

# **Brief review for Wadi Gaza area in relation to proposed Gas pipeline**

## **(Preparatory study for potential full EIA)**

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(with 10 figures)

### **Introduction**

Project background: “Launched in 2015, Gas for Gaza (G4G) will connect Gaza to gas via a natural gas pipeline through Israel, enabling the Gaza power plant (GPP) to generate electricity using natural gas rather than expensive, carbon-intensive and unsustainable diesel and facilitating the provision of infrastructure, including desalination, and social and economic development generally. The G4G pipeline route is approximately 47 km, of which 43 km are located within Israel and 4 km within Gaza (Figure 1). The project and associated tasks pertain solely to the Gaza section of the pipeline.



Fig. 1. The planned route

The area to be investigated is defined in Figure 2. There are currently two options for route and the final route is yet to be finalised. The final route will likely be a combination of both or a new but similar route. We are asking the detailed design contractor to provide a GIS file of the route options, a route corridor encompassing all likely options and up to date satellite imagery. We have been informed that there is additional new settlement and extensions to existing settlements that have encroached on some of the agricultural land, which are NOT shown on the above imagery. To be safe at the moment, we suggest you gather data on the above route options and 500m each side of each route option (this should include the Wadi Gaza). Please also advise if the area of influence (area of impacts) could be wider than this and therefore the suggested study area needs to be extended, (e.g. because some species on the dunes use a wider area of supporting habitat or impacts on the Wadi Gaza).

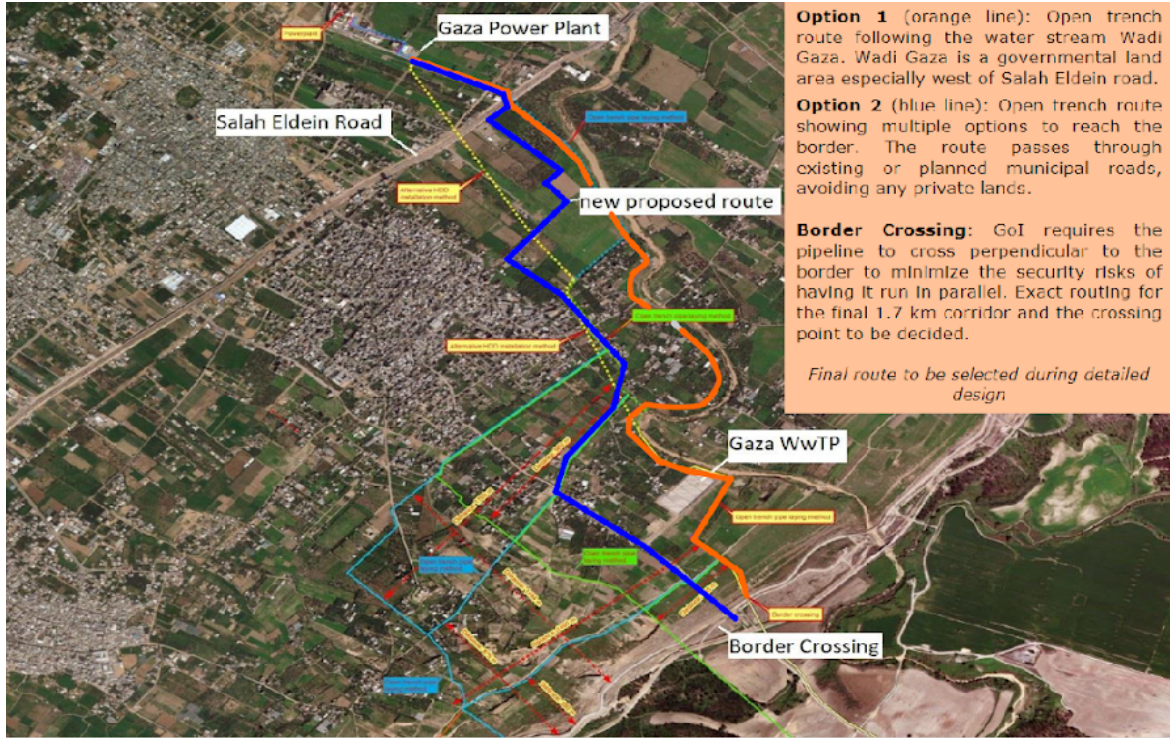


Fig. 2. The proposed path



Fig. 3 proposed route near Wadi Gaza

### Methodology

This is just a quick desktop study related to the planned route in Gaza identified in Figure 2. Reviewing literature using standard search tools and also adding materials and reports available to us at the Palestine Institute for Biodiversity and Sustainability. Key information sources reviewed here included a) national reports such as the 6<sup>th</sup> national CBD report, National Biodiversity Action Plan for Palestine, 2) Published scientific papers relating to Wadi Gaza, 3) Unpublished reports (usually done for projects), 4) communication with the Environment Quality Authority and People on the ground.

**The study area:** Between 1948 -1950 Israel was created and expanded its borders to control 78% of historic Palestine. Between 1949-1967, the Palestinian areas of the Gaza strip and of the West Bank came under jurisdiction of Egypt and Jordan respectively. Wadi Gaza is a 105 km valley that is carved by rain water running from the Hebron

Mountains to the Mediterranean. Decades ago it had flowing water nearly year round (e.g. PEF data). Now rain water flows during winter season (roughly December –February). This valley within the artificial political borders of Gaza (post 1949) is about 9 km long study area is situated between two refugee camps (Al-Nuseirat and Al-Bureij camps) and also Al-Zahra city in the middle of the Gaza strip. Coordinates N31 26 33 - 31 27 32 E34 22 37 - 34 24 35. The Gaza strip is 363 square kilometers with a maximum length of 41.8 km and maximum width of 12.5 km. Maximum elevations above sea level is 105 meters but most of it is around 50-60 meters above sea level (Mustapha 2016). For Geology, geomorphology and hydrology of the Wadi Gaza see Zaineldeen and Aish (2012). For socioeconomic indicators see GMCG (2001) and PCBS data.

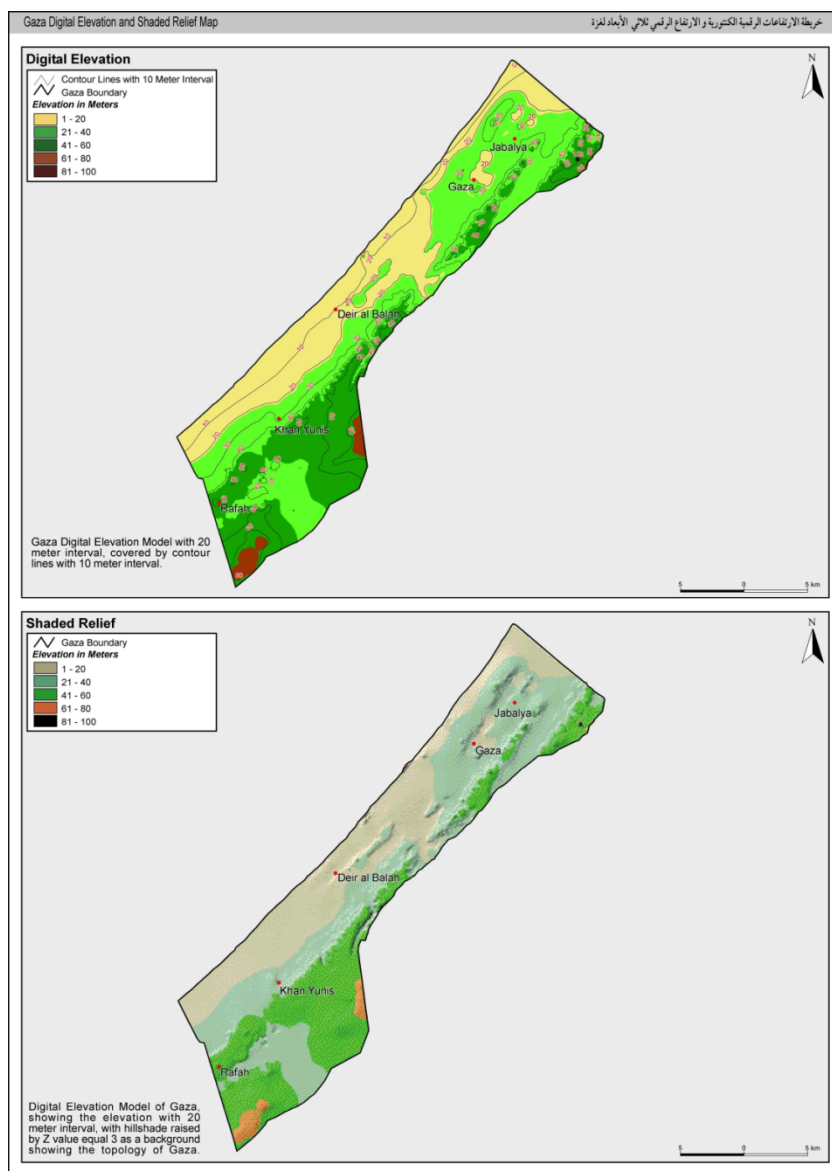


Fig. 4 Elevations (From ARIJ via Mustapha 2016)

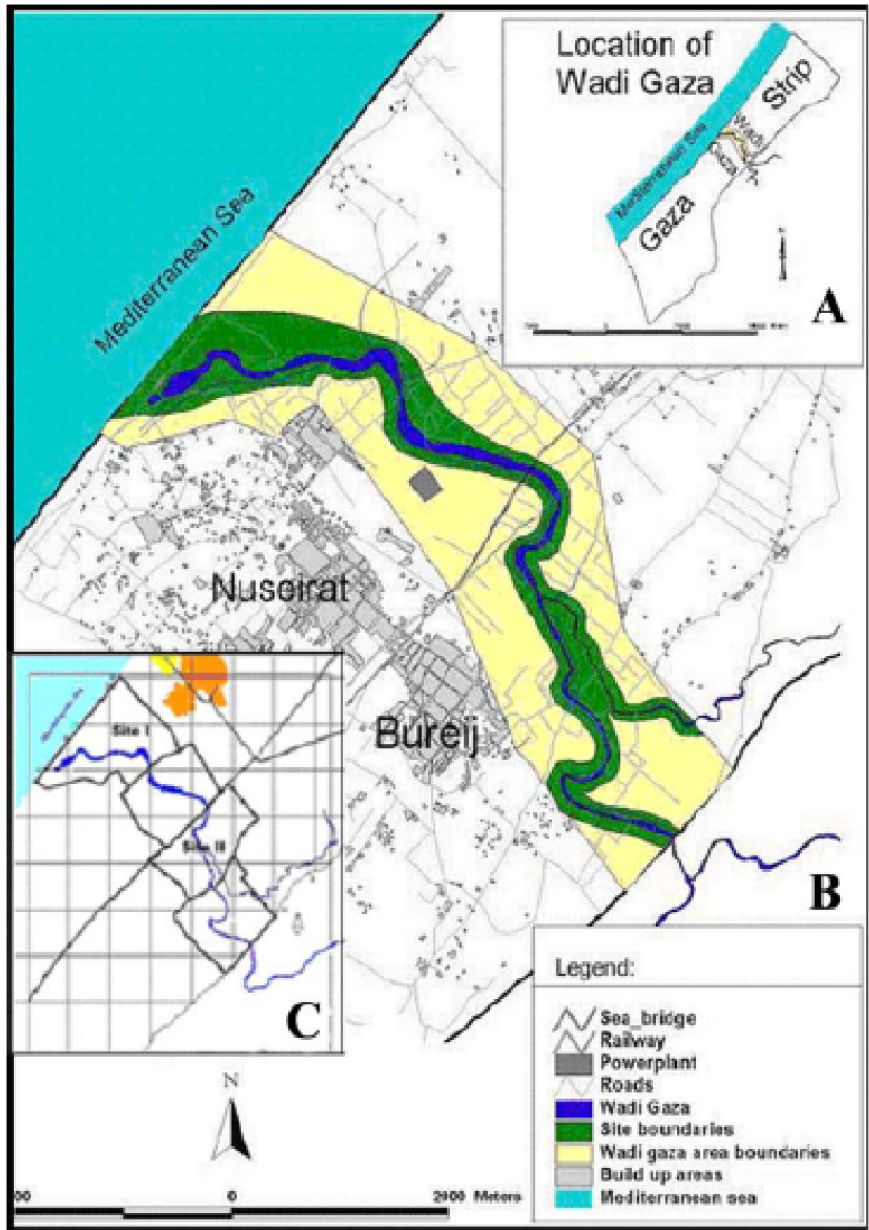


Fig. 5. Wadi Gaza portion inside the Gaza strip (from Abd Rabou et al. 2007)

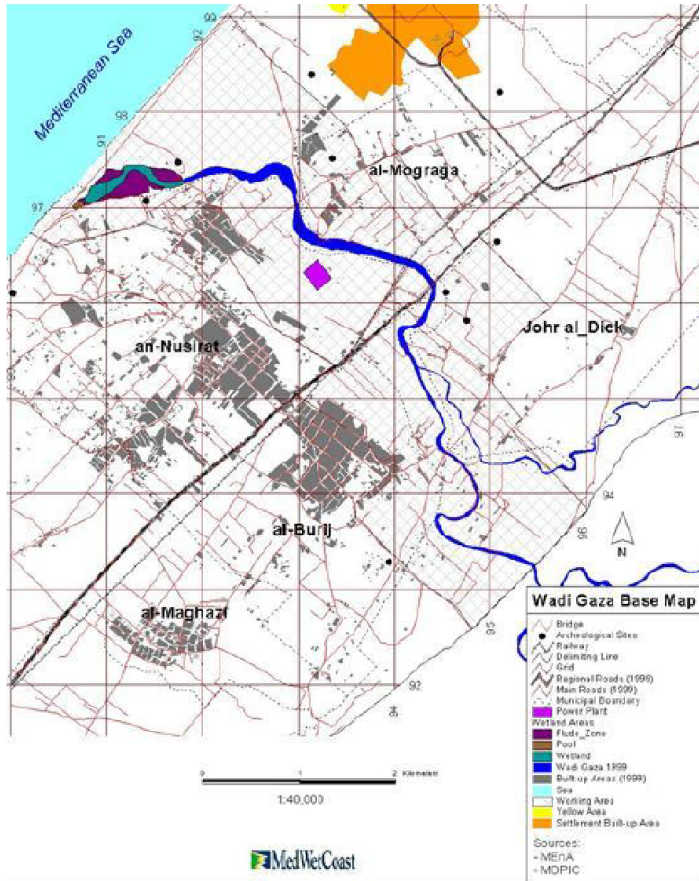


Fig. 6. Wadi Gaza base map from MedWetCoast





Fig. 7. Wadi Gaza near residential areas: Sewage mixed with rainwater and some semi-natural habitats

### Findings

**Habitats:** The Gaza strip includes at least three phytogeographic and habitat areas: Coastal Mediterranean, Sand dunes, and Saharo-Arabian element (Soto-Berelov et al 2015). Despite its relatively semi-arid overall climate, this allows it rich biodiversity (flora and fauna, see below). But these habitats are fragile and threatened with a number of factors (also see relevant section below). Top[ographically the area slopes east to west towards the Mediterranean and the northern part of it receives more rain than the southern part. Wadi Gaza intersects Gaza and is a key geography and geologic feature.



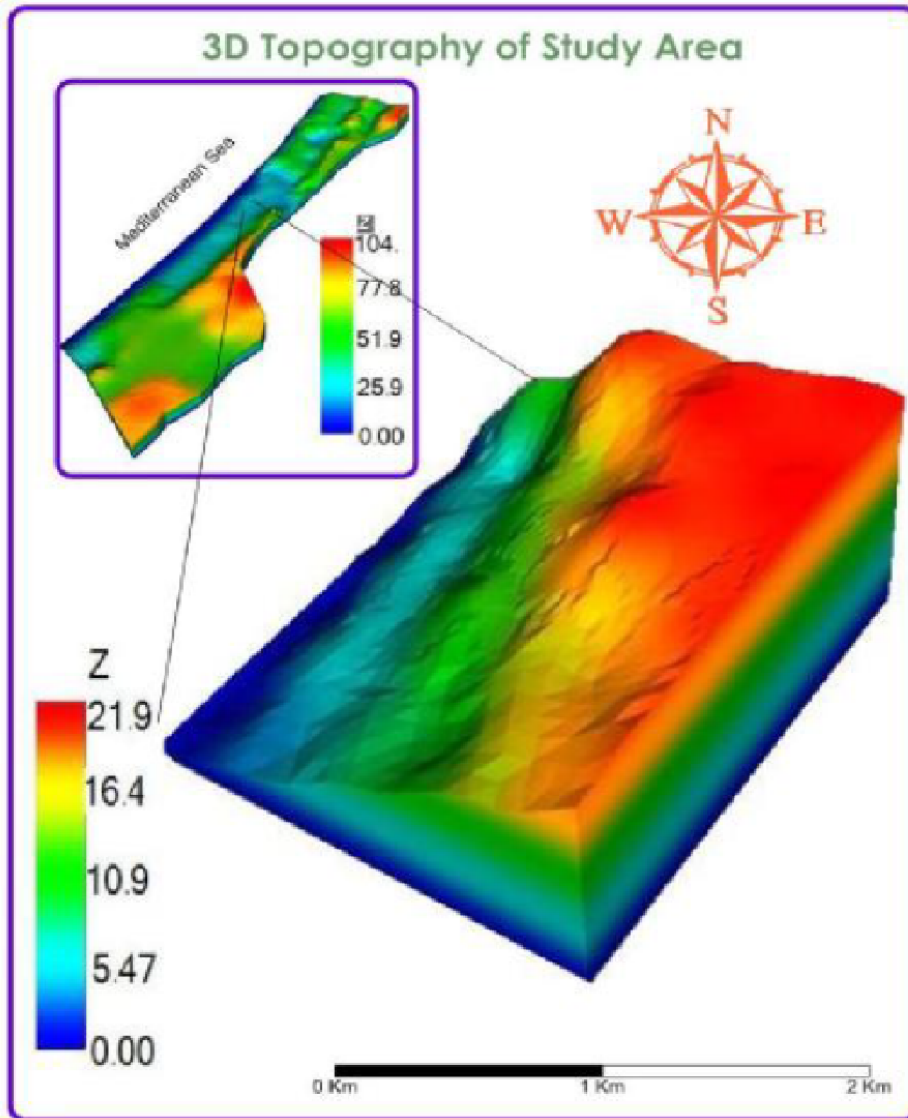


Fig. 8. Topography of study area (from Nahhal 2009)

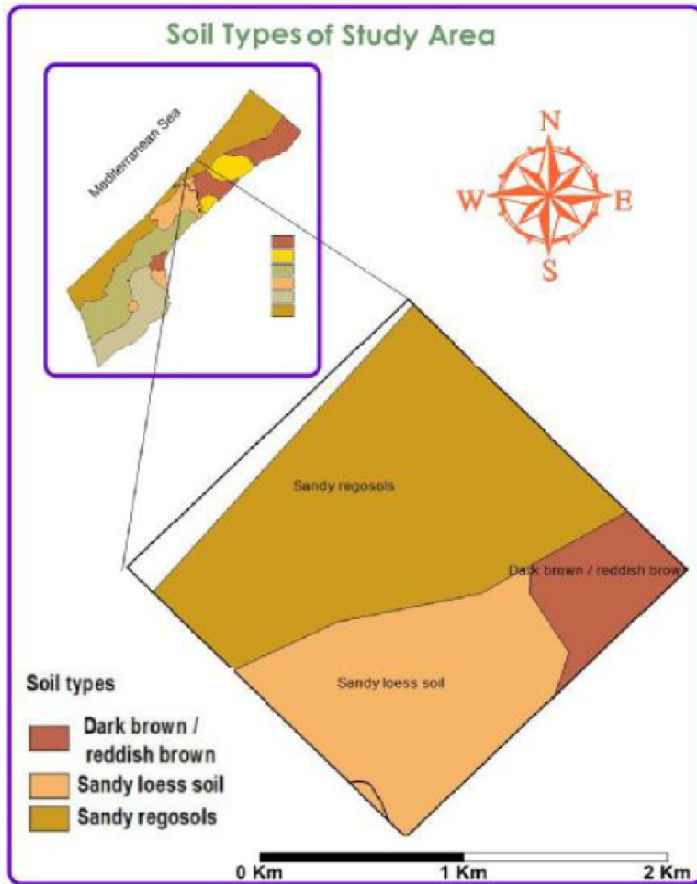


Fig. 9. Soil Types Fom Alnahal 2009

**Protected Area Status:** Wadi Gaza is the most important coastal wetland in the Palestinian areas and is in the Eastern Mediterranean biodiversity hotspot, a station point for the migratory routes (500+million birds pass through the area on annual migration) (Skinner and Zalewski 1995; EQA 2002; HSF 2017). Earlier reviews of its validity as a protected area exists (Awadallah 2000). A study was done to fix much of the challenges of Wadi Gaza to opportunities by creating a nature reserve for eco-tourism (AlAgha 2003). It was accepted by UNSCO as an important wetland (date of submission 2/4/2012) as an important wetland area because “considered as one of the most important coastal wetlands located on the Eastern Mediterranean Basin, very rich in biological diversity (both flora and fauna). The wadi is also a station point for the migratory routes from north to south and from south to north. In addition, being the biggest in Gaza and having a special outstanding landscape, and being one of the biggest in Palestine, it has the potential for being a recreational area attracting people from different areas.”

It was proposed but not approved yet to Birdlife International to recognize as an important bird area. The Palestinian Authority established the Wadi Gaza protected area in June 2000 containing 1.25 km<sup>2</sup> as coastal wetland but is an area of great promise with

limited studies (Auda et al., 2009; Rabou et al. 2015). But plans and structures for protection do exist albeit small (MedWetCoast 2003; UGEC 2004; EQA 2015).

**Environmental damage and conservation efforts:** Palestine including Gaza and also Wadi Gaza suffers from multiple environmental threats (UNEP 2003; ARIJ 2018). A UN report on Gaza states that the territory might not be habitable by 2020 (UN, 2012).

Major risks for Wadi Gaza are:

- 1) Pollution: Baalousha (2006) used GIS and the DRASTIC measures of vulnerability to show that many areas in Gaza Strip are susceptible to significant water pollution damage. There are small scale desalination projects by reverse osmosis in Gaza but these have their own environmental issues, (Assaf, 2001). The situation for sewage management in the occupied Palestinian areas is critical. In Gaza, a significant portion of the sewage flows untreated to the Mediterranean Sea (Ashour *et al.*, 2009). The sewage running in the valley next to areas of population like two refugee camps also causes health problems (see e.g. Abu Mourad 2004; Abu Naser et al. 2007). Wastewater and other pollutants also heavily impact ecological integrity and socioeconomic issues in this valley (Abu Shaban 2002; Shanban and Saleh, 2002; Rabah 2013; Roskin and Bergman 2013; Saleh et al. 2013; Ubeid et al. 2016).
- 2) Pesticide use on limited land (see Abu Middain, 1994) and nitrates seem to affect the health of people in Gaza (Abu Naser *et al.*, 2007, Al-Absi, 2008).
- 3) Wars on this area as an environmental hazard (Safi 2015). There is also an issue of seasonal flooding in the valley (Jouda 2018).
- 4) Illegal hunting (Abd Rabou et al., 2007, 2015; AlHirsh, 2016).
- 5) Climate Change (Werner 2012)

There is a lot of interest to conserve the natural and cultural heritage of Wadi Gaza (UNDP/SDE 2002; Sadeq 2005). A management plan for the valley was produced (MedWetCoast 2003). A training program/capacity building also existed for the area since 2004 as Palestine is also a signatory to the Ramsar Convention (<https://medwet.org/2014/01/training-program-on-the-sustainable-development-of-coastal-areas-for-the-mena-region/>). It seems there is little regulations or enforcement of conservation measures for example on the use of pesticides in the area (AbdRabou et al 2002) or in general ecological knowledge of inhabitants (AbdRabou et al 2002; AbdRabou et al. 2015a). Of course some of these studies are old and need to be updated. Some interest in using collections is starting in Gaza (e.g. see AbRabou, 2020). There is also an interest indeed at least among local people in preservation and management (see also Goodson, 1999; Assaf 2001; Atrash 2003 Asfour and Hathat 2016).

**Flora:**

According to a survey conducted by a specialized ARIJ team in 2006, it was found that 2,076 plant species inhabit the West Bank and Gaza Strip alone (75.5 percent of species in Mandate Palestine), while 1,959 species in 115 families grow in the West Bank and 1,290 species in 105 families grow in the Gaza Strip, of which 117 species grow only in the Gaza Strip. A more limited study in Wadi Gaza identified 70 species (AbdRabou et al. 2015b) but the number is likely at least 10 times more. Typical species in the valley include *Tamarix nilotica*, *Arundo donax*, *Cynodon dactylon* and the more common *Alhagi graecorum* and *Silybum marianum* (Auda et al. 2009). Salinity tolerant species were observed in Al-Bahr the coastal location of the valley system and there are more needed floral studies in the areas close to the sea (El-Sheikh et al. 2003; Madi 2018)

Many plants in the valley are also used for medicinal purposes (AbouAuda, 2012).

### **Fauna**

There are few actual studies of fauna of Gaza but more lately much anecdotal and perfunctory (examples Abd Rabou 2005, 2009; Abd Rabou et al 2015). and done not be professionals in those areas (like ornithologists, mammalogists, botanists etc). For example we find work like Atrash (2003) “Wildlife field guide of Wadi Gaza” showing some species some of them are misidentified. Thus a more intensive and scientific study is needed and this is recognized by the Palestinian government (e.g. see EQA 2015). We can here however refer to what is known especially focusing on threatened or endangered species.

AbdRabou et al (2007b) reported 18 species of **reptiles** (2 turtles, 8 lizards, 8 snakes and 3 species of **amphibians** in Wadi Gaza. The **birds** of Gaza Strip were studied on several occasions. Abu Shammalah and Baha El-Din (1999) gave an account of the birds of Gaza. Al-Safadi (1997) presented a comprehensive study on the breeding cycle of the Spur-winged Plover, *Hoploperus spinosus*, in the sewage lagoon of Beit Lahia, Gaza Strip. So far, 373 bird species belonging to 23 Orders, 69 families, 21 Subfamilies, and 172 genera have been recorded from Palestinian areas (Khalilieh, 2016; Awad et al., 2016). Abd Rabou *et al.*, (2015a) recorded 118 bird species belonging to 38 families were recorded in the targeted area many of them are very rare or even endangered (e.g. imperial and golden eagles).

Abd Rabou (2007c, 2011) reported 17 mammalian species at the zoological garden of Gaza belonging to 12 families and 5 orders including the Grey Wolf, Jungle Cat, Egyptian Mongoose, Common Badger, Striped Hyena, Indian Crested Porcupine and others. AbdRabou (2009) also reported on some of the carnivores (threatened). But still the

most comprehensive data available on the mammals of historic Palestine including Gaza (Qumsiyeh 1996; Yom Tov and Mendelssohn 1999 and personal observations/updates on mammals) shows 42 terrestrial species and 10 marine species as likely found in the Wadi Gaza area (including in the coastal areas):

*Erinaceus concolor*  
*Hemiechinus auritus*  
*Paraechinus aethiopicus*  
*Rousettus aegyptiacus*  
*Eptesicus bottae*  
*Hypsugo ariel*  
*Hypsugo savii*  
*Pipistrellus kuhlii*  
*Pipistrellus rueppelli*  
*Plecotus austriacus*  
*Tadarida teniotis*  
*Taphozous nudiventris*  
*Nycteris thebaica*  
*Otonycteris hemprchi*  
*Rhinolophus clivosus*  
*Rhinolophus hipposideros LC*  
*Asellia tridens*  
*Canis aureus*  
*Canis lkupus EN*  
*Vulpes vupes*  
*Caracal caracal*  
*Felis chaus*  
*F silvestris*  
*Herpestes ichneumon*  
*Hyaen hyaena*  
*Mellivora capensis*  
*Meles meles*  
*Vormela peregusna*  
*Sus scrofa*  
*Gazella gazella*  
*G. dorcas*  
*Hystrix Indica*  
*Jaculus orientalis*  
*Jaculus jaculus*  
*Gerbillus gerbillus*  
*G. andersoni*  
*G. pyamidum*  
*Meriones sacramenti*

M tristrami  
*Mus macedonicus*  
 Rattus norvegicus  
 R. rattus  
 Lepus capensis

Mediterranean sea (many unconfirmed in coastal waters of Gaza)  
 Balaenoptera physalu EN  
 Physeter macrocephalus VU  
 Ziphius cavirostris  
 Tursiops truncatus  
 Steno bredanensis DD  
 Stenella coeruleoalba DD  
 Delphinus delphis  
 Grampus griseus  
 Orcinus orca DD  
 Pseudorca crassidens DD

Very few studies (and much of it unsubstantiated and anecdotal) exists for the invertebrate fauna of Wadi Gaza. Dardona et al. (2015) recorded 25 species of butterflies and 11 species of moths. For butterflies that is actually high diversity for the area.

### Conclusion

Priorities of the environmental strategy for Gaza vs West Bank (UNEP, 2003).

Priority	Gaza	West Bank
High	Depletion of water resources Deterioration of water quality Shoreline and marine pollution	Depletion of water resources Deterioration of water quality Land degradation
Medium	Depletion of natural resources Land degradation Deterioration of nature and biodiversity	Depletion of natural resources Air and noise pollution Deterioration of nature and biodiversity
Low	Air and noise pollution Landscape and aesthetic distortion Threats to cultural heritage	Landscape and aesthetic distortion Threats to cultural heritage

The total biocapacity in the WB and Gaza was the lowest among Arab countries at 0.16 ha/person (Verner, 2012). As noted above Wadi Gaza is rich in biodiversity but suffers from significant threats. But biodiversity is threatened both in the West Bank and Gaza (AliShtayeh and Hamad 1997; EQA 2015). We are now writing the 6<sup>th</sup> National CBD report and it shows Palestinian arewas suffer from structural 8issues and could not meet most of the Aichi Biodivesrity Targets. The proposed routes of the gas pipeline are to the

north of the valley and since that is higher area than banks of the valley in the south, the environmental issues are going to affect both the valley and the aquifer reload and potential development of the valley as an eco-park (resources, maps in AlAgha 2003; EQA 2015; others cited above, see Fig. 10).

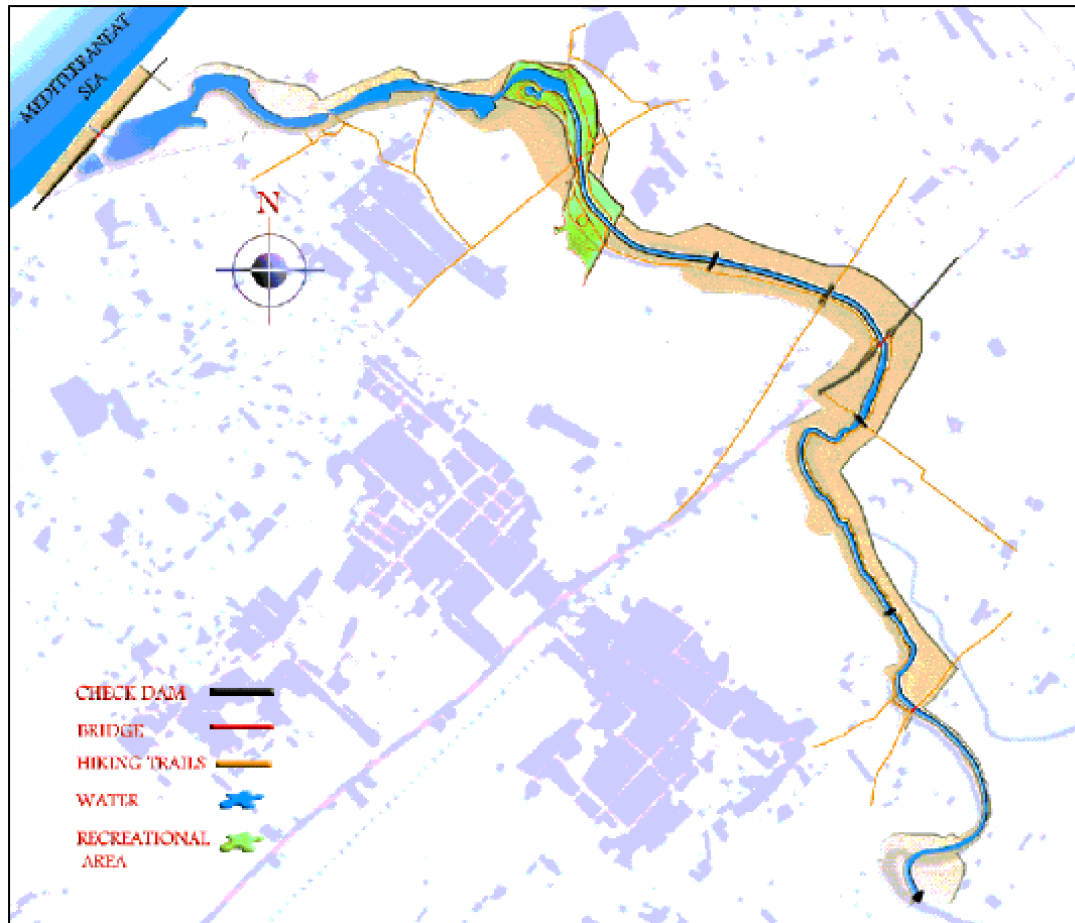


Fig. 10 Proposed development of the valley as a nature park (AlAgha 2003)

Note added 15 December 2023: The many wars in the past 20 years (2006, 2008/2009, 2014, 2020, 2021, 2023) inflicted on the Gaza Strip had a devastating impact on the environment (Qumsiyeh 2023 paper in press). The last genocidal war especially cost over 20,000 lives (8000 children) and devastated the strip with over 60% of infrastructure, agricultural and natural areas bombed or bulldozed.

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