, where farmers have been using traditional surface irrigation for more than a century and where agricultural yields per unit of water are the lowest in the world, is an example of a region experiencing similar agricultural issues. Agricultural experts have suggested that there is a need to maximize the 'per unit' production of water and that this challenge can only be fulfilled in Pakistan by better and more efficient use of both productive land and irrigation water supplies.² The achievement of this goal can be assisted in both Pakistan and Iraq by the adoption of advanced irrigation such as drip and/or sprinkler irrigation systems.



An example of an IOM-provided greenhouse in which drip irrigation is often used

1. Aquastat, FAOs Information System on Water and Agriculture, <http://www.fao.org/nr/water/aquastat/countries/iraq/index.stm>
2. Use and Limitations of Sprinkler and Drip Irrigation Systems in Pakistan, Dr. Muhammad Mehboob Alam, Dr. Muhammad Nawaz Bhutta, Dr Aftab H Azhar, Pakistan Engineering Congress, 70th Annual Session Proceedings, p.82



ANNEX 1: IRRIGATION (CONT.)

Drip Irrigation

Drip irrigation is a method in which water is supplied to crops at “specific points”, usually at the base of the plant. This method uses a network of pipes ending with small emitters to give water to the plant’s roots.¹ Research studies have indicated that the water saving is about 40-70% and the yield is increased by 10-100% for various crops, if the drip method is used (INCID, 1994).²

Advantages Water use efficiency of the drip irrigation system is as high as 90 to 95% compared to only 40 to 50% in conventional furrow or flood irrigation.³ It can be operated efficiently in undulating terrain, rolling topography, hilly areas, barren lands and areas which have shallow soils⁴ and has the ability to keep saline concentration below the detrimental level, even when using brackish or saline water.⁵



Disadvantages

An IOM beneficiary cultivating crops

Extensive maintenance is required in addition to initial investment and annual costs which are high when compared with surface or portable sprinkler irrigation systems.⁶ Also a high level of design and management skill is required.⁷

Sprinkler Irrigation

Sprinkler (or overhead) irrigation is a method of distributing water in pipes under pressure, and spraying it into the air so that it breaks up into small water droplets and falls to the ground like natural rainfall.⁸

Advantages As in the case of drip irrigation, sprinkler irrigation can also be used in all kinds of terrain conditions - undulating terrain, rolling topography, hilly areas, barren lands and areas which have shallow soils.⁹ On saline soils, sprinklers are recommended for better leaching and crop germination.¹⁰ It can be the most economical way to apply water, as the same sprinklers can often be used for irrigation and the application of pesticides, herbicides and fertilizers.¹¹

Drip and sprinkler irrigation systems represent a significant advantage over traditional flood irrigation methods. Surface irrigation is by far the most widespread irrigation method in Iraq. However, in areas where the soil has a very high infiltration rate or where there is a scarcity of water, sprinkler and drip irrigation may be more appropriate.¹³ If the high set-up and maintenance costs can be borne and workers skilled enough to deal with the day-to-day running of the system can be found or trained, then the subsequent rise in water usage efficiency and crop productivity would be a distinct advantage in regions where water scarcity is an issue.



Disadvantages

(Above) Land suitable for sprinkler irrigation

Sprinkler irrigation systems have high initial set-up costs and relatively high operation and maintenance requirements.¹²

¹ Use and Limitations of Sprinkler and Drip Irrigation Systems in Pakistan, Dr. Muhammad Mehboob Alam, Dr. Muhammad Nawaz Bhutta, Dr Aftab H Azhar, Pakistan Engineering Congress, 70th Annual Session Proceedings, p.82

2/3/5/6/7/8/10/11/12/13 Ibid.

^{4/9} Potential for Drip and Sprinkler Irrigation in India, A. Narayanamoorthy, p.22/23



ANNEX 2: IRRIGATION IN THE NORTH-CENTRAL GOVERNORATES

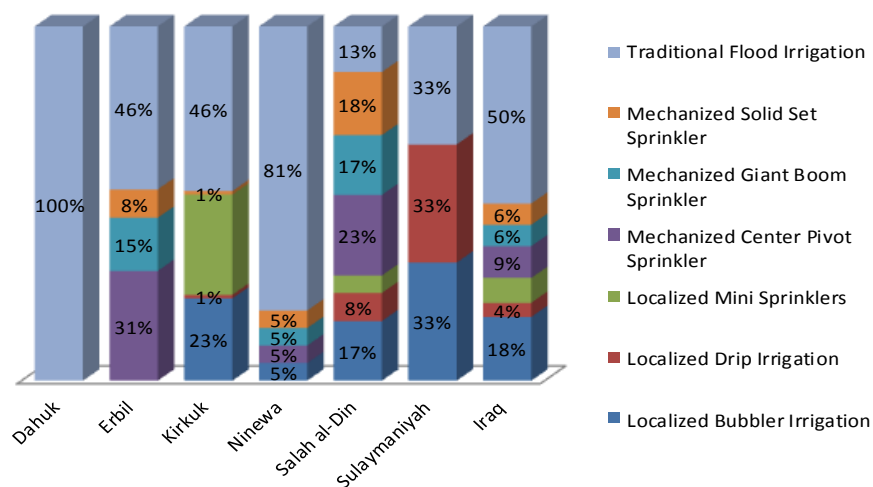


Fig.1 (Left)

Irrigation methods used by assessed agricultural communities in the north-central governorates

Fig.2 (Right)

Source of irrigation water among assessed agricultural communities in the north-central governorates

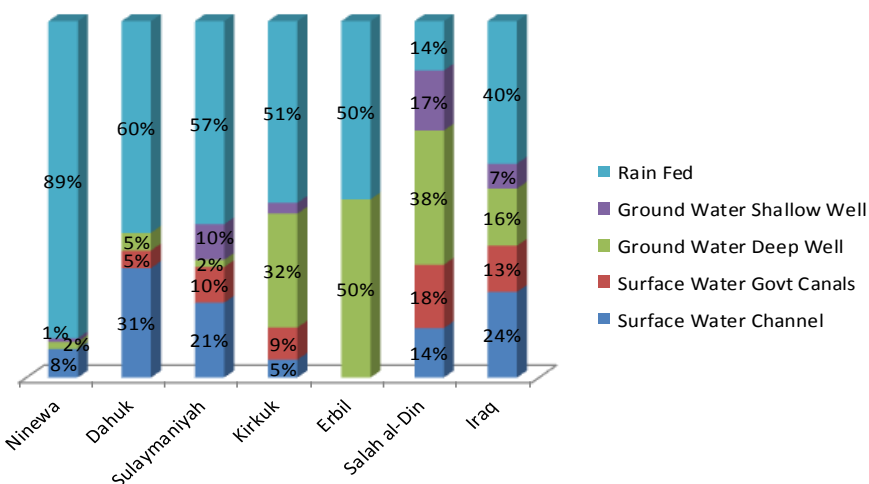
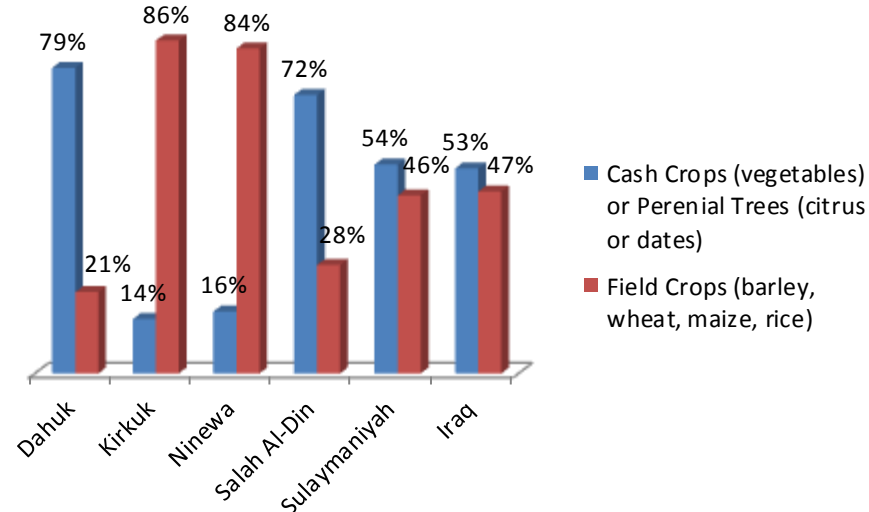


Fig.3 (Left)

Percentage of assessed agricultural communities specializing in cash or field crops in the north-central governorates





ANNEX 3: MUTHANNA

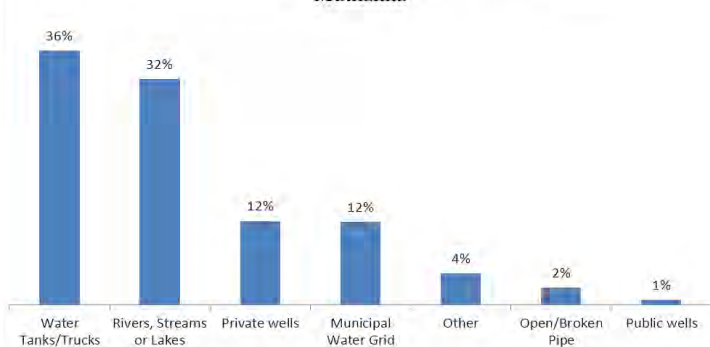
Governorate Focus: Muthanna

The experience of vulnerable families in the governorate of Muthanna, in terms of access to clean water supplies, is particularly bad. Whilst in the north of Iraq, drought and desertification are among the major drivers of water scarcity, in the south of Iraq, where Muthanna is located, the effects of rising water salinity and pollution are major factors affecting levels of available clean water for both personal and agricultural use. The percentage of households that use the public network as their main drinking water source in the governorate is between 1% and 27%, varying significantly between districts with some rural areas having no access at all. The consequence of this lack of infrastructure is that many families are either reliant on supplies which have to be brought in by truck or are forced to collect water from wells, broken pipes or rivers which are often contaminated by pollution or high levels of salinity.

Water Scarcity and Displacement in Muthanna

Water scarcity has become a major cause of displacement both to and within the governorate of Muthanna. 94% of assessed IDPs cited drought as a cause of their displacement, the highest of any category, and 92% of assessed IDPs cited drought as a reason preventing return to their place of origin. Both of these figures are significantly higher than those representative of the whole of Iraq. Furthermore, in their host communities, families are not necessarily finding improved access to water. 75% of assessed IDP families reported that the availability of clean water had decreased following their displacement. Only 12% of vulnerable families in Muthanna have access to the municipal water grid, whilst 32% use water taken from rivers, streams or lakes as their source of water, sources which are often contaminated and left untreated. IOM monitors have also reported that 13% of assessed families in Muthanna use water drawn from public or private wells, which is often very high in salinity. Continuing difficulties in accessing sufficient water for both personal and agricultural use are also causing further displacement. A number of farmers interviewed by IOM have been forced to move to other governorates such as Najaf to seek work.

Main Source of Water among Assessed Vulnerable Families in Muthanna



Reason for Prevention of Return amongst Assessed IDPs	IDP Families from Muthanna	All IDP Families within Iraq
Drought in place of origin	92%	10%
Poor relations with community	3%	48%
Lack of job opportunities in place of origin	56%	32%
Security concerns	3%	69%

Cause of Displacement amongst Assessed IDPs	IDP Families from Muthanna	All IDP Families within Iraq
Drought in place of origin	94%	11%
Lack of job opportunities in place of origin	56%	18%
Lack of electricity	17%	3%
Armed Conflict	3%	40%



A vulnerable family in Muthanna which is not only forced to use the untreated water from a river, but must spend significant amounts of time carrying the water back home in pots and buckets.

IOM-IRAQ SPECIAL REPORT

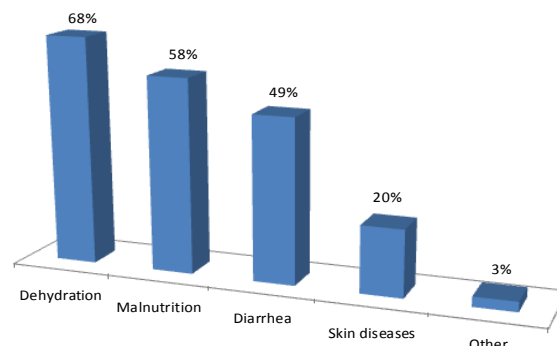
Water Scarcity



ANNEX 3: MUTHANNA (CONT.)

Almost all assessed locations in Muthanna have reported moderate or severe water scarcity. The deterioration and overload of infrastructure has led to a general shortage of potable water, particularly evident among vulnerable IDP populations which often live in poor urban or rural areas without access to functional water systems. Monitors have observed a high incidence of skin and intestinal issues among groups that rely on non-potable water sources such as wells, rivers, or broken pipes.

Percentage of assessed water scarce locations in Muthanna citing water-related health problems in the last 12 months



A water pipe used by vulnerable families in Muthanna and the pots used to transport and store this water.

68% of assessed locations reported the incidence of dehydration in the last 12 months. Levels of malnutrition and diarrhea were also significant at 58% and 49% respectively. Food and health services, the importance of which are significantly increased by water scarcity, were reported by assessed families in Muthanna as among their top five priority needs. Across Iraq, demand for food is currently not satisfied by agricultural production,¹ and this imbalance is worsening as high levels of water scarcity continue and more farmers sell their land to seek alternative sources of income.

Vulnerable families in some areas of Muthanna have also reported that the effects of water scarcity have had severe consequences in terms of their livelihoods. Of the families assessed who depend on agriculture as a main source of income, only 4% reported that water scarcity had not affected their livestock at all, while others reported that their livestock had become sick, had died, or that they had been forced to sell them.

A large number of families, dependent on agricultural income, also reported that water scarcity had forced them to change the crops they produce. Families may change from staple crops that rely heavily on water, such as wheat and barley, to seasonal crops like tomatoes. The income from seasonal crops is usually not sufficient to meet seed, fertilizer and cultivation costs.

If you own livestock, how have they been affected by water scarcity?	Assessed vulnerable families in Muthanna	Percentage of assessed vulnerable families in Muthanna
Sickness	111	55%
Death	11	7%
Forced to sell	69	34%
Not at all	8	4%
Has water scarcity forced you to change the crops you produce?		
Yes	40	22%
No	146	78%

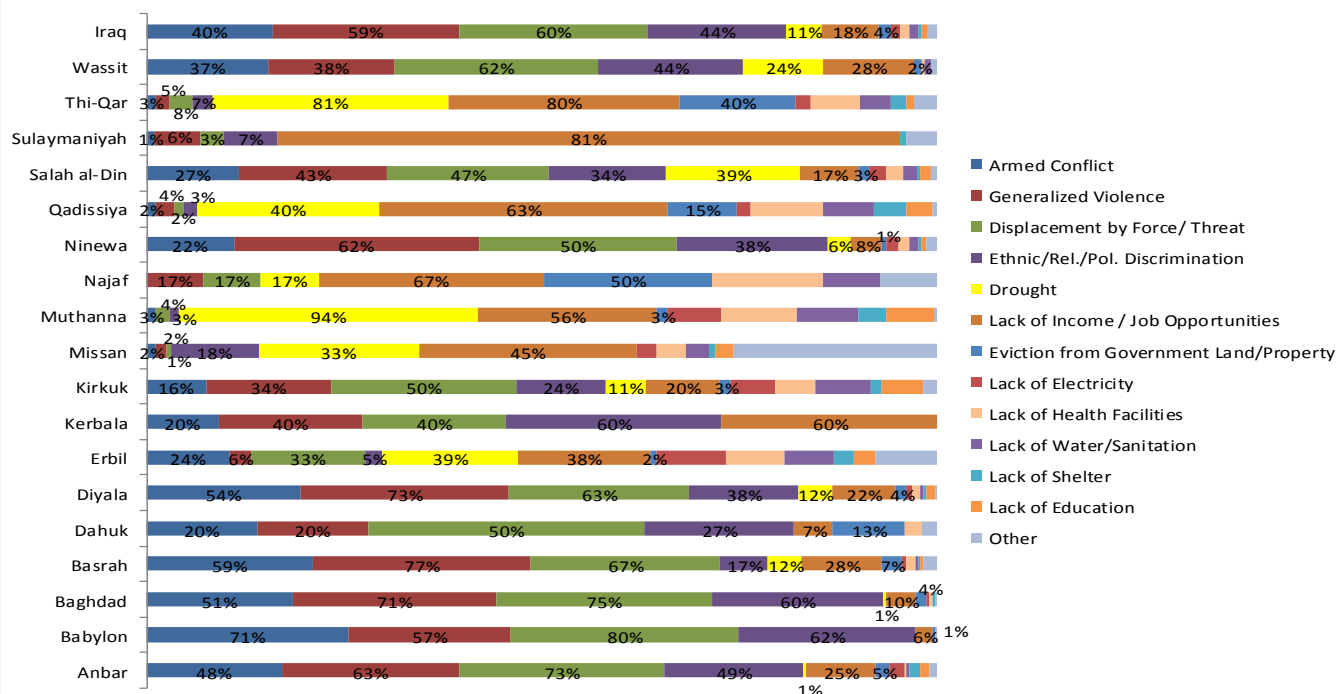
The above questions were asked only to those IDP families living within communities where agriculture was their main source of income.

¹ IAU World Food Day Factsheet October 2010

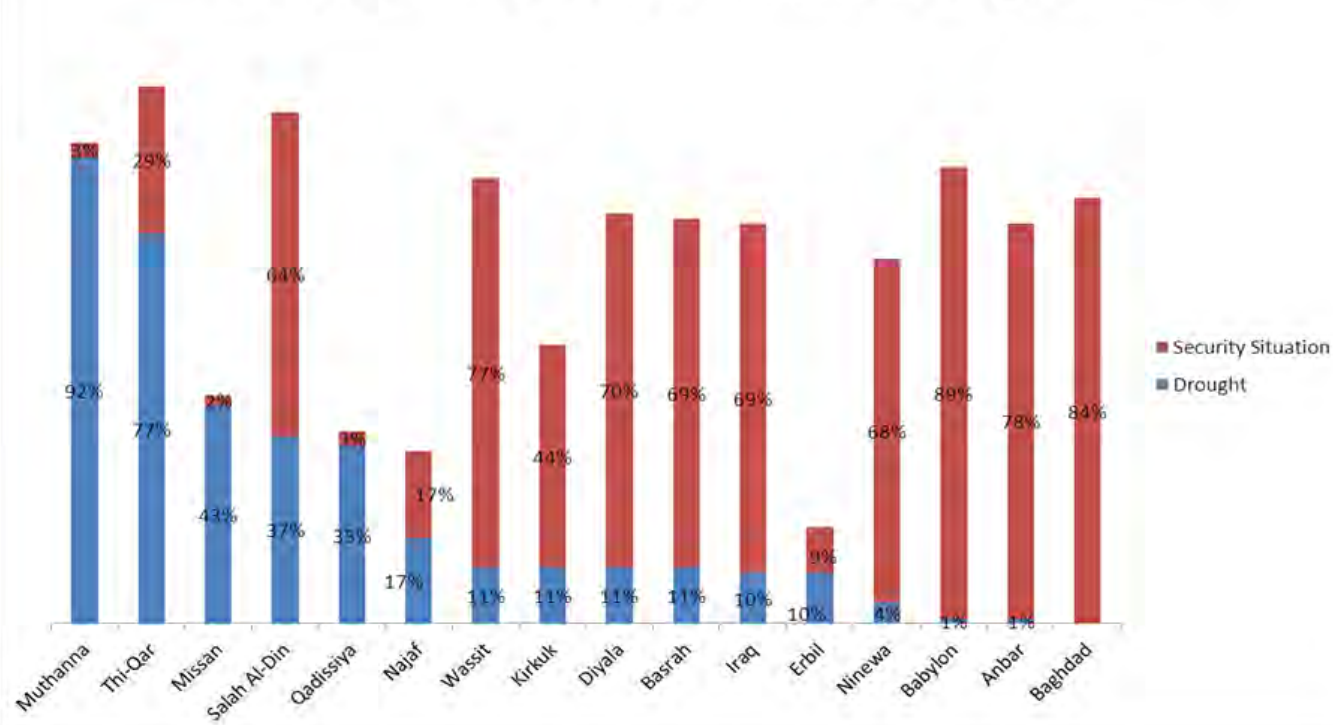


ANNEX 4

Reasons for Displacement from Governorate of Origin among Assessed IDPs

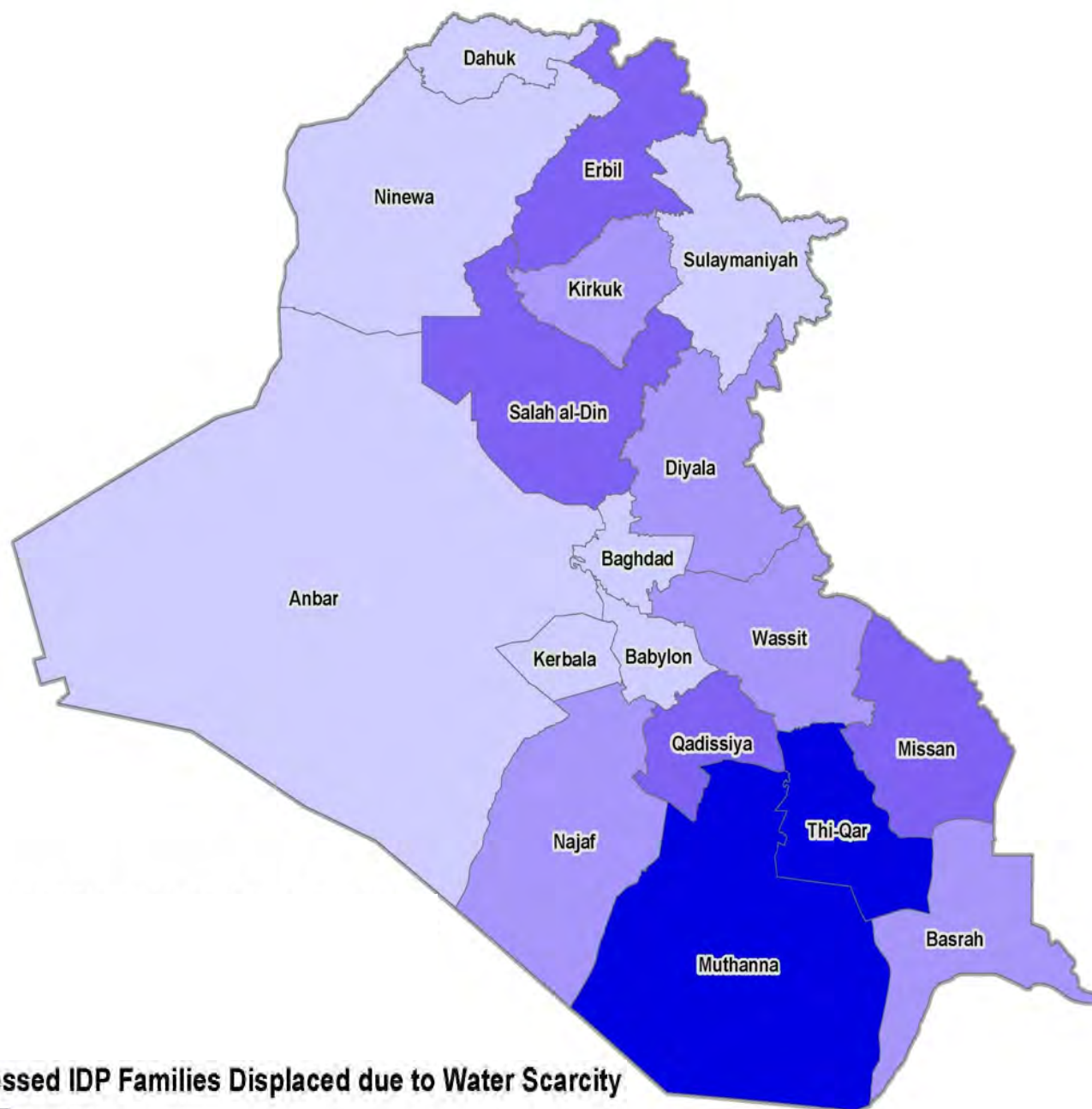


Percentage of Assessed IDPs Citing Drought and/or the Security Situation as a Reason for Prevention of Return to the Governorates of Origin Below

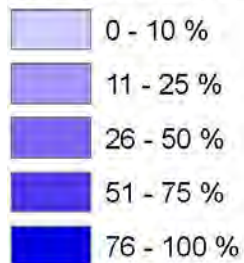




ANNEX 5



Assessed IDP Families Displaced due to Water Scarcity





ANNEX 6



Assessed IDP Families that Cannot Return to Place of Origin due to Water Scarcity

