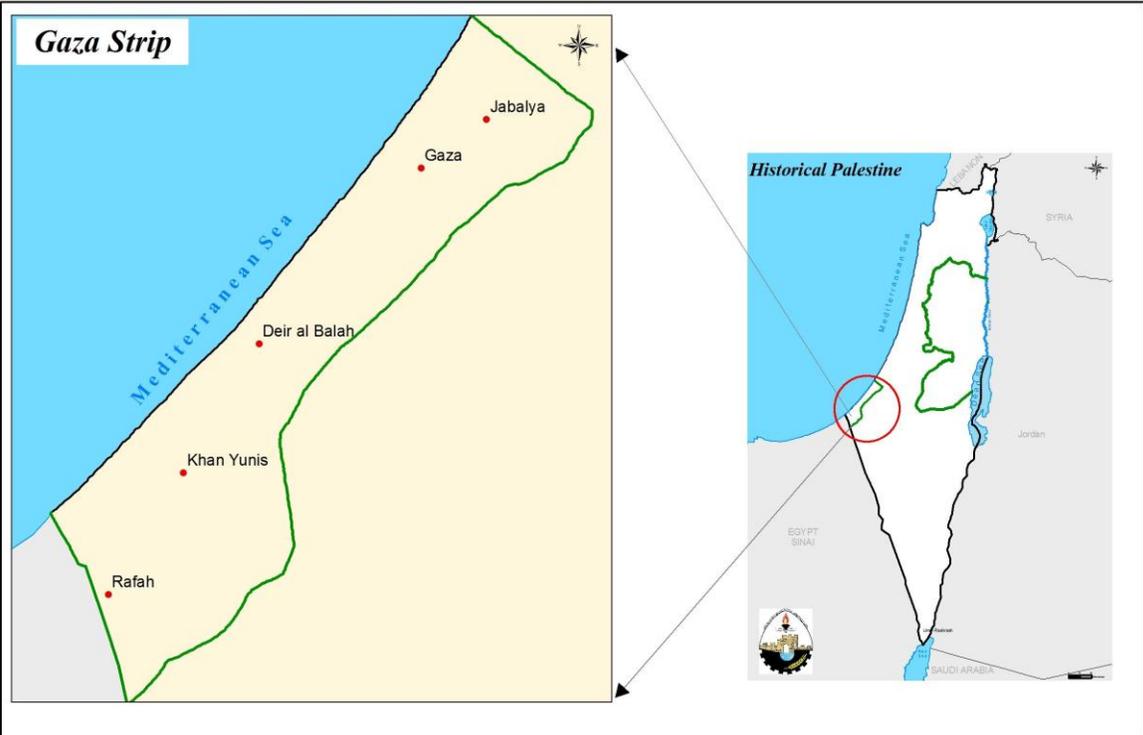


The Gaza Strip's Water Crises: A Case of Climate Change under Occupation

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Introduction

Environmental fragility combined with man made factors associated with political conflict has created *climate change vulnerability* in the Gaza Strip (Gaza), which is the term used to describe the environmental effects that place people or systems in harms way (Mason, Ziad, Zeitoun, 2010). At present the Palestinian people who live in Gaza are under the impact of a critical water shortage. This paper examines the political context and the environmental factors that have facilitated a water crisis in the Gaza Strip. It also will assay the complexity of the cross relations between politics and environment and their role in creating an unsustainable water situation in Gaza.

The political context, explored in this paper, includes Israeli generated polices, military operations, and combinations of polices and military operation. The Israeli polices' all of which are expressed through military orders, have given Palestinians little control of their water resources including efficient usage. These policies include a "permit system," which requires individuals and entities to receive a permit before starting a water related project or entering water reservoirs and pumping sites. Additionally the blockade imposed on Gaza is preventing the installation and development of an effective modern water and sanitation system. The military operations, particularly those since 2000 have inflicted devastating damage to Gaza's infrastructure especially in Cast Lead operation of 2007-2008 (Makdisi, 2008; United Nations Development Project, 2009). It is important to note that the interim peace agreement between Israel and Palestinians also known as the Oslo Accords has not

changed the occupation policies and measures that are imposed in the West Bank and Gaza. Thus, the Israeli authorities continue to tighten their control over the Palestine Territories including its water resources.

The gripe of the water crisis in Gaza is further tightened by factors induced by climate change, which includes decreases in precipitation, drought, and seawater intrusion. There is a cascading effect of climate change. The start and duration of seasons has changed, which has exposed Gaza to more fragility (Mimi, Ziara, and Nigim, 2003; Ministry of Agriculture, 2009). As a consequence of seasonal change, there is an alteration in quantities of rainfall and periods of heavy precipitation. The alteration in precipitation has an effect on the capacity of the soil absorption, which causes a decrease in the water basin's ability to recharge (Mimi, Ziara, and Nigim, 2003). Thus the combination of decrease in water recharge along with seawater intrusion has exacerbated the Gaza water crises.

After examining the issues this paper will recommend an intervention strategy based on the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) issued in 2007. Specifically the no and low regret strategies are recommended in this paper as strategies to mitigate the effects of climate change. The no-regret adaptation strategies are measures justified under all plausible climate change scenarios. The low regret adaptation strategies, however, needs low financial resources (United Nations Development Project, 2011). Additionally in order to carry out these strategies this paper recommends capacity building for Palestine Water Authority. The water crisis is placed within the framework international humanitarian law, which emphasizes access to water is a human-right.

Background the Gaza Strip: Political Context and Demographic Information

Gaza is part of the occupied Palestinian territories (oPt)¹; it is 140 square miles (363 square km) with a 40 km costal line. Using the population growth rate of 3.4% per annum in the oPt (Palestinian National Authority, 2008: 22), the estimated population of Gaza is 1,535,120 (Palestinian Central Bureau of Statistics, 2010). Thus, Gaza holds the highest population density in the world with 4,073 persons per square km (Palestinian Central Bureau Statistics, 2009), and the United Nations Relief and Works Agency for Palestine Refugees (UNRWA) has estimated that three-quarters of the population of Gaza are registered as refugees. Presently the unemployment rate is 37.4% (Palestinian Central Bureau Statistics, 2011). Also some of the Gaza labor force work on seasonal base in agriculture. The farmers who use traditional ways of farming, compose 12% of Gaza economy (Palestinian Central Bureau Statistics, 2011).

The oPt including the Gaza Strip fell under Israeli authority on June 6, 1967 as a result of the 1967 war. From 1967-1981 the security and civil authorities in oPt were managed by appointed Israeli military commander. In 1981, following Camp David peace agreement between Israel and Egypt, the Israeli army transferred the responsibility of oPt to a newly created civil administration unit. The mandate of the civil administrative unit included overseeing the life of Palestinian population that includes

¹ The occupied Palestinian territories (oPt): it includes West Bank, East Jerusalem and Gaza.

economic, infrastructures and the relation with foreign and international organizations (Cater, 2007).²

The PA was established in 1994 based on the Declaration of Principles on Interim Self-Government Arrangements also well known as Oslo Accords between Government of Israel (GoI) and Palestinian Liberation Organization (PLO) that was signed in 1993. Since 2006, the Palestinian Authority (PA) comprised of two political parties Hamas and Fatah. Hamas controls the administrative authority for the life of Palestinian population who live in Gaza Strip.

The interim agreement (Oslo accord) categorized oPt into three areas –excluding Jerusalem³--. In area A (17.7%), PA has complete autonomy over administrative and security issues. In area B (18.3%), the PA has civil administrative authority while the security is in the hands of Israel, and area C (61%) is under full administrative and security control of Israel. The deployment of the Israeli army and settlements from Gaza Strip in 2005 does not create a substantial change to the percentage of the areas under the various levels of control since the majority of Gaza area was part of area A. Presently, the Israeli army and Egypt control the Gaza borders (United Nations, 2008).

Article 40 of Oslo Accords, created the Joint Water Committee (JWC), which is made up of Palestinian and Israelis representatives, and was established to govern such issues as the management of the shared water basins (underground). The JWC is also mandated to insure that Palestinians receives more water than they did prior to the Oslo interim agreement. In practice “the JWC does not function as a “joint” water resource management institution because of fundamental asymmetries” (World Bank a, 2009 p.

² For more information : Israeli Defiance Forces website: <http://dover.idf.il/IDF/English/units/other/coordinator/default.htm>

³ The status of Jerusalem was left to final negotiation, thus it is under Israeli full control

31) resulting from the imbalance in power, capacity and information between parties (World Bank a, 2009 p.53). These advantages favor Israel who controls the water resources and the amount of pumping. There is also no enforcement mechanism to put into effect the agreement of allocate more water to Palestinians.

Climate Change

The Climate Change Adaptation Strategy and Programme of Action of Palestinian Authority (CCAS/PA) has identified the Gaza Strip as having a high level of climate vulnerability (United Nations Development Programme, 2010). The vulnerability of Gaza is result by two factors, those factors that are man made and policy driven and those that are based on the environmental fragility of the area. The Israeli Occupation of the oPt combined with general policies toward the area, military operations, and a combination of policy and military operations has had major environmental consequences for the Gaza Strip. At the same time the climate vulnerability of the Gaza Strip is affected by environmental factors such as a decreases of precipitation, drought, and seawater intrusion. The relationship between man made policies and environmental factors as they impact the climate vulnerabilities of the Gaza Strip is complex, this paper attempts to explore these issues.

Political Conflict: Man Made Factors and their Affect on the Environment

Israeli scholar Jeff Halper describes his governments policies toward the oPt as a matrix of control. He states that there are three key points to this matrix: 1) physical control over key Palestinian areas; 2) bureaucratic and "legal" policies that restrict

Palestinians, 3) use of military force to maintain control over the matrix. This section explores the way in which the matrix of control has affected natural resources of the Palestinians and has accelerated the harsh affect of climate change (Halper, 20006)

The policy instrument

Following the Israeli army's take over of the Palestinian territories, in June 1967, several military orders have been implemented to restrict the control of water in the West Bank and Gaza. For example Military Order (No. 92) was issued in August 15, to limit the control of water resources and water related issues to Israeli army. The Military Order 158, issued in November 1967, requires Palestinians to secure a permit for all water structure/ instillation construction projects. This requirement involves water projects that require importing machines, spear parts or any new cemented construction. If the projected is not permitted and Palestinians continued in the construction, the structure will be confiscated by the army (Israeli Military Orders, n.d.). It is important to note that the military orders do not apply to the around half million Israelis settlers residing in the West Bank and who lived in Gaza, as these individuals are subjects of Israel and therefore fall into the Israeli civil law (Amnesty International, 2009). In 1994, with the signing of the Oslo accord and the creation of the PA, the management of Palestinian water was supposed to fall into the purview of the PA, however, the water presently allocated to Palestinian communities and issues involving water resources remains in control in the hand of Israeli authorities (Cairo Agreement, 1994).

Since the second Intifada in 2000, the Israeli army established a policy of a buffer zone to meet its security objectives. This area serves as a 'no man's land' and its size

depends on an assessment of the Israeli security situation. According to Applied Research Institute Jerusalem (ARIJ) (see annex 1) the buffer zone is between 24% to 30 % of the land mass that makes up the Gaza area. The buffer zone is an area on the Gaza borders that is contiguous with Israeli cities (Applied Research Institute Jerusalem, n.d.). Data shows that this buffer zone contains 46% of agricultural land in the Gaza Strip, which could be used for food production. The inaccessibility of this land, has heightened the problem of issues of food (World Bank 2009a; World Food Programme, the Food and Agriculture Organization, and the United Nations Relief and Works Agency for Palestine Refugees in the Near East, 2008).

During the Palestinian second Intifada, anew policy was developed to ensure Israel's maintenance of control of water resources. Consequently each water project approved by the JWC, which falls within the area fully controlled by Israel (called area C) and marked by Israeli army as a buffer zone, needs an additional level of approval by Israeli Civil Administrative. Accordingly "almost all wells, water conveyance and wastewater treatment and reuse infrastructure" (World Bank a, 2009 p. 9) exist in area C and Gaza's buffer zone⁴. The results are "a number of projects have been approved by the JWC, for which detailed planning permission has not been granted by the [Israel] Civil Administration⁵" (World Bank a, 2009 p. 53).

The World Bank's report, to the Ad Hoc Liaison Committee that represents the international donors to the PA, emphasized that joint water governance mechanisms established under Oslo have in fact "been downgraded to a project-by-project unmediated

⁴ Israel created another buffer zone in West Bank after building the Separation Wall/Barrier in 2002.

⁵ Israel Civil Administration is run by the Israel Army.

permitting negotiation process between unequal parties, which Israeli interests and internal processes can override with no credible recourse for Palestinian needs” (World Bank, 2009a 31). Thus Palestinians have to handle their water and sanitation resources under the measures of the Israeli occupation.

The Israeli measures, first includes preventing Palestinians from having control over the water reservoirs (wells). Thus, the Palestinian water authority does not have any ability to determine the amount of water pumped from the wells, and the time of pumping. This measure also prevents Palestinians from monitoring water quality on-site. In order for staff members of the Palestinian Authority to visit water reservoir sites, they must apply for special travel and access permits. If permission is granted and a site visit does occur Israeli security forces monitor the staff from the Palestinian Water Authority (Amnesty International 2009, World Bank a, 2009).

The second factor impeding the effectiveness of the Palestinian Authority staffer is the physical disconnection between Palestinian territories. Staff must resort to communicating with each other over phone or video conferences. This is particular true for the Palestinian Authority staff from Gaza Strip. The staffers have been prohibited from visiting the West Bank (and vice versa) since 2006, when the Islamic party “Hamas” were elected into power. The situation is even more difficult because a unified training program cannot exist between the Palestinian Authority staff between the Gaza Strip and West Bank (World Bank a, 2009).

The communication between Palestinian Water Authority in Gaza and Israeli Water Authority⁶ regarding water and sanitation issues was suspended in 2007 (World Bank, 2009). The suspension of communication affects both parties ability to deal with the Israeli wastewater lagoons for example. The Israeli wastewater lagoons affect the Gaza residents' health and the farming land quality by providing rich habitat for insects propagation, and wastewater leakage to Gaza farming land. Furthermore, the suspension of communication has put a halt to a plan for dealing with trans-boundary water resources between the Israelis and the Palestinians. This plan if developed would address the water shortage in Gaza by shared management of the shared costal water basin (Amnesty International 2009, World Bank, 2009).

Military Instrument

Since 1967 the Israeli military operations targeting Gaza has tended to inflict harm on the infrastructure including the infrastructure that provides clean and adequate water services. Due to the 2008 to 2009 Israeli military operation entitled Cast⁷ Lead for example, just 57% of water pumped into the grid reach its final destination (house, factories, farms), without being potentially contaminated. The Cast Lead operation caused serious damages and destruction to 11 registered groundwater wells and four

⁶ The coordination between Palestinian water authority two parts in West Bank and in Gaza ended in 2007 after the split between the Palestinian Authorities two parties (Fateh and Hamas). The Gaza staff became part of Hamas affiliated government with no connection with the external world. However the West Bank staff continued their work in coordination with Fateh affiliated authority who have some coordination with the Israeli water authority.

⁷ Two military operation preceded Operation Cast Lead; Operation Summer Rain (June 27-30,2006), and Operation Autumn Clouds (November 1-7, 2006)—for more information on Israel military operations in Gaza Strip see GlobalSecurity.org

water reservoirs, and damaged 19,920 meters of water pipes (Nembrini, 2010; United Nations Development Programme /Programme of Assistance for Palestinian People, 2009). Additionally the Cast Lead military operation caused heavy destruction to the wastewater infrastructure. The following table (1) provides some figures.

| Gov. | Design | Actual |
|--------------|---------------|---------------|
| North Gaza | 5,000 | 20,000 |
| Gaza | 32,000 | 50,000 |
| Middle | 0 | 0 |
| Khan Younis | 0 | 0 |
| Rafah | 2,000 | 8,500 |

Table (1): Treatment capacity of the wastewater treatment plant in Gaza Strip

Adopted from: UNDP, one year after report (Gaza Early Recovery and Reconstruction Needs Assessment, 2009).

The combination of policy and military instruments

The Israeli occupation affected the management and performance of water and sewage treatment systems in such a way that it inflicted damage to the environment. For example, through its destruction of treatment plants Cast Lead decreased the already limited ability of sewage water treatment in Gaza. The situation resulted in a weakening of the existing wastewater treatment, an increase the risk of underground water contamination (Nembrini, 2010 p. 24), while heightening coastal seawater contamination (World Bank a , 2009 p 30). The damaged inflicted on the sewage water grid by the Israeli military operations resulted in a significant leakage in the sewage water system. The leaked sewage percolated into the underground water, and the remaining untreated water was dumped to the sea causing coastal contamination (World Bank a, 2009 p. 31)

The siege imposed on Gaza since 2007, has limited the amount of industrial fuel allowed into Gaza. The fuel is needed to generate the electricity required for such entities as households, hospitals, and civil usage that includes sewage water treatment plants and water desalination apparatuses. The decrease of fuel to the area has resulted in deterioration human basic civil services and the complications in importing spare parts needed to maintain and rectify the un-worked and damaged plants (Amnesty International 2009, United Nations Development Program, 2009)

The Effects of Man Made and Environmental Impacts

The occupation-- and its policy instruments, military operations, and a composition of and policy-military apparatus-- has also impacted the climate vulnerability of the oPt in general and the Gaza in particular. This vulnerability is most pronounced in the inability of Gaza to develop an effective strategy that would allow it to build up water and sanitation systems. The constraints of the Israeli occupation has not only hindered present capacities to address water issues, but with its restrictions on movement has also made it impossible to develop an environmental strategy for the area.

The imbalance of power between Israelis and Palestinians is reflected in each group's daily consumption of water. According to an Amnesty International report, in 2009 the Palestinian consumption is "70 liters a day per person – well below the 100 liters per capita daily recommended by the World Health Organization (WHO) – whereas Israeli daily per capita consumption, at about 300 liters, is about four times as much" (2009, p. 4). The same report cited that "[I]n some rural communities Palestinians survive

on far less than even the average 70 liters, in some cases barely 20 liters per day” (p. 4), the minimum amount recommended by the WHO for response to emergency situations.

The Palestinian water grid experiences a deep shortage of water. In these areas the average amount of water used is 20 liters per day (p. 4). These communities bring water by mobilized water tanks from far away areas, which create additional hardships for the individuals in these poor communities (World Bank a, 2009, 119). For example, importing water from long distances significantly increases the water prices. The aforementioned report highlight that “[t]he cost to the economy of tanker water over network water could be as much as 1% of GDP” (World Bank a, 2009, 23). It is important to bear in mind that this cost is born by individuals whose economic resources range between strained and dire. Additionally, importing water by cisterns exposes the water to variety of contaminations including bacteria, thus increasing the health risks to the adults and children who dwell in these communities (World Bank a, 2009).

The average seasonal rainfall is 522mm in the northern Beit Lahiya governorate of Gaza and is 225mm in the southern Rafah governorate. According to a report by the Palestinian Water Authority (2007), Gaza Strip is presently 12% below the historic average of rainfall (Mason, Ziad and Zeitoun, 2009).

Climate change predictions are found in several reports. Examples include the Intergovernmental Panel on Climate Change (IPCC), which states that climate change will affect the start and duration of the seasons, and the quantity of rainfall. This change will lead to, periods of heavier precipitation that will be concentrated in a shorter time, resulting in “increased run-off and erosion and decreased absorption capacities of the soil” (Mason, Ziad, and Zeitoun, 2009 p.8). Less retained water will have a direct

economic impact on farming process and social groups. Pasture production, for example, will be affected and this will force shepherds to either purchase more fodder or reduce the number of their sheep. Reduced rainfall will result in a lower quantity of water harvested and stored in tanks, forcing shepherds to buy more water, which increases the cost of breeding. These changes will affect the cost of raising herds, the economic life of the farmers, and food security (United Nations Development Program, 2009).

Another economic effect will be a result of a change in growing crops season. A change to the season would likely cause Palestinian agricultural sector to lose advantages it receives due to the timing of its imports relative to countries in other climates. The delayed of season will negatively affect Gaza, which has been an early exporter of flowers, fruits and vegetables to colder countries (Ministry of Agriculture 2008).

It is also clear that the expected changes in precipitation will affect quantity and quality of groundwater sources. The decrease in rainfall will affect the water basin recharge. The decrease in rainfall also will induce a rise in soil salinity. As a consequence of growing groundwater extraction, the groundwater to water basin recharge will far exceed the safe yield⁸. It has been estimated that the oPt will experience a water deficit of 271x106 m³ by 2020 (Mimi, Ziara, and Nigim 2003).

Seawater intrusion is another critical factor that will affect the ground water in Gaza Strip. The concerns related to seawater intrusion are found in an Israeli Ministry of Environmental Protection report that states an anticipated 10mm/year rise in sea level in the Mediterranean (cited in -- United Nations Development Program, 2009, p 13)

⁸ Safe yield: a term used to describe the amount of discharged water from water basin without leaving negative impact since the consumed water would be recharged by natural resources (rain, rivers).

Finally the high precipitation events (HPEs) is likely to lead to flash floods. The flash floods further intensify the issues by creating a low percolation percentage to groundwater. The HPEs can potentially has a devastating effect on the Gaza's infrastructure in the scope that the water management infrastructure because it lacks resilience. This lack of resilience was evidenced, in the Gaza Strip, at the end of October 2008, where storm-water and wastewater drainage systems were overwhelmed by an unusually intense HPE-induced flash flood (cited in -- United Nations Development Program, 2009) (see annex 3, destruction)

The expected change in the precipitation is already adding to the water crisis in the Gaza Strip. The over-extraction the Palestinian portion of the Coastal Aquifer that mount to 170 million m³ per year while the annual rainfall recharge estimated to be around 60 million m³ per year according to Coastal Municipality Water Utility (CMWU) Water Safety Report in October 2008. The report also mentioned the water pollution from saline intrusion, naturally occurring salts in the Eocene in Israel, and nitrates and chlorides from untreated wastewater that percolate to groundwater (see the nitration map: annex 4; Gruppo di Volontariato Civile and Palestine Hydrology Group, 2009).

The untreated wastewater in addition to seawater intrusion and the over extraction of underground water beyond the safe yield (based on yearly recharge), has made worse the water contamination by nitrates. The increased level of nitrate in Gaza ground water beyond the WHO recommended limits (50 mg/liter), induced the methemoglobinaemia⁹ -

⁹ Methemoglobinaemia is a blood disorder characterized by higher than normal levels of methemoglobin, a form of haemoglobin that does not bind oxygen. It caused by high level of nitrate in blood. It causes anemia among infants and increase the mortality rate.

-blue babies -- sickness among Gaza children which increases the morbidity and mortality rate among Gaza infants (United Nations Development Program, 2009).

The water crisis, both man made and environmental, might reflect itself in the public health of Palestinians to include the re-appearing of water-borne diseases such as cholera that cause diarrhea, and dehydration (Amnesty International, 2009; United Nations Development Program, 2009). Recently, the Israeli Ministry of Environmental Protection predicted an increase in the mosquito populations and their distribution, which could have a large impact on the health of residents of the Gaza Strip. (Office of the Chief Scientist 2008, p 91-93). The mosquito problem will affect the Gaza Strip given that the Israeli lagoons are on the borders with Gaza Strip. The rise of the mosquito population could increase the potential of vector-borne diseases (such as malaria) in the long term and or increase the cost of dealing with the problem that needs usage of insecticides (cited in -- United Nations Development Program, 2009).

Strategies to Mitigate the Effect of Climate Change:

The Palestinian Adaptation Programme of Action (PAPA) defined climate vulnerability as “ the propensity of people or systems to be harmed by climate hazards in the context of other domains of vulnerability, as well as in relation to response capabilities in both the short-term (coping) and the long-term (adaptation)”(Mason, Ziad, and Zietoun, 2009,17). In accordance with this definition and the political context this paper uses two strategies to mitigate the negative effects of climate change. First is the no-regret adaptation strategy defined as adaptation options (or measures). These measures would be justified under all plausible future scenarios, including the absence of

manmade climate change. Second, is the low-regret adaptation strategy that needs low financial cost to be implemented (United Nations Development Program, 2009).

The intervention strategy base line for dealing with climate change is based on the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) issued in 2007. The IPCC predicts that, for the southern and eastern Mediterranean, warming over the 21st century will be larger than global annual mean warming: between 2.2-5.1 C according to a realistic emissions scenario (Scenario A1B). Annual precipitation rates are likely to fall in the eastern Mediterranean – decreasing 10% by 2020 and 20% by 2050 – with an increased risk of summer drought. This decrease will increase the water insecurity in the area in general including the Gaza Strip (Intergovernmental Panel on Climate Change, 2009). The water insecurity is defined PAPA as “ lack of access of individuals to sufficient safe water for health and well-being [due to] the absence of control and effective management of scarce water resources” (Mason, Ziad, and Zeitoun, 2009 p.2).

The combination of three significant strategies is proposed in order to address the risks posed by the climate change in Gaza. The first is to focus on targeting the environmental factors using the *no and low regret conclusive strategy*. The second strategy is to focus on building the capacity of Palestinian Water Authority. The final strategy involves engaging the international community.

The No and Low Regret Strategy¹⁰

The no regret strategy is justified under all climate change conditions since it bears the lowest financial cost, while low regret starting is one advanced step from no regret with low financial cost. Both the no regret and low regret strategies are proposed as in consideration of the weak financial status of the PA. Specifically, the PA is hindered in its ability to address climate change due to its: 1) limited resources 2) its lack of direct access to any of the climate change adaptation financing available to parties under the United Nations Framework Convention for Climate Change (UNFCCC) and the Kyoto Protocol, and 3) the impact of the Israeli occupation. Given these constraints the ‘no-regrets’ and ‘low- regrets’ strategies provide strong step in terms of addressing climate change and supporting disaster risk reduction. It is recommended that the adaptation strategies should be carried out by a variety of stakeholders.

The implementation of the no-regrets adaptation strategy would start with a review of the drinking water quality management systems. This review would be used to develop a management system that incorporates climate risks into the management process. The importance of the system will address the points that the Gaza Strip becomes under greater pressure from water scarcity and will have to increase usage of brackish water --salty water--. The management system will need to have procedures that will allow the inclusion of the re-use of treated wastewater in irrigation. Thus reducing pressure on underground water. The management system should have the capacity to introduce efficient irrigation techniques so that water consumption can be minimized.

¹⁰ The no and low regret strategies were proposed by the Palestinian Adaptation Programme of Action (PAPA) team in their report “Climate Change Adaptation Strategy and Programme of Action for the Palestinian Authority”.

Part of the adaptation will require developing a plan for dealing with trans-boundary water resources between the Israelis and the Palestinians. Because the Palestinians have limited control and access to water resources, the importance of developing a plan that stresses the fair allocation of groundwater and freshwater with equitable and reasonable utilization, is critical to a long term strategy.

The low-regrets adaptation strategy would start by increasing the use of water harvesting, for households and municipalities. The collection of water within each household is a popular custom among Palestinian farmers. Water collection can minimize the pressure on the grid, however it is also important that the management system provide technical support to insure the health and the maximum effectiveness of the system. The low regret strategy should protection of coastal sand dunes in the Gaza Strip since it has a direct impact on water quality, which minimize the threat of seawater intrusion. The adaptation strategy should introduce and support the selection of crop and ruminants that are tolerance to heat and drought.

The high cost adaptation measures require a larger budget and more effort than low and no regret options (United Nations Development Program, 2009). These measures and strategy would involve a high scale investment in the Gaza Strip's infrastructure in order to increase the efficiency of water usage in agriculture and industry. The need for fresh water resource requires finding water sources other than ground water, such as desalination plants. The Gaza Strip already uses a desalination method in a small-scale capacity (Nembrini, 2010). Because the Gaza Strip's underground water is the Coastal Aquifer, new coastal protection structures such as wave breaks and offshore protection

will have a positive effect on protecting the underground water. The high cost adaptation plan should also consider importing water from other countries such as Egypt.

Capacity building of Palestinian Water Authority

The PA has multiple structures and bodies, but each lacks the coordination and the capacity to deal with the climate change problem (World Bank a, 2009). The PA's lack of capacity hinders its ability to implement effective adaptation strategies. The capacity-building outcomes for the PA should meet the international standards and reflect the water based complications from the Israeli occupation. The first portion of a capacity building is the creation of a thoughtful analysis that would emphasize the identification of the key climate change information and related this information to models that reflect the need for Palestinian development, planning and environmental policy-making. The climate change identification process should address the priorities of climate change adaptation policy options and measures. The second component to capacity building is human capacity. There is the need to improve the capability of PA decision-makers to effectively analyze the impact of climate change, and then to use the information in such a way that would allow them to implement the best options. The capacity building of the PA staff will enable them to monitor and evaluate policies that induce the climate change directly and indirectly.

In order to build the capacity of the Palestinian Water Authority staff, the staff must have access to data and informational resources, and the ability to communicate ideas and research about climate with the regional units. After the inception of the PA in 1994 the PWA started to collect systematic data about climate change. However reaching

conclusive results on the climate issues in Gaza, as found in the data collected, is irrelevant since the time span is considered short by scientific measures. The research and data collection by the PWA are further hindered by The Israeli Water Authority, which has limited Palestinian access to data or samples. These samples would allow the PWA to engage in applied research that would evaluate the water resources capacity, quality and sources of contamination¹¹ -- the water status is part of the final peace process negotiation between GoL and PLO--.

Finally the PWA staff will not be able to be affective without sustainable work over a period of time. Some of the PWA employees were suspended from their work following the political division between Fatah and Hamas. The capacity building strategy emphasizes the importance of political neutrality of the PWA team. The political neutrality will enable the team to accumulate experience, data, and knowledge and share it with the upcoming employees. Some of the obstacles facing the Palestinian staff, could be alleviate by the involvement of a third party who would facilitate the communication and access to data available with Israeli Water Authority.

Advocacy Work and International Responsibility

Access to water is a human right. The Israeli occupation to Palestinian territories violates the right of Palestinian to access to water resources. Amnesty International and the United Nations Development Program, emphases that the Israeli polices conflict with General Comment 15 (The right to water 2002) of the United Nations Economic, Social and Cultural Rights. The General comment (15) obliges the international community to

¹¹The two third of the costal basin is in the Israeli side.

protect the Palestinians basic rights to have access to water. The Comment indicates “States ... should refrain at all times from imposing embargoes or similar measures, that prevent the supply of water, as well as goods and services essential for securing the right to water. Water should never be used as an instrument of political and economic pressure”. Not only do the Israeli policies increase the stress on the environment they also increase the impact of climate change on the residents of the Gaza Strip.

As a result of the War on Gaza in 2008-09, the United Nation (UN) carried out a campaign of reconstruction of Gaza’s infrastructure. The UN estimated the budget required for reconstructing and building infrastructure to provide adequate water, sanitation and hygiene to be around \$25,230,954 (Gaza Flash Appeal, 2009). During the International Donor Conference in Sharm el-Sheikh, Egypt, the PA was able to secure pledges from international donors of \$5.2 billion to “rebuild the devastated Gaza Strip and fund the Palestinian government” (Huffington Post, 2009). Some of this money would be allotted to help rebuild the water and sanitation infrastructure that was destroyed during the war on Gaza. However even though there is money to carry out some water and sanitation infrastructure projects, work can not occur because Israel will not give a permit necessary to import the needed materials and spare parts (BBC). The Israel justifies its blockade policy that tightened in June 2007 by describing Gaza as "enemy entity" controlled by Hamas (The Guardian, 2007).

Because the Palestinian territory is under Israeli military occupation it is subject to the international law of belligerent occupation, including the Hague Convention of 1907 and the Fourth Geneva Convention of 1949. Therefore Palestinians have the ability to use international laws in advocating for their human and national rights, which

includes water and natural resources. The international law is an instrument that obliges Israel, as an occupying power, to take responsibility for meeting the needs of Palestinian civilian population, including the guardianship of natural resources as stated in Hague Convention Article 55 of 1907. Additional damage to Gaza's infrastructure could be eliminated, by invoking the Fourth Geneva Convention Article 147, which prohibits the extensive destruction and appropriation of property.

Based on the international law (treaties and customary), Palestinians can ask for the intervention of the international community to protect them and to specifically prevent the disruption and destruction of Palestinian water and agricultural infrastructure. Palestinians through local and international human rights organizations can use advocacy strategies such as seeking an independent investigation by the international community to engage in a process that might support their efforts to address water issues. Among the policies that could be investigated is the disproportionate usage of water by the Israel military and settlers. Also in need of investigation are the Israeli policies that “undermined the adaptive capacity of Palestinian households and communities in the face of (present and future) climate hazards” (United Nations Development Program, 2009 p. 76).

The key players of international community represented by the Quartet (United Nations, European Union, Russian Federation and United States) are among the major patrons of the Middle East Peace Process. Since Palestine is the key element of the Arab-Israeli conflict, reaching a resolution to this conflict would benefit these nations by eliminating a major source of international instability, which can effect international economic growth. In order to reach a peace agreement, the aforementioned international

powers have split the conflict into its major strategic elements, including issues surrounding water. These water issues prevent Palestinian and Israeli parties from reaching a final peace agreement, and without greater involvement of the international community, an agreement is unlikely to result. Palestinians ask for full control over water resources in oPt, but Israel refuses for strategic reasons, since the water reservoirs are located under Israeli and oPt areas (see annex 4). In the short term, and for the benefit of all parties involved (including the international key players), the Quartet should work toward securing a resolution to the water crisis in Gaza Strip by providing large-scale solutions such as a desalination treatment plant.

The fact that PA is a young entity (less than 20 years) make it clear that Palestinians cannot develop their capacity and management without the help of the international community in accordance with the international standards and practices.

It is important to note that conflict driven factors and environmental factors are intertwined in their influence on climate change, and the hazards of climate change will affect both parties: Palestinian and Israelis. Though the two parties would suffer different proportion of burden, the two parties should be open to different adaptation climate change scenarios. These scenarios should consider both political and environmental justice. Accordingly considering the British mandate Palestine (the area between the Jordan River and Mediterranean Sea) as one geopolitical unit, should be among the preponderate scenarios to adopt when thinking about climate change. This option can be viewed as holding an increased importance when it is noted that the water tables as well as many other reasons are joined (see Annex 4). The climate change adaptation scenarios

should also include the regional adaptation strategies that consider the water crises in the Middle East.

Conclusion

The step by step adaptation strategies based on cost-scale will enable the Gaza Strip to adapt to the climate change problems which are a resulted of environmental and man made impacts. The adaptation strategies are not the ultimate solution for the water crisis in the Gaza Strip, however they do provide tools to mitigate the affect of the climate change in the short and mid-term. A long-term strategy should be based on international collaboration and regional integration, the issue that the paper did not discuss. Laying the foundation of dealing with the climate change problem in Gaza Strip should start with building the capacity of PA and gaining the cooperation with the local community. The proposed no-regret and low regret strategies can be carried out by the local community in de-centralize management and the involvement of the local investors. The de-centralize monitoring and management of water authority, not discussed in this paper, might be an option for the community who lives under the restrictions of the Israeli occupation.

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Annexes

Annex 1



Annex 2



Figure 2.4: The disruptive and destructive impacts of a flash flood in the Gaza Strip, following 36-hours of heavy precipitation on 27-29 October 2008 (Source: UNDP/PAPP).

Annex 3

Nitrate contamination map:

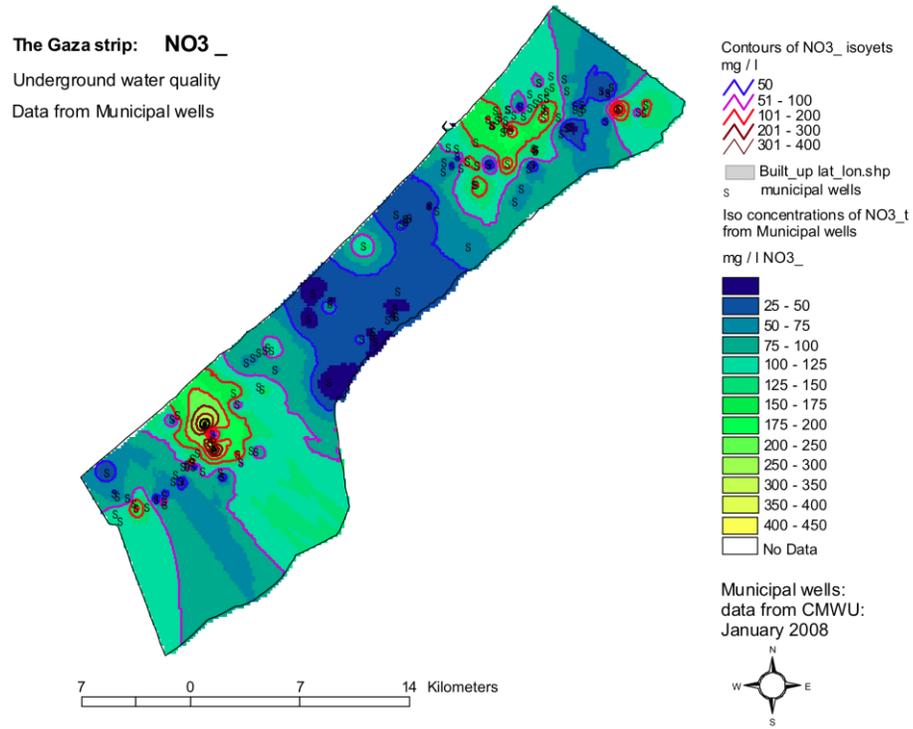


Figure 21 Spatial distribution of NO3_ concentrations obtained by interpolation of municipal data (n=143) collected in January 2008 by CMWU.

Annex 4 Aquifers locations

