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**GLOWA Jordan River Scenarios
of Regional Development
under Global Change**

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Introduction

The GLOWA-JR project aims to provide scientific support for improving water management in the Jordan River region with particular emphasis on adapting to global change. The project consists of several phases with various objectives and outputs.

Phase II built a framework for analyzing region-wide questions about global change and water resources. One main component was a scenario building process in which experts from the region and Germany interacted with stakeholders from the region. This interaction produced four scenarios describing how global change could affect water resources in the Jordan River region up to 2050. These four “general development scenarios” are described in this report.

The Jordan River



The 4 GLOWA-JR “regional development” scenarios

The subsequent storylines are the final versions as developed during the third and last Scenario Panel meeting of Phase 2 of the GLOWA Jordan River Project. They constitute the underlying general “regional development” scenarios that should be used in Phase 3 of the GLOWA Jordan River Project in order to elaborate more detailed and region-specific, or possibly also country-specific, water planning and management scenarios.

The emphasis in these general “regional development” scenarios has been on the effects of likely climate change and its impacts on the overall water availability situation in the region. These were analyzed in the context of possible alternative economic developments as well as the overall willingness to move to a lasting peace in the region which would imply either a sharing or non-sharing of water resources.



Poverty & Peace

The Poverty & Peace scenario constitutes a combination of peaceful development in the region without economic prosperity. This means that, despite peace and although water resources are being shared, water stress problems, caused by climatic changes that occur over the coming decades, cannot be solved due to bad economic conditions. Although political stability leads to a slow but steady spread of technology throughout the region, the cooperative projects remain small-scale and continue to be dependent on financial support from outside the region. The continued shortage of water resources combined with a lack of financial means are the reason for a slowly deteriorating environment in which soil erosion as well as water pollution problems cannot be stopped.

Storyline

2008 - 2010

After many years of regional conflict and violence, the regional peace process is revived. On 27th of November 2007, the U.S.-sponsored Israeli-Palestinian conference takes place in Annapolis, Maryland. Peace is initiated and, by 2008, the two parties reach a comprehensive peace agreement. Other governments in the region are now also pushed into the negotiation process. The basis for the peace agreements are the principles advocated by the Clinton administration in the 1990s, the Arab initiative of 2002 and the “Road-map to Peace”.

Regional stability leads to regional immigration. The increase in population (+22% between 2000 and 2010, see Fig.1 below) combined with a breakdown in maintenance leads to an overloading of many wastewater treatment plants, and untreated wastewater finds its way into water supplies. Various Ministries of Health in the region broadcast warnings that high concentrations of coliform bacteria have been found in public water supplies indicating dangerous levels of contamination. Cholera breaks out in Jerusalem and hospitals are in a state of alarm. The World Health Organization provides help to fight the epidemic. *Among the children in a Jerusalem hospital are also the two boys Ilan and Mohammed. They are the children of Haim, an Israeli, and Hassan, a Palestinian. While recuperation in the hospital, Ilan and Mohammed share the same room and become friends.*

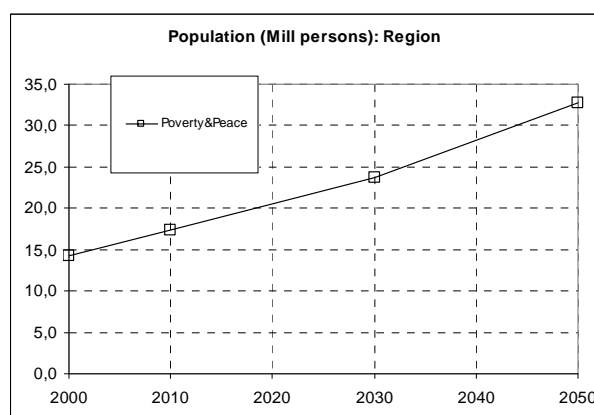


Figure 1. Population development in the region - Poverty & Peace scenario

Riding on the heels of the water pollution crisis comes a devastating drought. Lower than normal levels of precipitation persist for seven years and many wells run dry. One consequence is that Lake Tiberias drops so low that the Israeli national water carrier halts the pumping of water from the lake. Water suppliers give priority to household and industrial water users. Agricultural users protest that they are receiving inadequate supplies and conflicts break out between farmers and other water users.



The positive atmosphere caused by the revived peace process, together with the challenge of coping with the water-related catastrophes, finally leads to a measure of cooperation between states in the region. One of the first signs of this new cooperation is that regional governments informally agree to a modification of some water allocations between states. This results in more water allocation to the Palestinians. Small cooperative steps eventually lead to bigger confidence building measures until Israel and the Palestinian Authority finally agree on a cease-fire in Gaza and the West Bank.

Life for all citizens also becomes easier now. Haim's family, for example, goes shopping in Ramallah, and Hassan's family goes to the beach in Tel Aviv. Here the two boys Ilan and Mohammed meet again as well as the two families. They spend some time together at the beach.

Hassan, who has to take the road from Tulkarem to Ramallah to go to work, now has a free road without check points, which makes his journey a lot quicker each day. Haim is a business man with interests in building greenhouses in the Jordan valley near Jericho. He does this now together with some Palestinian partners.

Ilan and Mohammed participate in one of 100 educational workshops with 3000 Palestinian and Israeli school children.

The new cooperative atmosphere stimulates the regional economy (see Fig. 2). Israel and the Palestinian Authority sign an agreement on the building industry. A new factory for constructing buildings is opened in Tulkarem and the Israeli producer of state-of-the-art irrigation systems opens branches in Gaza and Nablus. For first time since 2000, ten thousand work permits are issued by Israel for Palestinians. *Hassan's younger brother also gets a work permit to work in Israel.* The new cooperation culminates in a peace treaty and a new water agreement between the Palestinian Authority and Israel.

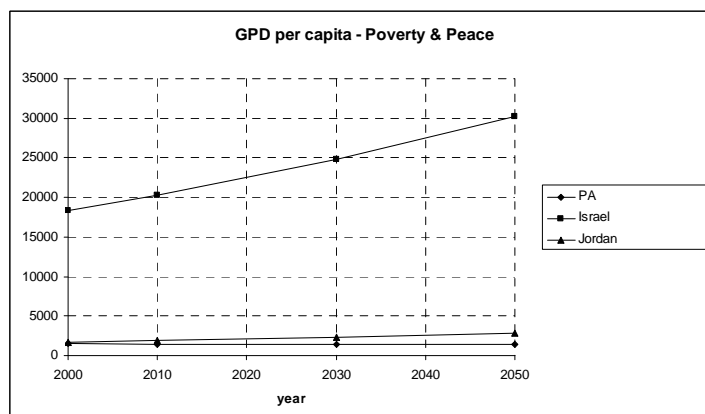


Figure 2. GDP per capita - Poverty & Peace scenario

However, while the peace process continues, the regional economy faces new crises. A series of developments leads OPEC to raise the price of oil to over 150 \$/barrel. *Hassan's family and his Jordanian cousin Atwa's family suffer electricity blackouts, sometimes lasting eight hours per day. High energy prices also make Hassan stop using his car to go to work from Tulkarem to Ramallah and he starts using public transportation.*



Among other impacts, high fuel prices make irrigation pumping very costly and these higher costs are passed on to consumers in the form of higher food and feed prices. Social gaps in all three countries increase and cause some social tension. Emigration from Palestine to Europe and the Gulf States is at a record high and emigration from Jordan to Gulf States is also increasing. *Hassan's brother goes to Dubai leaving his family behind.*

The high energy prices combined with the impacts of drought lead to an economic slowdown in the region. The economy is further damaged by the crash in 2012 of the global price of potash and phosphates.

2025 - 2030

One of the many side effects of the regional economic slowdown are reduced investments in agriculture which cause a shortage of fertilizer and tractors and this causes crop yields in many parts of the region to remain low. Moreover, the amount of water for irrigation is limited and must be spread over a large crop area. These factors cause an overall low level of agricultural production (see Fig. 3). Nevertheless, regional food demand continues to grow because of growing population. With crop yield low, food demand growing, and local people too poor to import food, the only alternative is to add new hectares of cropland and pasture land in the region (see Fig. 4). But this means that agricultural land expands onto much of the remaining open space and natural vegetation in the region which reduces the region's biodiversity and eco-tourism. The demand for irrigation increases and soil erosion intensifies. Given the cooperative atmosphere, the states in the region work together in a limited fashion in order to cope with the agricultural situation, by building a few new irrigation projects.



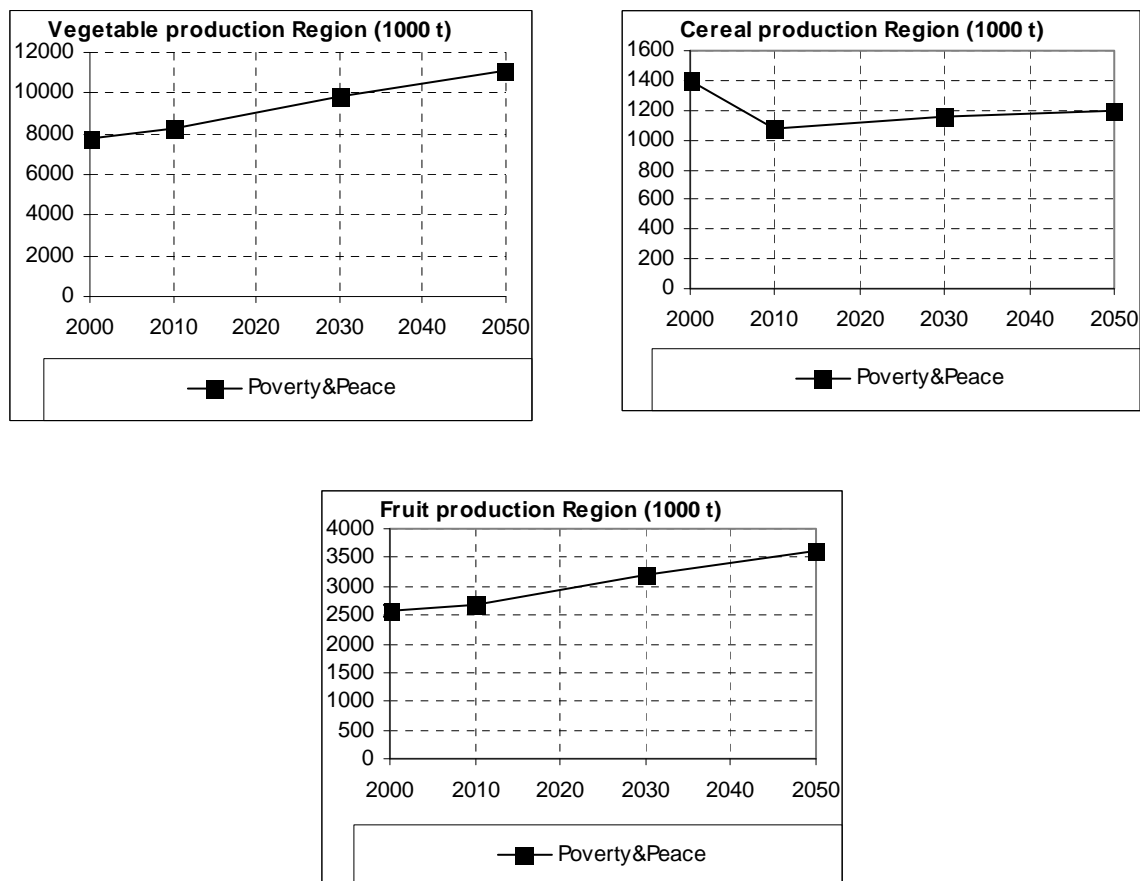


Figure 3. Agricultural production in the region (2000 – 2050)¹ - Poverty & Peace scenario

Because of the overall problems, however, economic emigration from Israel to the United States is on the rise. *Ilan, for example, also goes to the US.*

¹ Agricultural production for Jordan and PA was derived from the scenarios of the Millennium Ecosystem Assessment (MEA) as computed by the IMPACT model:

Pop Glowa in yr x * (MEA production per capita yr x / MEA production per capita yr 2000) * production per capita in 2000 (FAOSTAT) = Total production in yr x

This was done for cereals, temperate/tropical fruits and potatoes/vegetables.

The production numbers served as input for the land-use change model Landshift in order to compute the land demand for agriculture considering the MEA assumptions on yield increases under the .different scenarios.

Based on the trends in economic growth and yield changes we assumed similarity of the following scenarios
MEA "Global Orchestration = GLOWA JR "Willingness & Ability"

MEA "Techno Garden" = GLOWA JR "Modest Hopes"

MEA "Adapting Mosaic" = GLOWA JR "Poverty & Peace"

MEA "Order from Strength" = GLOWA JR "Suffering of the Weak and the Environment"

More information on the MEA scenarios can be found under:

<http://www.millenniumassessment.org/en/Index.aspx>

For agricultural production in Israel we present here the production numbers of the economic model of Iddo Kan et al (University of Haifa), who considered SAS assumptions on population dynamics, economic growth and water availability from desalination plants and TWW production for his allocation of area to different crop types.

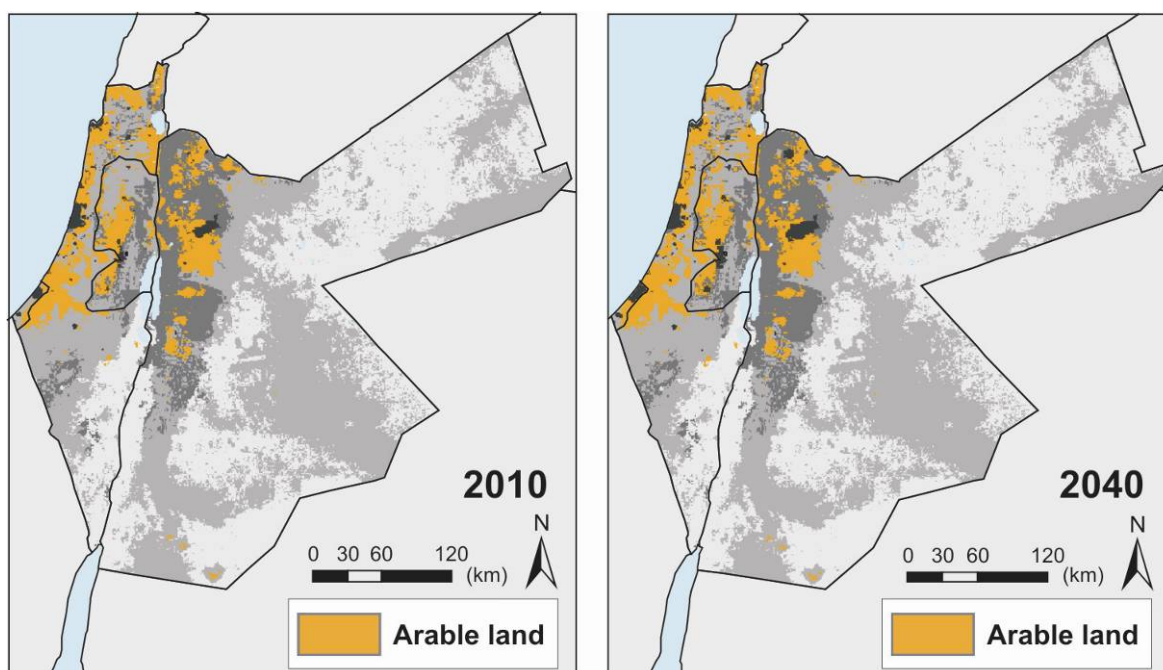


Figure 4a. Arable land in the region (2010 & 2040) - Poverty & Peace scenario

Modest progress is made in improving water management. Visible signs of this progress are the new wastewater treatment plants (+529 million m³ treated wastewater) built in the region. *Hassan's son Mohammed takes advantage of available treated wastewater and starts a small irrigated farm. He buys two tanks for storing water.*

But, despite the peace, water stress problems cannot be fully addressed and solved because of the recession (compare Figure 2). Neither does treatment capacity in the region expand fast enough to keep up with the rising production of wastewater due to growing population. Hence the net volume of untreated wastewater grows and water pollution problems increase.

Extreme climate events and their impacts pile up during this period. Two big floods hit Safi in five years with the second flood causing ten deaths. A scientific panel estimates huge losses of topsoil because of the increase in flooding and soil mismanagement. The temperature climbs to 40 degrees Celsius four times. Warmer temperatures reduce the water supply and the economic downturn slows the development of alternative sources of water.



These climate extremes have many economic impacts. One is the collapse of eco-tourism in the region. An even greater impact of the extreme climate together with the economic downturn is a severe loss of jobs and a resulting massive exodus of workers out of the region. But the general peacefulness of the region also leads to a continuing immigration of Palestinian émigrés into the region. The net balance is a rate of population increase in Palestine considerably above its rate of increase in the first decade of the 21st century (compare Fig.1).

The poor economic conditions also halt the building of new wastewater treatment plants. Although wastewater is not properly treated, it is still used for irrigation. For safety reasons it is diluted with very scarcely available freshwater supplies but this does not protect public health. The use of non-properly treated wastewater for irrigation causes contamination of crops, and the crops have a lower sale price. *Jordanian police arrest Atwa's son Ali because he sells contaminated lettuce.* The situation in agriculture is worsened by the larger and larger diversions of water from agriculture to provide water for households and businesses. On top of all of these setbacks, agriculture also suffers from the impacts of climate change. In 2027, an outbreak of an unidentified crop pest destroys the regional vegetable crop and this is later linked by a scientific panel to climate change. *Ali leaves his vegetable farm and finds work in Amman in the tourist industry.*

In the spirit of cooperation that developed in the previous decade, the “Quartet of Parties” – these are the United States, Russia, the European Union and the United Nations – convenes a 6-state Commission to deal with the regional climate catastrophe.

Big changes continue to occur in various water-using sectors. In the household sector, the growing population causes much larger water demands. Meanwhile, regional stability encourages an increase in religious and archaeological tourism and a modest expansion of industry which together cause a medium increase in industrial and commercial water demands. Since preference is given to household and industrial water users, more and more water is diverted from the agricultural sector to meet household and industrial water needs.

One consequence of overall poor economic conditions is that resources are shifted from military budgets to support research and development of new efficient and water-saving crop varieties and industrial processes.

2050

Immigration to the region eventually slows and this lessens the pressure on municipal water supply. The overall economic situation is still poor so that industrial water demands only modestly increase. Nevertheless, water continues to be diverted from agriculture to satisfy the slowly increasing needs of municipal and industrial water users.

Political stability over the past decades has led to a slow but steady spread of technology throughout the region. This also includes technology for treating wastewater and eventually construction begins again on new wastewater treatment plants so that wastewater treatment capacity slowly increases and covers a larger and larger percentage of water users. Water quality in the region slowly improves.

The impacts of climate change become more noticeable especially in reduced yields of key crops. To cope with these impacts, states cooperate more intensively on new irrigation

projects. Also, new and relatively inexpensive desalination facilities are being built in Jordan and Israel (+385 million m³). The cooperative projects remain fairly small-scale and are dependent on financial support from outside the region.



Willingness & Ability

The Willingness & Ability scenario reflects the most optimistic and wished-for scenario in which peace and economic prosperity rein. This means that, despite the effects of climate change which reduces the naturally available amount of water, the overall water availability can be increased sufficiently through high-tech solutions, such as desalination plants and the construction of a Dead Sea / Red Sea canal. Innovative industries, including water- and energy-technology industries, are growing fast. Although the pressure on nature increases due to an increasing population and a growing tourist industry, the availability of financial resources and the level of public awareness guarantee a sustainable development of the region where, e.g., overgrazing and intensive agriculture are avoided.

Storyline

2008-2010

Noora from Nablus is six years old, when everything changes in the Middle East with a breakthrough in peace negotiations. First, an agreement is reached on Article 13 on water. A final status agreement is signed between Palestinians and Israelis covering all open aspects on borders, water distribution, etc. Additionally, Lebanon and Syria sign a peace treaty with Israel. This is very important since all water available in the Jordan River region originates from the Syrian and Lebanese territory.

Due to these achievements, the governments in the three countries are re-elected. Additionally, they win the Nobel Peace Prize. In 2020, Noora is a student of water engineering in at Technion in Haifa, one of the best universities in the region. As a student, she does voluntary work for an organization called 'Nature without Borders'. They try to raise public awareness on clean water and treated wastewater. Friends of hers organize a march from Damascus to Gaza all through the region to visit different water resource projects.

In the same year, the three students, Lujain, an electrical engineering student from Birzeit University, Ghadeer, an economics' major from Jordan University, and Yuval, a water quality engineering student from Tel Aviv University meet at the American University in Beirut in a regional exchange program. A short time afterwards, they all celebrate finishing their degrees; for this, they get together again and go out to eat pita, falafel and humus.



Caused by the general positive development and the expectation that political stability will last and motivate further investments, a regional donor conference gives three billion US\$ for investments in all kinds of infrastructure, but especially water infrastructure. These investments prepare the ground for numerous large-scale projects suitable to increase the water supply in all three states.



2025-2030

As a result, agriculture in many parts of the region becomes more intensive and industrialized. There is a general move towards more greenhouse agriculture and less agriculture in open areas. This increases the demand for energy and water, and also increases pollution levels. Because of the new opportunities, fewer skilled Jordanian and Palestinian workers emigrate from their countries to the Gulf States.



Population in the region increases (by 8.3 million between 2010 and 2030, also see Fig. 5). Whereas the birth and migration rates in Israel remain stable, in the territory of the Palestinian Authority, however, a still relatively high birth rate is accompanied by an increasing in-migration due to peace and economic growth. Ultimately, a Palestinian State is established and the Jewish minority leaves to return to Israel.

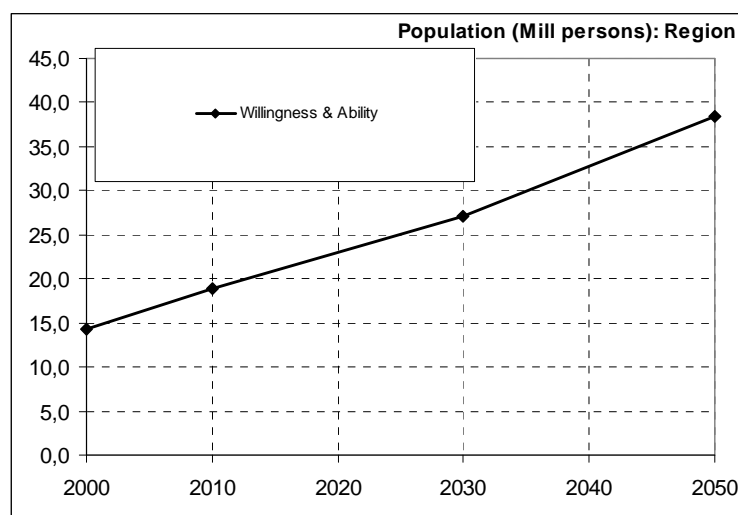


Figure 5. Population development in the region -Willingness & Ability scenario

Also, some social changes take place. Families become smaller, women become stronger, and there are more households with only old people. After 2040, people, in general, become fatter. There are more cars on the road and, as a result, there are more road accidents. Insurance business grows because of the increased involvement of insurance companies in everyday life.

New technologies find their way into many areas in industry and agriculture and, as a result, pollution levels first stabilize and then start being reduced. Connections between the scientific community and decision makers are getting stronger. Additionally, NGOs get more and more involved in increasing public awareness on environmental issues. There is a change in traditions resulting in a kind of “sixties in the Middle East.”

The Palestinians are constructing a national water carrier between Gaza and Hebron. First experiments of “cloud seeding” are being carried out in order to control and enhance rainfall. This is found very complicated, and turns out only sometimes useful and sometimes producing problems or even being destructive. Modified and advanced technologies are being developed.



The water-technology industry is growing fast. A regional wastewater treatment plant in Tulkarm starts operation. Desalination plants are constructed in Rafah and Hadera, providing 200 and 100 million cubic meters, respectively, of high quality potable water. *After graduating in 2025, Noora first gets a job in an international company on wastewater treatment. Later she works as a project leader of the desalination plant in Rafah. She also works as a consultant to the municipality of Nablus and she helps her father to get his scientific papers published.*

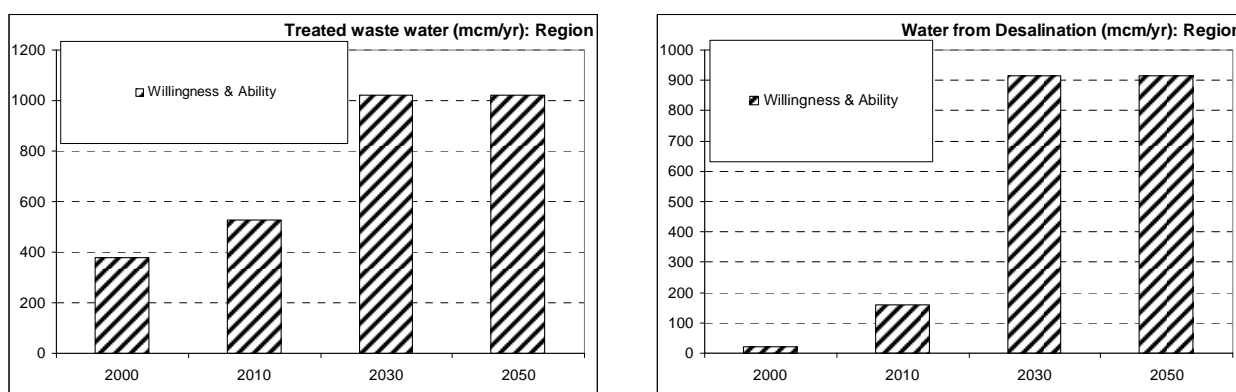


Figure 6. Increase in water from desalination and in wastewater treatment in the region (2000 -2050) - Willingness & Ability scenario

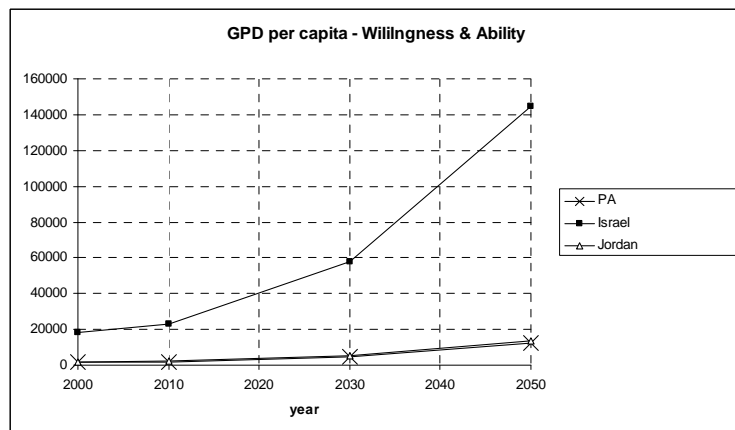
The Bank for Reconstruction (Kreditanstalt für Wiederaufbau - KfW) allocates 10 billion Euro to construct the Dead Sea / Red Sea canal, and after the opening of the canal, an additional 400 million cubic meters of water become available. Due to the recharge of the Dead Sea with Red Sea water through the newly established canal, the sinkhole problem around the Dead Sea is also solved and the tourist industry in the Dead Sea area can successfully be developed. *Noora meets her future husband at the opening ceremony of the Dead Sea / Red Sea canal. He is also a successful engineer, but not from the water sector. They usually spend their vacations in expensive hotels at the Jordanian side of the Dead Sea.*



All parts of the society are profiting from the economic development. Also local companies get more business. *In 2025, the three former students, Lujain, Ghadeer, and Yuval, establish Solar Desalination Technologies (SDT), a joint venture with headquarters in Jerusalem, for producing a new desalination technology employing solar energy. They build a test plant along the Dead Sea / Red Sea canal which successfully starts operation in 2035. At this time, SDT's earnings sky-rocket. In general, innovative industries do well. There is an increase in more hydropower generation using new energy technologies, and a huge solar energy industry starts to emerge. In 2045, SDT employs 6000 people, about one third in each of the three countries, and they start exporting new technologies to Europe and the United States.*

Because of this strong economic growth (see Fig. 7) and in spite of the additionally available water, some tension arises as more water is diverted from agriculture to industry and the tourism sector. To solve these tensions, more and more water is being recycled.

Figure 7.
GDP per capita - Willingness
& Ability scenario



Farmer unions become stronger and richer. In general, there is more democracy and more political parties emerge in the region. Enough money is available to invest in newest available technology. Agriculture becomes yet more industrial with large farms and often some food processing industries right on site. Since high-quality treated wastewater is available for agriculture, crop yields are increasing. The area dedicated to crops, which are not tolerant to treated wastewater re-use, drops by 50%. Abandoned area is dedicated partly to new crops which are resistant to treated wastewater application (scientists determine which plants are the most suitable), and partly to protected open space in order to promote eco-tourism. By 2040, pollution levels are generally reduced because of the innovative technologies employed.

Changing climate conditions do not significantly influence biomass production of the natural vegetation. However, management practices in the livestock farming become more sustainable and overgrazing is reduced to improve the landscape appearance. The pressure of society / NGOs increases to use additional open space for nature reserves since less land is needed for intensified agriculture. As a consequence, the area with natural vegetation slightly increases due to some abandonment of agricultural area.

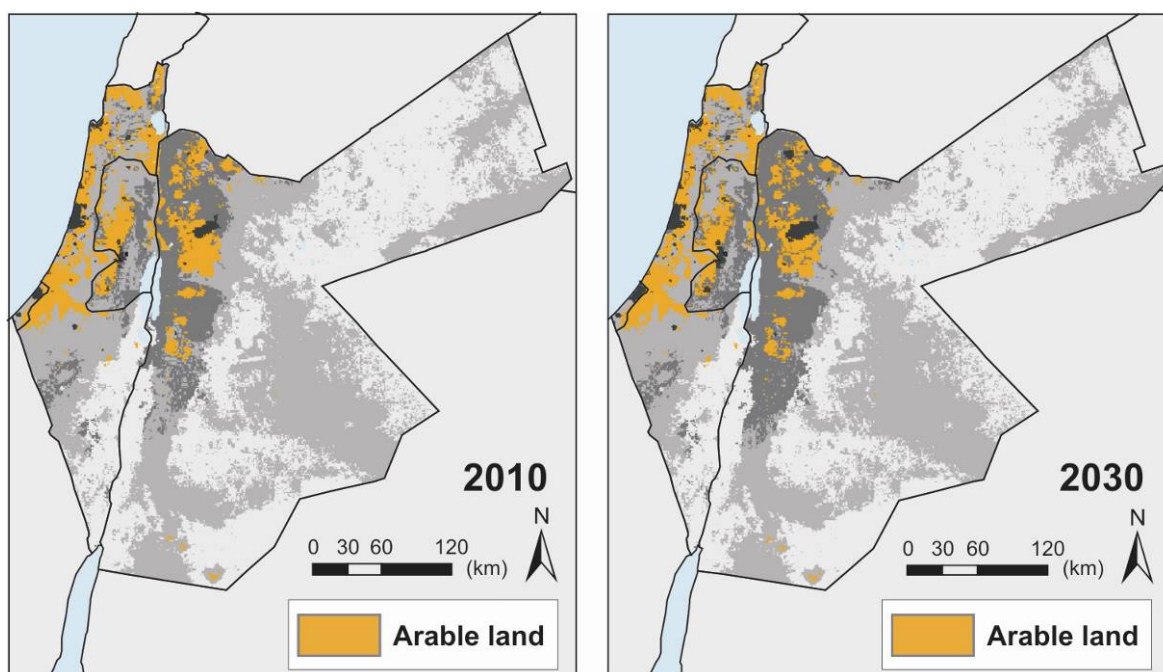


Figure 8. Arable land in the region (2010 & 2030) - Willingness and Ability scenario

In 2040, the opening of a new multi-lane highway from Jordan and Israel through Syria and Turkey to Europe is being celebrated. At the same time, a fast railway is being built parallel to the highway.

2050

Around 2050, families in Israel are getting slightly smaller and the birth rate in the territory of the Palestinian Authority also decreases. Mainly in Jordan, but also in Palestine, there is less influence of family types and tribes on society. Now, there are no borders any more and an open market exists between all Middle Eastern countries. A new regional currency is introduced – the MEC (Middle Eastern currency).

There are no more sectoral conflicts on water since enough water is available. An increasing water demand is fulfilled by increasing the water supply through opening up of additional water resources, such as, for example, desalinized water (compare Fig. 6). Treated wastewater use in agriculture exceeds 1000 million cubic meters per year (also compare Fig. 6).

Due to the lasting political stability, the level of foreign companies' investments reaches the highest level in the last 50 years and the region becomes more and more attractive to tourists. The mark of the 10millionth tourist in the region is exceeded in this period. Especially this development of new jobs in the fast growing tourist industry, together with easier movement in the region due to the stable political situation. leads to a migration of people from the rural areas but also from cities to the tourist centers at the Dead Sea. Since investments are taken in all sectors, including those needing non- and semi-skilled workers, the unemployment rate drops below a 10% target which was set for this period.

Now that Noora is 50 years old, she becomes director of the development branch of the Solar Desalination Technologies (SDT) company, which is still in very good business.

At this time, the pressure on nature increases since more people move there because of the growing tourist industries. Water quality of river ecosystems gets better due to more wastewater treatment.



Modest Hopes

The Modest Hopes scenario assumes that no peace agreement can be reached but that economic prosperity prevails, kindled by international donors. This results in fairly stable conditions in the region. Education, training and capacity building make up for some of the lack of cooperation. In order to counter the effects of climate change, high-tech solutions, such as desalination plants and irrigation with properly treated wastewater, make up for the lack of a diminishing natural water availability. Agriculture becomes very profitable, but increases the pressure on open land. Because of continued lack of political cooperation, countries refuse to let more water flow into the Dead Sea so that its water table continues to drop sharply and puts the Dead Sea at great risk.

Storyline

2008-2010

Water talks between Israel and the Palestinian Authority fail. This is followed by a drop in the cooperation level within the Joint Water Commission. *When cooperation within the Commission drops very low, Sarah, their secretary, loses her job and is now unemployed.*

Sarah's then joins a private construction company and is being trained in private business opportunities. Since her company is involved in construction projects around the Dead Sea area, she spends quite some time in this region and meets Ahmed, who is a landowner at the Dead Sea. They fall in love and after a while they want to build a joint future. Their dream is to build a hotel on Ahmed's property along the Dead Sea shore.

After the failed water talks, international donors come together who want to keep everybody happy in the region on a national level. The US pledges money. Support goes into infrastructure and education, including “water ethics”. Research and education funds in the Palestinian Authority focus on high-tech such as agro-technology. Jordan receives one billion to build its first desalination plant in Aqaba (compare Fig. 9). Also, the Gulf Country Council gives money to the Palestinian Authority for four wastewater treatment plants in West Bank (also compare Fig. 9). The Japanese government and business fund a Jordanian chemical complex at the Dead Sea. This is strongly opposed by Israel because they fear for the profit of their own Dead Sea industries. Changes in land use have negative effects on the eco-system, in particular in light of the effects of climate change. Adaptation requires proper spatial planning for agriculture and development.

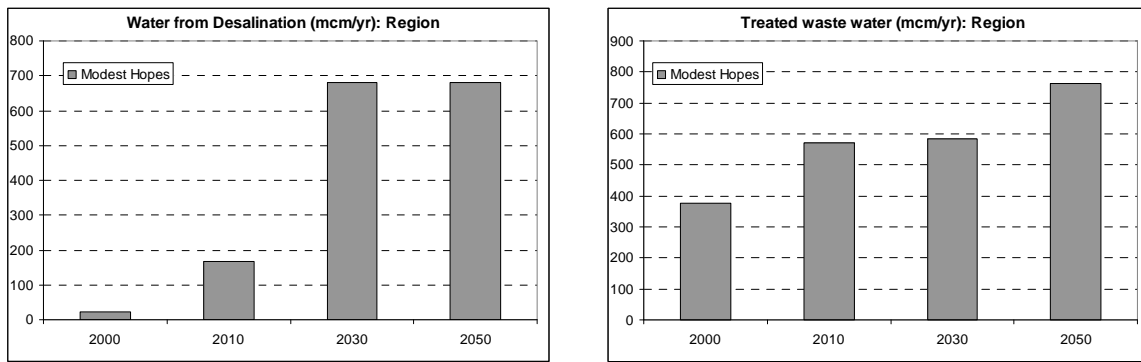


Figure 9. Increase in water from desalination and in wastewater treatment in the region (2000 -2050) - Modest Hopes scenario

All donor funds are being streamlined through the governments. Although governments continue tendering water and infrastructure projects, the low level of cooperation is the main challenge. This is dealt with by adapting measures predominantly on a national level. Also, it is difficult to think of sustainable development given the lack of cooperation. This is, however, managed through education, training and capacity building.

Sarah happens to have a cousin in the Jordanian Ministry of Foreign Affairs. Due to his job, Sarah's cousin Mohammed has many contacts to donors who are sponsoring projects around the Dead Sea. Mohammed manages to put Sarah and Ahmed into contact with some of the donors and through these connections they can realize their plan to build "Sunshine Resorts".



Other examples of projects implemented are that Israel allocates funds for desalination and wastewater treatment plants on its own territory (compare Fig. 8). As a result, local and outside agro-industrial companies build and improve irrigation infrastructure to channel water to demand centers. In Jordan, there is a ceremony by the king of opening the first desalination plant in Aqaba.

2025-2030

Due to proper maintenance, quality control and advanced water technologies in new plants, irrigation with wastewater is no longer a barrier to export of agricultural products. Jordan manages to draw up an integrated water resource management plan and, since water is no longer a limiting factor, most demands are being met. In turn, this opens a venue to negotiations with a delegation from the European Union and the EU draws up a trade agreement with Jordan. Since water generally is no longer a limiting factor, also Palestinians have adequate access to water resources. By 2030, all domestic demands are being met in the Palestinian Authority. This, in turn, leads to a large Palestinian middle class that did not exist before.



Intensive irrigation results in more intensive agriculture. This leads to changing cropping patterns with more animal feed crops. Farming becomes more intensive and high-tech. As a result, the size of farms increases so fewer people can live from farming. Palestinian firms as well as individual consultants advise the Gulf States on agricultural technology.

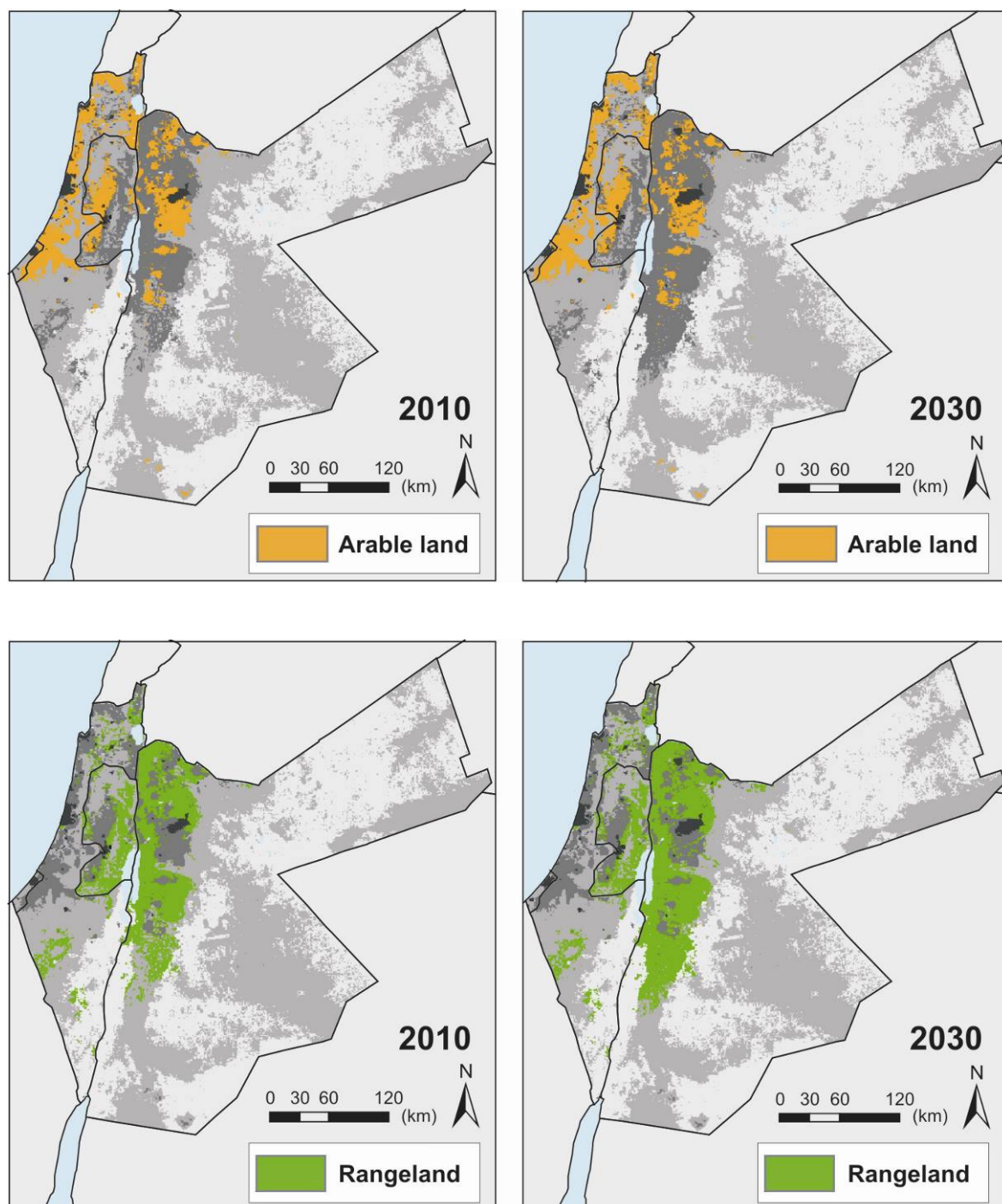


Figure 10. Arable land and rangeland in the region (2010 & 2030) - Modest Hopes scenario

More water availability results in better quality and better aquifer protection. Because of increased desalination (compare Fig. 9) the price of desalinated water drops to 50 cent per m³. This makes water more affordable for profitable agricultural projects, also in the territory of the Palestinian Authority, and ultimately results in a doubling of the agricultural share of the GDP of the Palestinian Authority.



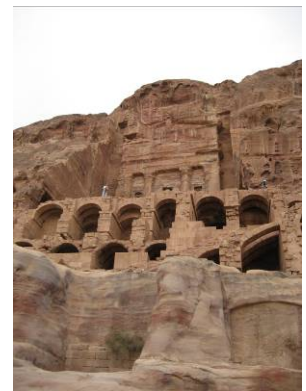
The 100,000th Palestinian immigrates to the West Bank supported by the Ministry of Housing and Public Affairs. Also, hotel chains want to invest in the region. There are 15,000 rooms at the Dead Sea shore in Jordan in 2025. A total of one million tourists visit the Jordan valley each year. *Sarah and Ahmed's hotel runs very well because all the people who invested and built in the region stay there and tourism is steadily increasing.*

2050

Tourist operators, however, complain about the spoiling of the “biblical landscape” by high-tech agriculture and the Palestinian Authority starts protecting its landscape against industrial agriculture. Also Jordan discovers “green tourism” and, as a result, Greenpeace is moving into the region; they open a regional office in Amman. The general public also becomes more aware of environmental issues.



Therefore, there is more pressure on the governments and, thus, the budgets of the Ministries of Environment of Jordan, Israel and the Palestinian Authority triple over the years. By 2050, all water demands are being met in the entire region. In the Palestinian Authority, the industrial demand is met predominantly through high-tech.



Because of the improvement in infrastructure and water, it had been expected that the Dead Sea level would rise again after the water issues in the region seemed resolved. However, although there is enough water available for everybody, countries are still hesitant to let more water flow into the Dead Sea because of continuing lack of cooperation since there is no political agreement. Also, negative effects on nature are increasing because of the continued pressure to develop open land. *Also for Sarah and Ahmed, it becomes more and more difficult to fill their hotel with tourists. The main reason for this is that the level of the Dead Sea is so low, thus unattractive, and is not rising. Therefore the tourists do not come at the expected rates anymore.*

The Dead Sea



Suffering of the Weak & the Environment

The Suffering of the Weak & the Environment scenario is a worst case scenario in which neither peace nor economic growth can be reached. Unilateral decisions make it impossible to solve the water problem in the region and water becomes increasingly expensive. Agriculture is particularly affected. Donor-funded rural projects fall away because of the political situation and many small farmers give up and move to the growing cities. There is a continuous decline in agricultural area and finally a complete collapse. The overall instability negatively affects investments and ultimately the infrastructure also collapses in many parts of the region. The poor suffer the consequences of a deteriorating environment most, but also the middle class is disappearing.

Storyline

2008-2012

This is the story of Ahmad who is a Palestinian with a Jordanian passport. In the early 1990s he works in Tel Aviv at the company of an Israeli contractor named Moshe. However, the ongoing peace process fails and the political situation worsens, Ahmad is denied his work permit in Israel in 1995 and has to leave Israel.



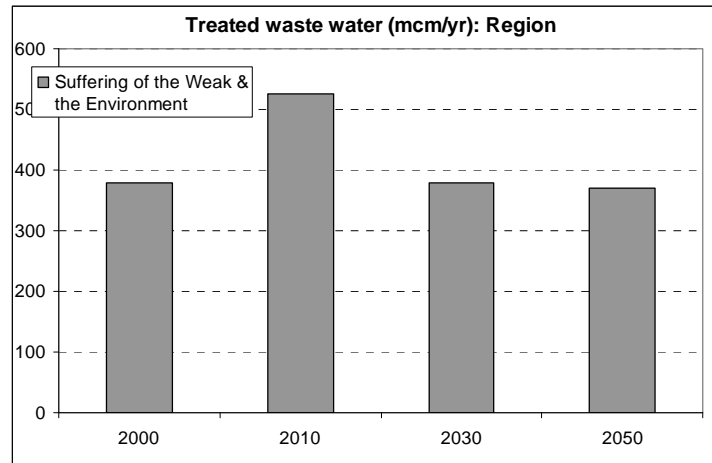
He returns to his home town in Jordan, a small village with 120 inhabitants located somewhere in the Jordan River valley. Here he continues the family tradition of being a farmer. He owns four hectares of land, which has belonged to his family for several generations. Ahmad has four almost grown-up children, with the family often struggling to make a living. After some time in this little town, Ahmad is elected mayor. He still earns most of his income from farming and selling produce to the nearest cities.

Some time ago, the local farmers joined a cooperative that exports tomatoes to the EU. For that they had to go through a tough procedure of certification. In the meantime, however, international development has changed because of changes in international markets, partly due to the effects of climate change.



Altogether, there is a lack of financial capacity in Jordan and Palestine. High energy costs and, in particular, high oil prices and reduce the ability to provide fresh water. Treated wastewater is also very energy intensive, as a result, there is a failure in many places to treat wastewater. Because of the general economic breakdown, the building of wastewater treatment plants is further slowed down considerably (see Fig. 11). Due to these deteriorating conditions, the EU puts a lot of restrictions on the trade with the Middle East and so the once increasing trade with Germany and other EU countries weakens. *For the farmers from Ahmad's village, it becomes impossible to meet the tough EU criteria and, thus, export decreases while prices of imported products increase.*

Figure 11.
Increase in wastewater treatment
in the region (2000-2050) -
Suffering of the Weak & the
Environment scenario



Ahmad's life has never been easy, he is used to deal with all kinds of difficulties, such as financial problems of his family and his community, troublesome citizens reacting aggressively to the political tensions in the region, and accusations of not being strong enough when standing up for his people. Authorities, on the other hand, have increasingly seen him as a troublemaker who defends his people's interest sometimes beyond legal limits. As if this is not enough, Ahmad's community has been plagued with increasing water scarcity which seems to have become a frequent phenomenon, no longer limited to extreme drought years. Rain-fed agriculture fails year after year, so they have to rely more and more on supplementary irrigation for keeping their crops alive.



In the past, they have always managed to move on with their lives. It was only recently that some kind of threshold seems to have been crossed. Water scarcity becomes unbearable after the main well in town falls dry. This triggers a downhill slide for Ahmad and his people.

2025-2030

In 2029, farmers in the village have an almost complete loss of crop harvest due to the most severe drought in memory. In vain they struggle to get some more water from other wells and the pipe system to make up for the shortage. The economic downturn together with the continued political conflict also increases other pressures on local resources, such as lack of fertilizer, lack of spare parts as well as donor support for maintenance - leave alone improvement - of irrigation systems and other infrastructure.

In general, the lack of capital in the region reduces investment in all kinds of technical improvements, such as, e.g., renewable energy production as well as fresh water from desalination. The overall instability negatively affects investments, funding, tourism, industrial plants, and the overall cooperation. Also for Moshe, Ahmad's former employer in Israel, it becomes increasingly difficult to remain middle class. Because of the bad economic situation and, in particular, the rise of energy costs, he goes into large debt, which, in turn, forces him to reduce the number of his employees. Shortly before his death, Moshe hands over his business to his son Itay.

Unilateral decisions make it impossible to solve the water problem in the region and lead to unfair conditions that harm all parties. The lack of water availability improves public awareness and causes a rise in the value of water. Also, because of this reduction in overall water availability, there is an allocation of water in favor of the domestic sector. Since there is, however, also an increased demand for irrigation water, water prices increase sharply.

There is a general loss of trees, in particular palms, and other vegetation from attempting to increase crop area. Most of the regional crops disappear and, instead, cash crops appear more and more. Farmers, who can still afford it, rely more on drip irrigation and less labor-intensive crops in order to be marketable. Availability of water at these farms actually increases because they are saving water due to improved irrigation technologies. Because of the changing vegetation, however, natural resource degradation of soils and vegetation, salinization and other pollution of water resources accelerate.

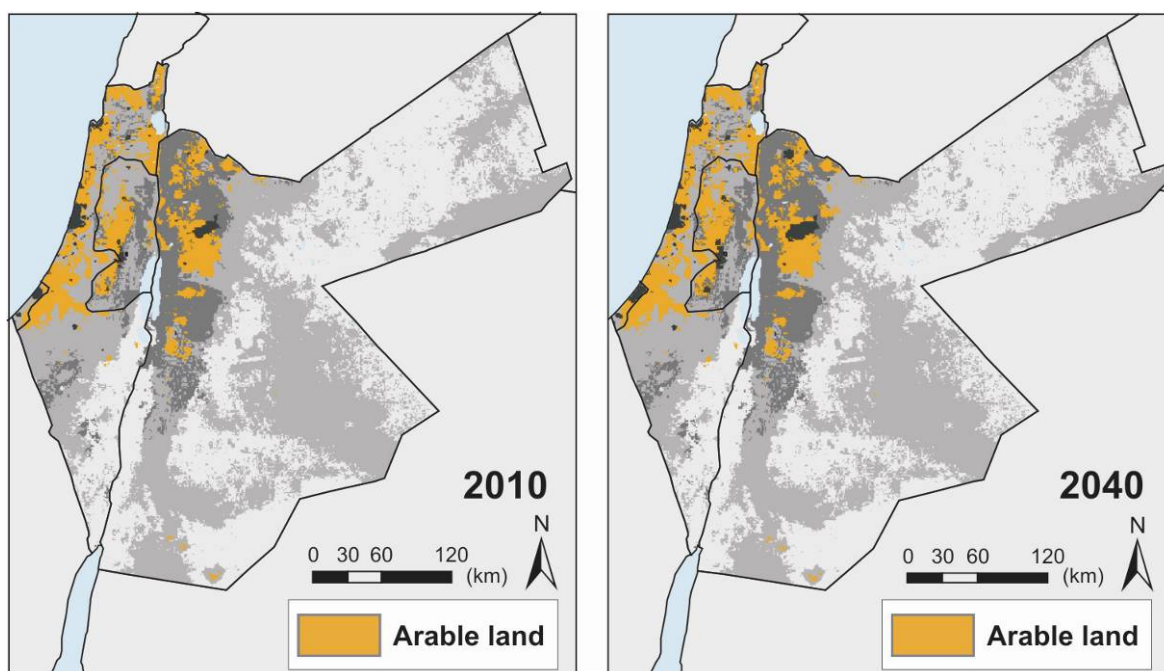


Figure 12. Arable land in the region (2010 & 2040) - Suffering of the Weak & the Environment scenario



Amidst all these pressures, Ahmad cannot manage any more the way he used to. All around their village, the same problems mushroom and he is not able to defend his people's cause any more in front of the water authorities. When that happens, he becomes more and more unpopular with his own people, not to mention the harsh reactions from the officials at the water authorities. Also, visits by police and security forces become more frequent and make being a mayor very unpleasant. As a result, Ahmad resigns and his son Jamal is elected mayor instead.



Ahmad's family farm is also in bad shape, especially after they can no longer afford to buy fertilizer. When their pumps break down with no chance for repair, the certification for exporting to the EU is out of reach. Closed borders to neighboring countries have also made that route for selling their tomatoes impassable for quite some time. Under these conditions, Ahmad and his son Jamal, who has taken over the farm by

now, have no chance of getting a credit from their bank any more as they used to previously for bridging critical periods.



Different from Ahmad's family, who still has some supplementary income from Jamal's job as mayor; other farmers leave the village to look for work in the cities. They look particularly for jobs in the public sector which still receives considerable support from international donors. Donor-funded rural projects fall away, one after the other, because of the political situation and the uncertainty about continued engagement by the local people themselves, thus, the sustainability of the projects. Ultimately, the focus of international donors shifts away from the region and those who remain there change from development cooperation to crisis management.

One of Ahmad's sons-in-law has managed to run a small hotel which sometimes has even attracted tourists from abroad. However, when political tensions grow and security becomes an issue tourism drops. When most of the green landscape is gone and the environment becomes very unattractive, tourism completely fails and Ahmad's son-in-law has to close the hotel. After that, he also moves to the city.

2050

By the end of the 2040s, the average temperature in the region has risen by 2°C due to global climate change, which has led to a 25% increase in aridity in the Middle East. Due to this global climate change, the sea level is now also rising. Regional and national social conflicts arise regarding the distribution of the ever more scarce water resources. There is a move everywhere towards privatization of the water sector and, since market values are dominant, water becomes a market-based commodity and is no longer a value-based good. As a result, social fairness disappears and certainly the poor suffer most.

Due to a lack of good birth control programs, population is increasing everywhere (2.3 times compared to 2000, compare Fig. 13). In addition, there are many environmental refugees and other immigrants, especially from Iraq. This has further negative economic effects on the region. Ultimately, the infrastructure collapses in many parts of the region caused by the general economic failure. *Also, Moshe's son Itay has to close his firm.*

Education possibilities drop further and the ability of the poor to get an education lessens even more.

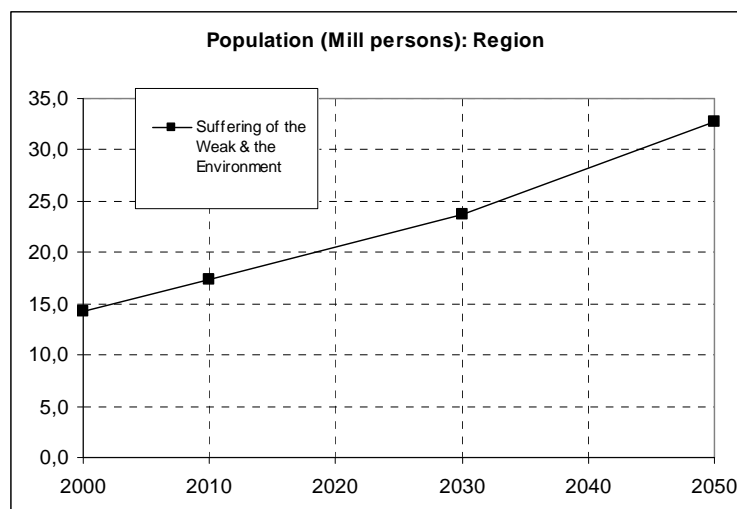


Figure 13. Population increase in the region - Suffering of the Weak & the Environment scenario

There is a continuous decline in agricultural area and finally a complete collapse. As agriculture decreases, grazing area increases. *Also, Jamal can eventually no longer afford to subsidize his farm from income as mayor, which was becoming more and more infrequent and eventually completely fails. Jamal starts selling off his machinery and other goods to feed his family. When the next drought hits, leaving him with no water for irrigation, he has to give up farming completely like most of his neighbors have done before. That drought also forces them for the first time to buy water from tankers at incredible prices, pushing them further into poverty. The quality of that water makes several people in the community sick. This adds further pressure to the health situation, already being critical due to food insecurity, heat and other climate stresses.*

Soon after his youngest child finishes school, Jamal starts looking for any kind of job to support his family and moves away to the city. Not many people are left in the village.



