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Academic Cooperation with the Environment Quality Authority to Refine Strategies for Biodiversity Conservation in Protected Areas in Palestine

Final Report



2021

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Executive Summary

The overall objective of this project was to create academic cooperation with the Environment Quality Authority to Refine Strategies for Biodiversity Conservation in Protected Areas in Palestine. The achievements by sub-objectives were:

- 1) Desktop study and data collection via focus group meetings and questionnaires and individual meetings. The data were analyzed in ways that aid building strategies and tactics for protected area management. This also included building a database of stakeholders (<https://drive.google.com/file/d/1CIjrbFpJM-KsP8E9rFK2xFzqpFsOZ24M/view>).
- 2) We worked collaboratively (EQA & PIBS) with stakeholders to reassess existing protected areas and policies related to those. We used this in also updating the 6th National Report (just finalized).
- 3) A SWOT analysis was performed and recommendations for way forward were introduced. These will lead to new policies and programs for better protected area management. Fortuitously as this project ended, we started working on the new National Biodiversity Strategy and Action Plan (NBSAP) and the data collected and discussions held pave the way for having protected area management as a key component of the new NBSAP.

These three main achievements are also accompanied by a number of other benefits. The desktop and other data collection methods identifying and mapping issues around protected areas will be of use in spatial planning and local authority planning and in rethinking local laws (including in compliance with International Treaties and Conventions signed). The latter (fortuitously) is being worked on now and new laws and regulations will be submitted for governmental approval at the latest by early 2022. Two other projects are also now being implemented at the national level that will benefit from the output of this project are: survey of invasive species and management of those (including in protected areas) and a project on medical/health aspects of human –animal interactions. Another side benefit was the networking created that allows for better coordination of all stakeholders (citizens, governmental and non-governmental groups, private sector).

As a way forward we recommend and started implementing: 1) Signing new international treaties and adjusting local laws accordingly, 2) Controlling fires, 3) more research and better planning, 4) reform at different societal levels, 5) More mainstreaming of biodiversity especially in communities around PAs, 6) Enhanced environmental awareness and education programs, 7) Capacity building.

Abbreviations

ABT	Aichi Biodiversity Target
BU	Bethlehem University
CBD	Convention on Biodiversity
CCC	Convention on Climate Change
CCD	Convention to Combat Desertification
CITES	Convention of International Trade in Endangered Species
COP	Conference of the Parties
EE	Environmental Education
EIA	Environmental Impact Assessment
EQA	Environmental Quality Authority
GBIF	Global Biodiversity Information Facility
GEF	Global Environment Facility
KBAs	Key Biodiversity Areas
MOA	Ministry of Agriculture
MOE	Ministry of Education
MOH	Ministry of Health
MOPAD	Ministry of Planning and Administrative Development (newer name)
MOPIC	Ministry of Planning and International Cooperation (older)
MOTA	Ministry of Tourism and Antiquities
NBSAP	National Biodiversity Strategy and Action Plan
NGOs	Non-Governmental Organizations
NRs	Nature Reserves
NSP	National Spatial Plan
OPT	Occupied Palestinian Territories
PCBS	Palestinian Central Bureau of Statistics
PENRA	Palestinian Energy and Natural Resources Authority
PIALES	Palestinian Institute for Arid Land and Environmental Studies
PIBS	Palestine Institute for Biodiversity and Sustainability
PMNH	Palestine Museum of Natural History, Bethlehem University
PNA	Palestinian National Authority (now State of Palestine)
PNARC	Palestinian National Agricultural Research Center
RSCN	Royal Society for Conservation of Nature (Jordan)
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
UNDP	United Nations Development Programme
UNRWA	The United Nations Relief and Works Agency

Introduction

Palestine, despite its relatively small size, has enormous biodiversity (EQA, 2015). The State of Palestine is now recognized as a non-member State at the UN (United Nations, 2019). The State of Palestine has signed numerous international conventions and treaties, including conventions that are significant to biodiversity conservation (United Nations Treaty Collection, 2019; Convention on Biological Diversity, 2019). Palestine, as a signatory of the International Convention on Biological Diversity (CBD), submitted its fifth national report in 2015 (see <https://www.cbd.int/doc/world/ps/ps-nr-05-en.pdf>) and is now working on the sixth report. Israel has declared 48 places in the West Bank as nature reserves since it occupied Palestine in 1967 (EQA, 2015). The total area of the West Bank's nature reserves was reported as 579 km² (Görlach et al. 2011). These protected areas are located mainly in the Jordan River area and on the eastern slopes (EQA, 2015). Most of the existing nature reserves in the West Bank are in Area C (Görlach et al. 2011). This means they are under the complete control of the Israeli civil administration. Military bases and Israeli settlements were constructed on some of the nature reserves (EQA, 2015). Most nature reserves in the West Bank are not actually in particularly biodiversity areas, and it has been suggested by the EQA that many of the protected areas were designated as such for political rather than environmental purposes (EQA, 2015). Although Israel has not designated any protected areas in the Gaza Strip, the Palestinian Authority (PA) designated the Wadi Gaza, a 2.84 km² area of wetlands, as a protected area (Mahmiyat.ps, 2019; Protected Planet, 2014 - 2019) in 1999 (Mahmiyat.ps, 2019) or 2000 (Qumsiyeh and Amr, 2016). This reserve is reported as being under the control of the EQA and MOA (Protected Planet, 2014 – 2019), although there is a longstanding disagreement regarding whether the PA or Hamas has ultimate responsibility for Gaza (Al Jazeera Media Network, 2019; The Guardian, 2017). There are 13 reserves in the West Bank that are in Area B and are therefore, at least in theory, under the control of the Palestinian Authority (PA) (EQA, 2015; Görlach et al., 2011). These equate to 11.3% of the total reserve area (Görlach et al., 2011). Qumsiyeh and Amr (2016) reports that eight protected areas are under Palestinian control and are actively managed by rangers. In Palestine, the two main governmental bodies with the legal authority for developing strategies for environmental protection are the Environment Quality Authority (EQA) (Qumsiyeh and Amr, 2017).

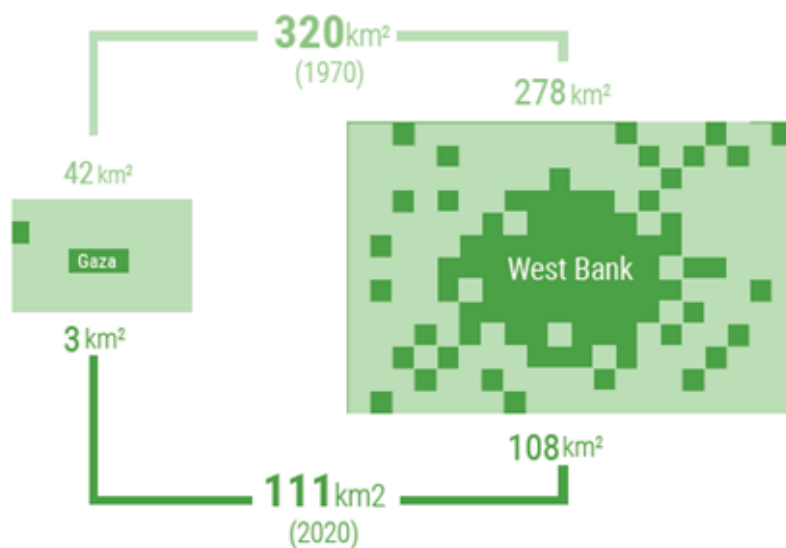
The project aims to enhance conservation, reclamation, and strengthening of biodiversity via creating structures for research on protected areas, especially in compliance with CBD guidelines. A further aim is to disseminate the strategies adopted by the national authorities. Palestine needs to improve compliance in a number of areas in order to meet its obligations as a signatory of the CBD (EQA, 2015; Qumsiyeh and Amr, 2017). Improved methods are needed in order to measure compliance and progress towards achieving environmental goals. Improved measuring would also allow areas that require better environmental management to be quickly identified. The EQA, along with the MOA, are responsible for the 13 Palestinian controlled protected areas in the West Bank (EQA, 2015). By working with the EQA to create strategies for biodiversity monitoring and conservation in protected areas, Palestine's progress towards achieving its obligations and environmental goals can be measured and areas for improvement can be quickly identified. Measuring the progress of protected areas is of particular interest. In the 1999 National Biodiversity and Action

Plan for Palestine (BSAPP), the development and management of a Palestinian protected areas system was listed as a priority project. A further priority project was the development of management plans or structures in designated protected areas based on biodiversity surveys and inventories (Palestinian Environmental Authority (PEA), 1999). For this reason, tools to measure the effectiveness of Palestine’s protected areas would be of enormous help in achieving these projects, as well as measuring the success of the projects.

Country profile

Palestine is located between Europe, Asia and Africa with an area of 27,000 km² (West Bank: 5,879 km², Gaza: 378 km²) (UNEP 2003) and belongs to the African Tectonic plate which as a result of the plate collision resulted in having the northern part of the great Rift Valley located here (including the lowest point on earth at the Dead Sea). Palestine is also the western part of the Fertile Crescent where humans first developed agriculture (Qumsiyeh, 1996). Its unique geography and geology gave Palestine more biological diversity than some countries ten times its size. The diverse habitats cover five ecozones: the central highlands, the semi-coastal region, the eastern slope, the Jordan valley and the coastal region. Palestine also spans five phyto/bio- geographical regions (Mediterranean, Irano-Turanian, Saharo-Arabia, Coastal, and Sudanese). Hence, Palestine is host to an estimated 3% of global biodiversity (EQA 2015).

The total wooded areas in the OPT in 1974 was 314,713 dunums (5.2% of the land mass) of which 209,510 dunums are naturally wooded (Abu Ayyash et al. 2007). This decreased by 29% from 1974 to 2007. Data is limited on further decline (see below). Like in other countries, decline stems from population growth, the industrial revolution and the consumerist society that developed leaving us with legacies like climate change and habitat destruction. Yet in our case, there is added pressure such as from political instability and the Israeli occupation.



Source: Ministry of Agriculture, Records 2020, 2020.

Figure 1 Forest areas in OPT between 1970 and 2020 (SP 2020b)

Circum-Mediterranean climate has mildly cold winters and warm and rather dry summers. In Palestine the geography is such that we have semi-permanent frost in high mountains like Jabal Alsheikh (Mount Hermon) and semi-tropical climate in the lowest point on earth in the Dead Sea region at 400 meter under the sea level. Rainfall is between 1000 mm in the highest mountains to less than 50 mm in arid regions. Temperatures also vary from freezing to over 35 C in summer months in the Wadi Araba areas (Issac, 2002, Qumsiyeh, 1996). The geologic activities over the past 100 million years and especially the formation of the Great Rift Valley ensured rich varied topography which resulted in a burst of speciation producing many endemic species of plants and animals. This is because of diverse habitats covering five ecozones (Central Highlands, Semi-Coastal Region, Eastern Slopes, Jordan Rift Valley, and Coastal Regions) and four biogeographical regions (Mediterranean, Irano-Turanian, Saharo-Arabian, and Sudanese/Ethiopian) (Por, 1975; Qumsiyeh, 1985). It is thus not surprising that this small country is biologically more diverse than some countries 10 times its size (Qumsiyeh, 1996). The mild weather, diverse fauna and flora, rich soils, and presence of wild seed species and certain animals in the Fertile Crescent stretching from Palestine to Iraq also allowed humans to go from being hunter-gatherers to developing an agricultural and nomadic shepherd life (McCorriston and Hole 1991; Eshed et al., 2004). The Fertile Crescent thus provided the first domesticated animals and plants (wheat, barley, lentils, goats, donkeys). This settlement ensured an increase in human populations and the development of civilization and religious beliefs among the local Canaanitic people (Bar-Yosef, 1998).

The Mediterranean Zone flora is characteristic maquis forest with trees like oaks and pistacia. The plant cover then decreases proportionally and includes different species as we head south and east into Irano-Turanean, Saharo-Arabian and then Ethiopian-Sudanese flora.

Palestine was represented at the Seventh Special Session of the Governing Council/Global Ministerial Environment Forum in Cartagena, Colombia, 13-15 February 2002. At that time, a resolution was adopted concerning the condition of the environment in the Occupied Palestinian Territories (OPT). The Governing Council requested that the United Nations Environment Program (UNEP) carry out a desk study as a first step in the implementation of the decision to support and advance environmental conservation in the OPT. The study identifying major areas of environmental threat was not very detailed (UNEP, 2003), but it was seminal especially if we combine it with the report by the Environmental Quality Authority which brought in experts and collected material also in a form of an expanded desk study in compliance with the Convention on Biological Diversity (EQA, 2015). That report estimates over 50,000 species living in Palestine.

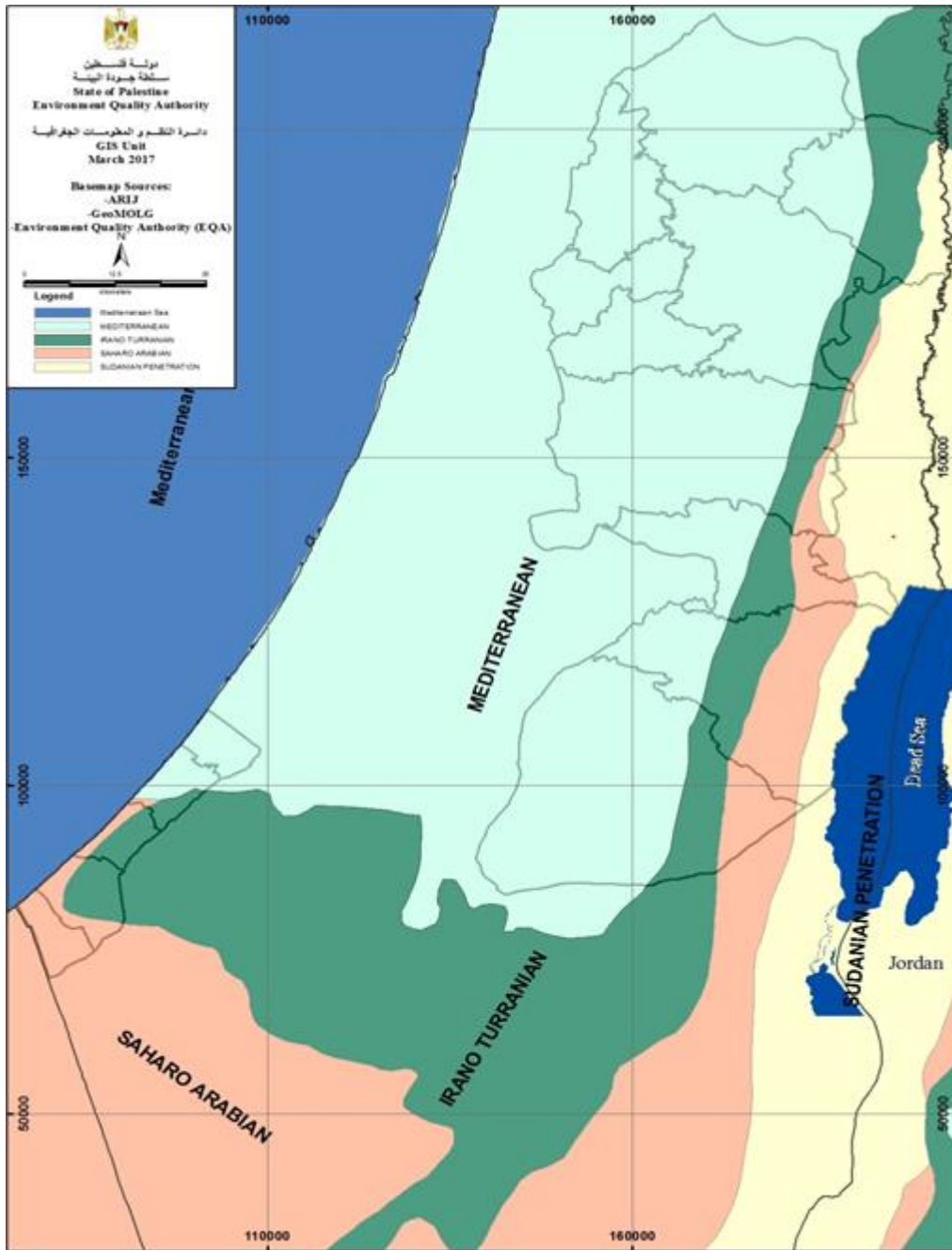


Figure 2 Classical biogeographic zones map of the West Bank.

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populations and the development of civilization and religious beliefs among the local Netufian (later called Canaanitic) people (Bar-Yosef, 1998).

Studies of biodiversity in the OPT were very limited in contrast to those of nearby areas of Palestine (called Israel since 1948) and Jordan. Research in general still lags behind in the OPT (Qumsiyeh and Isaac, 2012). As early as 1950, scientists warned of an environmental disaster in Palestine should the trends then evident persist (Ives, 1950). The environmental impacts of the geopolitical changes of the past 100 years have been dramatic (see relevant chapters in Qumsiyeh, 1996; Qumsiyeh, 2004), but direct studies of our environment are still in the early stages. Most studies of fauna and flora within Palestine were completed by Western visitors who came on short trips to study the "Holy Land" and many of those visitors were connected to Western imperial powers such as France and England (e.g. Tristram, 1884).

The Palestinian environment is suffering from loss of natural resources, neglect of the environment, environmental pollution, low water quality, depletion of water sources, and other human impacts leading to habitat loss and decline in biodiversity. The Israeli occupation made addressing these issues more difficult and added more challenges to the Palestinian environment. After the Oslo Agreements 1993-1994, the newly established Palestinian National Authority (a state in the making) attempted to deal with the environmental problems and to identify stakeholders authorized to follow up the environmental file. In October 1994, the Palestinian National Authority established the Department of Environmental Planning, a branch from the Ministry of Planning and International Cooperation, and was allocated to follow-up the environmental management in the National Authority territories. At the same time each of the Ministry of Health, the Ministry of Agriculture and the Ministry of Local Government formed departments for environmental affairs, causing duality of authorities and responsibilities for decision making. On the 18th of December in 1996, an environmental body within the Ministry of Planning was established by a Presidential Decree, and was entrusted with all administrative tasks related to the environment. However, each department in the other ministries continued to work according to their plans and programs. Later in 1998, and to avoid overlap, the Ministry of Environmental Affairs was established and was considered the reference for environmental affairs. In 2002, a Presidential Decree reformatted the Ministry of Environmental Affairs into the Environmental Quality Authority, and was given the same duties and powers.

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century and now, other example done on birds of prey by Saeed & Qumsiyeh. (2020) shows the decline of some species and the extinct of others.

The area has been sporadically studied before by visitors to the “Holy land” from Tristram (1866, 1884) to Morton (1924) to David Harrison in the 1960s (Harrison and Bates, 1991). In the 1950s and 1960s there were some studies of fauna and flora by Israelis (mostly immigrant settlers). The most notable of these was a series called “Fauna Palaestina” issues by the Israel Academy of Sciences, and good published work continued to flow into the 1980s (Levy and Amitai, 1980a, Tchernov and Yom-Tov, 1988, Zohary, 1973, Werner, 1988).

When Zionism was established in the late 19th century and the "Jewish Colonization Association" and later the “Jewish National Fund” (“Keren Keyemet l’Yisrael”) were formed, some Zionists saw the value of cataloging and understanding native animals and plants (including the native Palestinian people) and undertook studies of the region. An example of such a Zionist scientist was F. S. Bodenheimer (Bodenheimer, 1935; Bodenheimer, 1937). After Israel was founded, such studies of fauna and flora became commonplace and a number of studies were conducted including for example those on plants (Zohary, 1972, Zohary, 1966), spiders (Zonstein and Marusik, 2013), and birds (Shirihai et al., 1996).

Very few studies were published by Palestinian scientists in the field of biodiversity, ecology and environment. Among native Palestinian zoologists Dr. Sana Atallah (d. 1970) focused on mammals (Atallah 1977, 1978). Additional significant studies of mammals followed (Qumsiyeh, 1985, 1996, Werner, 1988, Harrison and Bates, 1991, Whitaker Jr *et al.*, 1994, Qumsiyeh *et al.*, 1996, Qumsiyeh *et al.*, 1998, Mendelsohn and Yom-Tov, 1999, Amr *et al.*, 2006, Benda *et al.*, 2010) reptiles and amphibians (Disi, 1985, Damhoureyeh *et al.*, 2009, Amr and Disi, 2011, Disi and Amr, 2010, Salman et al, 2014, Bar and Haimovitch, 2011, Disi, 2001, Handal et al., 2016, PIBS 2018), Arachnids (Levy, 1985, Levy, 1998, Levy and Amitai, 1980b, Qumsiyeh *et al.*, 2013 & 2014, Amr *et al.*, 2004b), mollusks (Heller and Arad, 2009, Amr and Abu Baker, 2004a and references cited therein, Handal et al., 2015, Unpublished master thesis on Land snails of the West Bank), and insects (Halperin and Sauter, 1991, Katbeh-Bader *et al.*, 2002, Abusarhan et al. 2016, 2017, Adawi et al. 2017; Handal and Amr 2018; Sawalha et al. 2017; Najajrah et al. 2019; Handal and Qumsiyeh 2019; Handal et al. 2018).

Isaac (2000) published a book in Arabic on the mammals of Palestine through a series of educational books from the Educational Program for Public Awareness and Participation, Applied Research Institute (ARIJ). Recently 15 mammalian species of Gaza were recorded (Rabou *et al.*, 2015b). Rabou et al. reported that seven previously known mammalian species had disappeared due to factors such as the limited area of the Gaza Strip, over-population, residential and agricultural encroachment, and hunting. Abd Rabou (2009) also studied the carnivores of the Gaza Strip based on actual records. Albaba (2015) conducted a survey on the striped hyena population in the West Bank and Gaza Strip , moreover Handal et al., 2020 published a research about Striped hyena distribution, status, and threats from the West Bank, and mentioned the rehabilitation of a hyena that done at the PIBS and shows the education awareness related to protect our biodiversity. Rabou (2011)

documented 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. So far, a total of 92 species and subspecies of mammals are known to live in Palestine. These species belong to eight orders (Artiodactyla, Carnivora, Chiroptera, Soricomorpha, Erinaceomorpha, Hyracoidea, Lagomorpha and Rodentia).

In terms of the 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. Find Bana list (add papers of flora of wadi quff, wadi zarka, al mahrour).

In the Eastern Mediterranean region some initial faunal work on scorpions was done by Vachon (Vachon, 1953, Vachon, 1966) followed by some studies in Palestine (Levy and Amitai, 1980a). Qumsiyeh *et al.* (2013) reported on a collection of scorpions from the occupied Palestinian territories, including the first karyotypes of species from the Eastern Mediterranean region. They later published paper on a species of scorpion from the protected area of Wadi Al-Quf (Qumsiyeh *et al.*, 2014).

Previous studies on the freshwater snails of historical Palestine include Tristram (1884) and Germain and de Kerville (1922). Azim and Gismann (1956) included data on freshwater snails collected from the West Bank during a study on the snail intermediate host for schistosomiasis in south-western Asia. Recent studies on the snails of the genus *Melanopsis* including records from the West Bank were published by Heller *et al.* (2005). Recently Bdir and Adwan (2011, 2012) investigated the presence of larval stages of trematodes among freshwater snails collected from the Palestinian Territories. A recent study by Handal *et al.* (2015) reported on the taxonomy and distribution of the freshwater snail fauna in Palestinian. A total of 10 species of freshwater snails belonging to four families (Neritidae, Melanopsidae, Pulmonata and Thiaridae) in seven genera (*Galba*, *Haitia*, *Lymnaea*, *Melanoides*, *Melanopsis*, *Pseudoplotia*, and *Theodoxus*) were collected, more studies need to be done in this field specially the appearance of some invasive species.

The amphibians of the Palestinian Territories were revised recently (Salman *et al.*, 2014). Surviving amphibians are represented by three families (Bufonidae, Ranidae, Hylidae) and three species. Toads, water frogs and tree frogs are represented by a single species (*Bufo viridis*, *Rana bedriagae* and *Hyla savignyi* respectively). A report published by the Palestine Institute for Biodiversity and Sustainability on a rare species of amphibians (the Syrian spadefoot toad (*Pelobates syriacus*)), a species only recorded in Jinsafut temporarily pond from the West Bank.

Reptile studies in Palestine started in the 19th century (Festa, 1894, Boettger, 1878, Tristram, 1884). There is a rich biodiversity of reptiles, both endemic and non-endemic elements, from various biogeographic zones: Ethiopian, Mediterranean, Saharo-Arabian, and Irano-Turanian (Werner, 1988). While significant studies on the reptiles in the areas occupied by Israel since 1948 were conducted, there are few studies by local scientists on

the herpetology of the OPTs. A single publication on the reptiles of Gaza Strip was published by (Rabou *et al.*, 2015a) and included 18 species of reptiles. Recently, the Palestine Natural History Museum reported on a collection of reptiles from several localities within the Palestinian Territories. Distributional data for 36 species belonging to 13 families are given (Handal *et al.*, 2016). Reptiles are diversified and include 17 families (tortoises: Bataguridae, Testudinidae, Lizards: Agamidae, Anguidae, Chamaeleonidae, Gekkonidae, Phyllodactylidae, Lacertidae, Scincidae and Varanidae; Snakes: Leptotyphlopidae, Typhlopidae, Boidea, Colubridae, Atractaspididae, Viperidae and Elapidae) with a total of 97 species and subspecies including some new species described from the Negev (Tamar *et al.*, 2016; Meiri *et al.*, 2019).

Birds were the most visible of the Palestinian fauna and much earlier scientific work was done on them. But unlike the studies of other groups, there were also “layman” books and booklets that appeared for this visual group (Kharoob, 1992, Awad, 2009). Brett (1988) reported on the birds of prey in Palestine. 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. Rabou *et al.*, (2015) recorded 118 bird species. Al-Safadi (1997) presented a comprehensive study on the breeding cycle of the Spur-winged Plover, *Hoplopterus 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).

In the past 25 years there has been a revival of interest in studies of biodiversity among native Palestinians. Of course we have in no way even approached the level of publications or interest in nearby countries like Jordan or Israel, but we must guard against a decline of that interest in biodiversity research seen, for example, in Israel in association with industrialization (Dayan *et al.*, 2011). We will discuss below examples of this revival of interest, including the establishment of a number of programs at universities (e.g. master programs in Environmental Studies at Al-Quds and Birzeit, and the Institute of Biodiversity and Sustainability at Bethlehem University). But we must also separate scientific work from anecdotal notes and opinions on the Palestinian environment. After the establishment of the Palestine Institute for Biodiversity and Sustainability (PIBS) and the Palestine Museum of Natural History (PMNH) in 2014, one of its obligations is to identify the neglected biodiversity elements of the OPT. Within the past five years, PMNH has produced a number of publications in peer reviewed journals on groups of local fauna, including freshwater snails, land snails, scorpions, butterflies, Mantids, grasshopper, beetles, invasive true bugs, dragonfly, sand-fly, rodents, amphibians and reptiles (see <https://www.palestinenature.org/research/>) . Vulnerable areas are of particular interest for further study because environmental degradation in Palestine has been accelerated with industrialization and large-scale deforestation.

Rare and endangered Taxa in protected areas

Flora

“There is only national list of threatened species available for Palestinian flora and there is no national list for Palestinian threatened fauna due to lack of comprehensive surveys of

fauna species. There are two published lists of threatened plants: one Israeli and one Palestinian. Based on IUCN global guidelines and criteria and Red List publications there are only 24 species listed as globally threatened as published on the official website of IUCN Red List. From these 24 species there are: 10 birds, 4 reptiles, 3 mammals, 2 fishes, 2 molluscs, 1 amphibian, 2 other invertebrates, and there is no plant recorded in the IUCN Red List website although there are two published lists of threatened plants as indicated earlier” EQA 5th CBD NR (2015).

There is only national list of threatened species available for Palestinian flora and there is no national list for Palestinian threatened fauna due to lack of comprehensive surveys of fauna species. There are two published lists of threatened plants: one Israeli and one Palestinian (Ali-Shtayeh and Jamous 2002, 2018). Consolidation of data in a recent meta-analysis (Al-Shaikh and Qumsiyeh 2021) identified 600 species that are of concern in the Israeli occupied West Bank of which 187 are endangered (found in 1-3 sites), 171 very rare species (found in 4-10 sites), 238 rare (found in 11-30 sites), and four already extinct in this area. Plants thus provide the loudest alarm bell for a deteriorating environment in need of protection. We argue that protection is feasible: 1) in situ in the declared protected areas which are just beginning to be studied and managed properly, 2) in situ in special areas of rich biodiversity that would be informally protected, 3) ex situ in botanic gardens such as that at the Palestine Institute for Biodiversity and Sustainability.

Fauna

Based on IUCN global guidelines and criteria and Red List publications there are only 24 vertebrate species listed as globally threatened as published on the official website of IUCN Red List. From these 24 species there are: 10 birds, 4 reptiles, 3 mammals, 2 fishes, 2 molluscs, 1 amphibian, 2 other invertebrates, and there is no plant recorded in the IUCN Red List website although there are two published lists of threatened plants as indicated earlier” EQA 5th CBD NR (2015). On one hand, among the 130 mammals almost all of the higher mammals are on the Red Data List labeled as threatened, extinct or rare. It was reported that seven mammalian species have gone extinct since 50 years ago, for instance, the Cheetah *Acynonyx jupatus*, Syrian Brown Bear *Ursus arctos syriacus*, Mesopotamian Fallow Deer *Dama mesopotamica*, and Roe Deer *Capreolus capreolus*. Currently, there are only 200 hyenas inhabiting Palestine. Among reptiles the extinct species is the Nile crocodile. The Gaza Environmental Profile (Gaza Environmental Profile, 1994) had identified the sea turtle species *Caretta caretta* (Loggerhead turtle) and *Chelonia mydas* (Green turtle) as existing in the coastal region of Gaza Strip. (MOPIC, 1996). However, these species and their eggs face extreme danger due to hunting and collecting. It was demonstrated that there are two dolphin species in the Gaza strip; the Bottlenose Dolphin *Tursiops truncatus* and the Common Dolphin *Delphinus delphis*. Moreover, the status of the Monk seals; *Monachus monachus* remains unclear. (Gaza Environmental Profile, 1994). Among the 373 reported bird species in Palestine (West Bank and Gaza Strip 6220 KM²), there are four birds considered extinct species: Ostrich (*Struthio camelus*), Brown Fish Owl (*Bubo zeylonensis*), while the other two extinct birds are breeders: Lammergeier (*Gypaetus barbatus*) and Lappet-faced Vulture (*Torgos tracheliotus*). It is reported that almost all amphibians in Palestine are endangered due to

intensive farming, degradation of wetland habitats in the Dead Sea basin, the Gaza Strip and the degradation of fresh and grey water, rivers and Wadi systems. It was detected that the drying of the main wadis and the exhaustive use of remaining water resources in the Gaza Strip has rendered amphibian life to be in danger. It was found out that execution of wildlife management plans has complex difficulties due to the current Israeli the occupation power in Palestine. Some of the critical obstacles that hinder wildlife conservation and reintroduction are hunting, agricultural expansion and poverty. Furthermore, the weakness in applying wildlife protection laws is obvious and needs to be enhanced.

It was demonstrated that the main focus of biotechnology research activities is restricted to agriculture mainly tissue culture of which some of its applications are related to endangered species, dates, wheat and Barley, Royal Irises, wild species of economic concerns, also biological control of agricultural pests and insects, disease-free grapes, diagnostic studies on the genetic polymorphism of the causes of pests, yeast and enzymes (plant by-products, enzyme production by bacteria, monoclonal antibodies for diagnosis, etc.), genetic engineering and their tests (fingerprinting of dates, GMOs, etc.), veterinary medicine and animal production (use of hormones, animal feed improvements, in vitro fertilization and embryo transfer, etc., and biofertilizers such as the uses of olive cakes and dairy cattle manures for biogas production, etc. Research work is also going on the application of new technology for animal disease diagnosis.(Unpublished, Palestine Biosafety assessment Report 2021, EQA)

BirdLife International, IUCN and UNEP World Conservation Monitoring Centre (2019) listed IUCN status for species in Palestine. By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained. The unique geography and geology of Palestine results in the likelihood of presence of many more endemic and threatened species than described above. There are significant shortages of data relating especially to Molluscs, arachnids, and insects (dominant groups). For example, it is impossible that we have only one species of endemic land snails and three Mantodea. Much more work is needed on the flora and fauna of Palestine. 614 species were assessed by this group and 36 of them were found to be threatened, including 26 vertebrates and 6 plants (BirdLife International, IUCN and UNEP World Conservation Monitoring Centre 2019). In the red list area, Palestine has an index of 0.8 (globally 1 means all species categorized as least concern and 0 means all species are endangered).

Protected Areas

“According to the National Spatial Plan (NSP) set forth by Palestinian partner approximately 9% of the ministries, (National Spatial Planning takes into consideration spatial dimension in directing development and geographical distribution for economical and social activities; it was set up by Palestinian ministries in 2012.) West Bank region is designated as nature reserves, forming 511,578 dunums (51,158 hectares).5 of these reserves are situated in the Eastern Slopes region (52.9% of the total NR area), followed

by the Central Highlands (34.5%), the Jordan Valley (11.9%) and the Semi- Coastal Region (0.7%).” (Ghattas, 2008)

Vulnerable ecosystems in Palestine essentially include the whole area of the WB and Gaza. This is because the areas are very small and already heavily populated including the refugees from 1948. The EQA tries to manage the remaining open areas by designating and protecting KBAs and a national system of Protected Areas. Thus to see more details on management of these vulnerable ecosystems please see ABT 11. Gaza is most particularly vulnerable from an environmental standpoint. 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. The sewage running in Wadi next to areas of population like two refugee camps (Nuseirat and AlBurj) also causes health problems (see e.g. Mourad 2004; Abu Naser et al. 2007) and causes other health risks and diseases (OCHA [link](#)). 72% of Gaza's Mediterranean coastline has been designated as highly polluted due to untreated sewage being pumped into the sea (<https://www.palestine-studies.org/en/node/232141>). Intervention in Gaza to solve this issue in 2018 <https://www.worldbank.org/en/news/feature/2018/03/12/north-gaza-communities-will-finally-benefit-from-sewage-treatment-services>. 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, over 100,000 cm sewage flows untreated to the Mediterranean Sea every day (Ashour et al., 2009; OCHA 2019). 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).

Another vulnerable ecosystem is the hills surrounding Jerusalem. To the East of Jerusalem is wilderness part of the IBA for migrating birds routes. To the South of Jerusalem is a critical habitat that includes Wadi Cremisan and Wadi Al Makhrou (UNESCO World Heritage Site). These vulnerable systems are influenced by massive Israeli colonial settlements that ring Jerusalem. There were some plans to protect vulnerable ecosystems in Palestine including for example in the Uskar temporary pond at the buffer zone of Wadi Qana NR or in Wadi Quff NR. There efforts are limited by a number of factors including the Israeli occupation (Rotem and Weil 2014; Qumsiyeh and Abusarhan 2021; Qumsiyeh and Albardeya 2021)

Palestine (West Bank & Gaza Strip) is very rich in biodiversity including more than 50 sites were identified as biodiversity hot-spots, these sites were included in the national spatial plan for protection from any change or land use (SP 2014). The investigation of these sites were carried out in 1996, which is now outdated, and needs a new investigation and assessment. EQA signed an agreement with the Belgium cooperation to re-assess and re-evaluate the situation of the biodiversity hotspots with main objective to re-delineate the borders of these sites and producing new maps to be included into the national spatial plan, for the benefit of the local communities and easing of the pressures they suffer from the spatial plan. A cross-sectoral strategy (EQA 2017) by the Palestinian Government 2017-2022 was developed and shared with key stakeholders and committed resources and

experts to increase environmental awareness and find funds to work on study and conserve the environment (https://info.wafa.ps/userfiles/server/pdf/en_2017-2022.pdf). Further, a new environmental awareness and education strategy is being developed by the EQA in 2021.

The nature reserves/protected areas in Palestine fall mostly under area C based on the classifications of the Oslo Accords which means direct Israeli military and civilian control. While these arrangements were supposed to be interim for 5 years they have now gone for over 27 years. The figure below shows the relationship of population centers and areas A, B, C relevant to protected areas

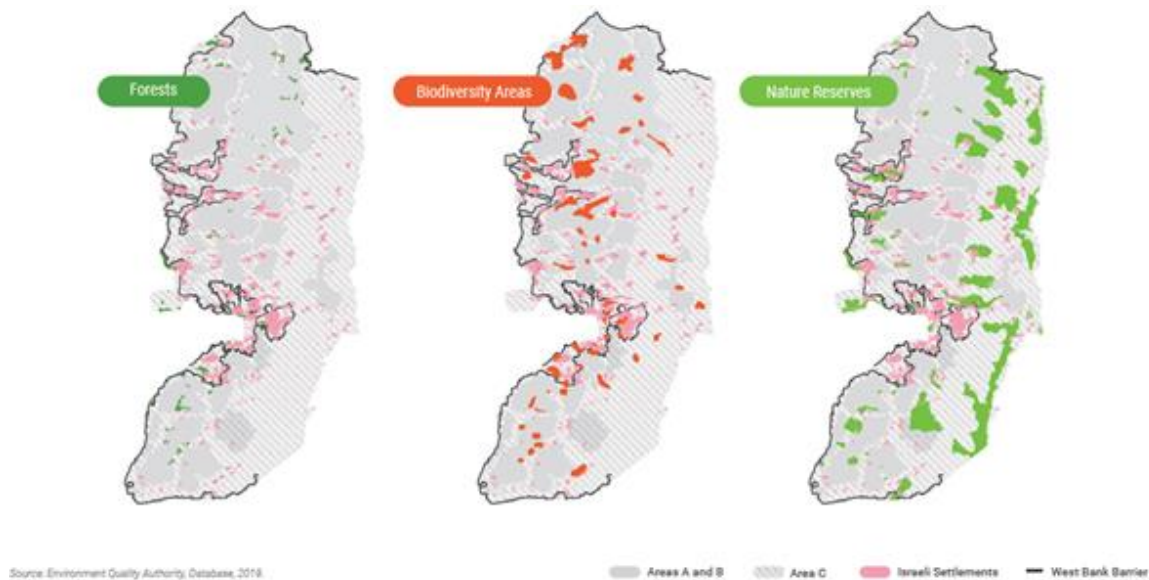


Figure 3 Forests, biodiversity areas, and nature reserves in the West Bank (SP 2020b)

The world's protected areas have grown in terms of land and designated protected areas but there are many remaining challenges to having them provide a critical safeguard against habitat loss and other human activities that decrease biodiversity (Chape et al. 2008). In this chapter we will review the rich biodiversity areas, including Important Plant Areas (IPAs), Important Bird Areas (IBAs), Wetland, and natural forests and go into the issue of protected areas in OPT. Details on the existing protected areas and proposed reserves are discussed with areas of potential to be designated as protected areas.

The IUCN did a survey of biodiversity in 2010 for 15 protected areas (Al-Hashmee, Deir Ammar, Ein Darra, Fahmeh, Jabal Alkabeer, Jesrualem Wilderness, Sheikh katrawny, Sheikh zeyd, Shoubash, Sirris, Tammoun, Tayyasir, Um Al Tut, Wadi Al Dilb, Wadi Zarqa Ulwi). This study (Garestecki et al., 2010) will be built on and developed into a network of protected areas in 2021.

Nineteen protected areas were partially or wholly turned over to the Palestinian National Authority and only 15 of them recognized and seven others were added by the Environmental Quality Authority in 2010 for a total of 22. In 2015, the Palestinian

ministerial committee approved a list of 49 protected areas. In the spatial plan the number became 51. Most of these fall in parts of the Occupied Palestinian Territories (OPT) that are under direct control by the occupying power. In effect only eight protected areas totaling less than 15 sq km are under Palestinian effective control making management difficult (see also Garstecki et al. 2010; Qumsiyeh & Amr, 2016).

The Environmental law chapter five article 40 concerns the Protection of Natural, Historical and Archaeological Areas which states that the Ministry of Environment (subsequently EQA) shall coordinate with competent agencies to prescribe bases and standards for the protection of natural reserves and national parks, monitor and declare them, and establish and designate the national parks and supervise them. Moreover, article (44) states that it shall be forbidden for any person to conduct activities or perform any action that may cause damage to the natural reserves, forests, public parks or archaeological sites, or affect the esthetical aspects of such areas.

Garstecki et al. (2010) categorized the evaluated protected areas in the Palestinian Territories according to the IUCN categories for protected areas. Of the 22 evaluated candidate protected areas, one was listed under category V as Protected Landscape, three under category III as natural monuments, four under category I as strict protected areas, and 14 under category IV as managed reserves.

Table 1 List of protected areas handed over to the Palestinian Authority under the Oslo agreements (Garstecki et al., 2010). Area is area handed over in dunums and not the total area of the potential protected area.

Protected area	Governorate	Area (Dunum)	Habitat type
Al-Hashmee	Ramallah	200	Pinus halepensis and Arbutus andrachne woodland
Deir Ammar	Ramallah	120	Pinus halepensis woodland
Ein Darra	Ramallah	250	Quercus calliprinos woodland on limestone
Fahmeh	Jenin	400	Semi-steppe batha
Jabal-Alkabeer	Nablus	9,500	Semi-steppe batha
Jerusalem Wilderness	Hebron and Bethlehem	172500	Steppe vegetation
Sheikh Katrawny	Ramallah	11	Quercus calliprinos woodland on limestone
Sheikh Zeyd	Nablus	52	Quercus calliprinos woodland on limestone
Shoubash	Jenin	5,000	Ceratonia siliqua and Pistacia lentiscus forest

Sirris	Jenin	1,118	Quercus calliprinos woodland on limestone
Tammoun	Tubas	4,300	Semi-steppe batha
Tayyasir	Jenin	1,200	Ceratonia siliqua and Pistacia lentiscus forest
Um-Altutt	Jenin	320	Quercus calliprinos woodland on limestone
Wadi Al-Dilb	Ramallah	800	Quercus calliprinos woodland on limestone
Wadi Zarqa Al-Elwey	Salfit	2,700	Quercus calliprinos woodland on limestone

The most recent update of the protected areas in Palestine shows 51 protected areas which account for 504 sq km and the total area of WB and Gaza is 6020 sq km so that is 8.3% of the OPT.

Important Plant Areas: Al Shaikh (2011) identified six Important Plant Areas of the West Bank. These areas host a variety of plant species many are considered endemic to Palestine. In general, the Palestinian IPAs are dominated by maquis vegetation, with trees such as the Palestinian Pistachio (*Pistacia palaestina*), Palestine Buckthorn (*Rhamnus palaestinus*), Palestine Oak (*Quercus calliprinos*) and Boissier Oak (*Q. boissieri*).

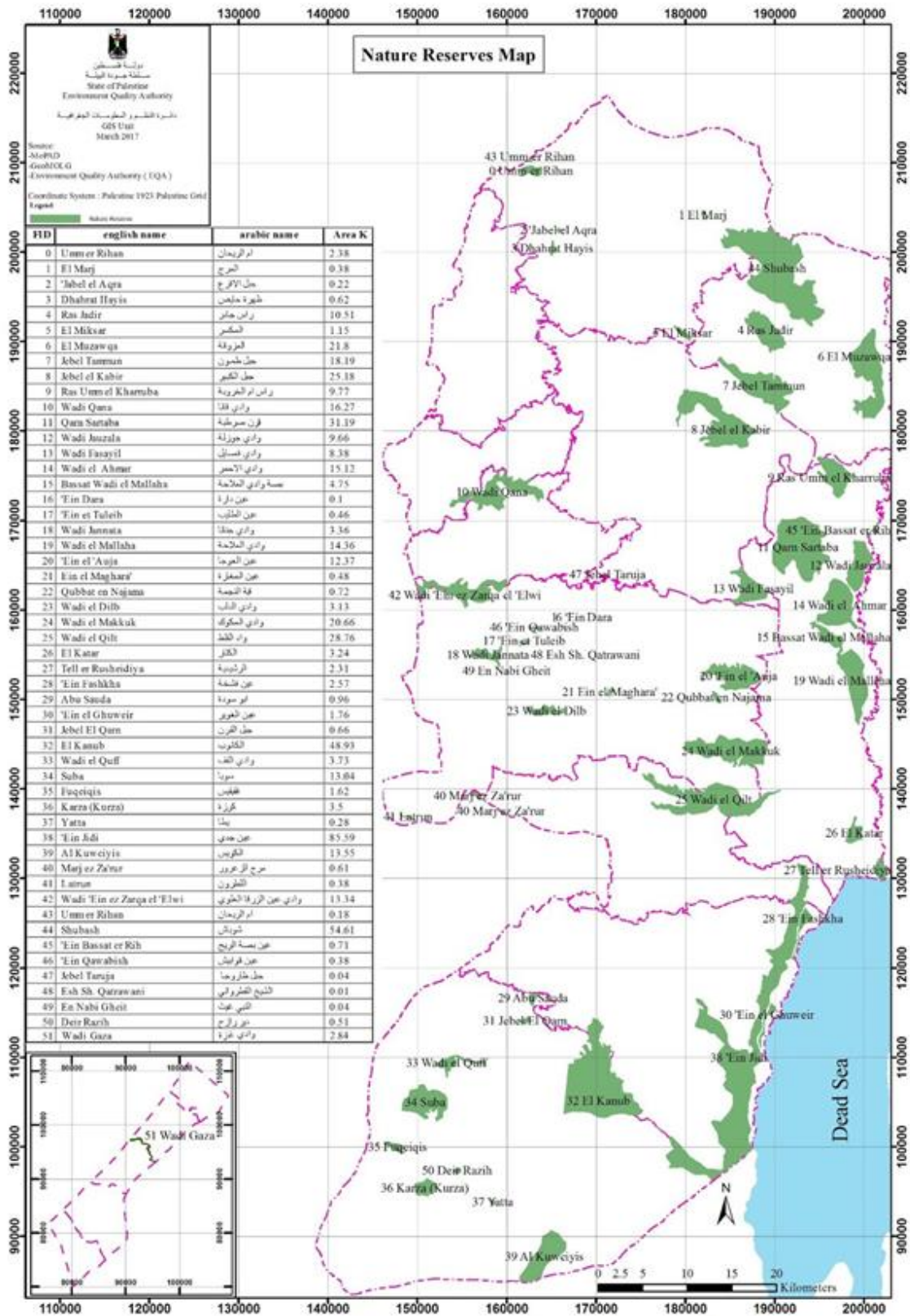


Figure 4 Nature Reserves Map

Important Bird Areas: Four IBA's (Table 2) are recognized by Bird-life International (BI) with a total area of about 21,500 ha (<http://www.birdlife.org/datazone/country/palestinian-authority-territories/ibas>).

Table 2 IBA's of the Palestinian Territories (Source: Birdlife International)

IBA	Area (ha)	Key Species	IBA Criteria
Ein Fashkha A1-	2500	Dead Sea sparrow	A4iv, B1iv, B2, B3
Jericho	3500	Lesser Kestrel, Honey Buzzard, White Stork, Black Stork, Sand Partridge, Tawny Owl, Lapwing, Barbary Falcon.	A1, A4iv, B1iv, B2, B3
Jerusalem (east)	500	Lesser Kestrel	A1, B2
Jerusalem wilderness	15,000	Sand Partridge, Lanner Falcon, Lesser Spotted Eagle, Griffon Vulture, Egyptian Vulture, Common Crane, Hume's Owl, Arabian Babbler, and Tristram's Starling.	A4i, B1i, B1iv, B2, B3

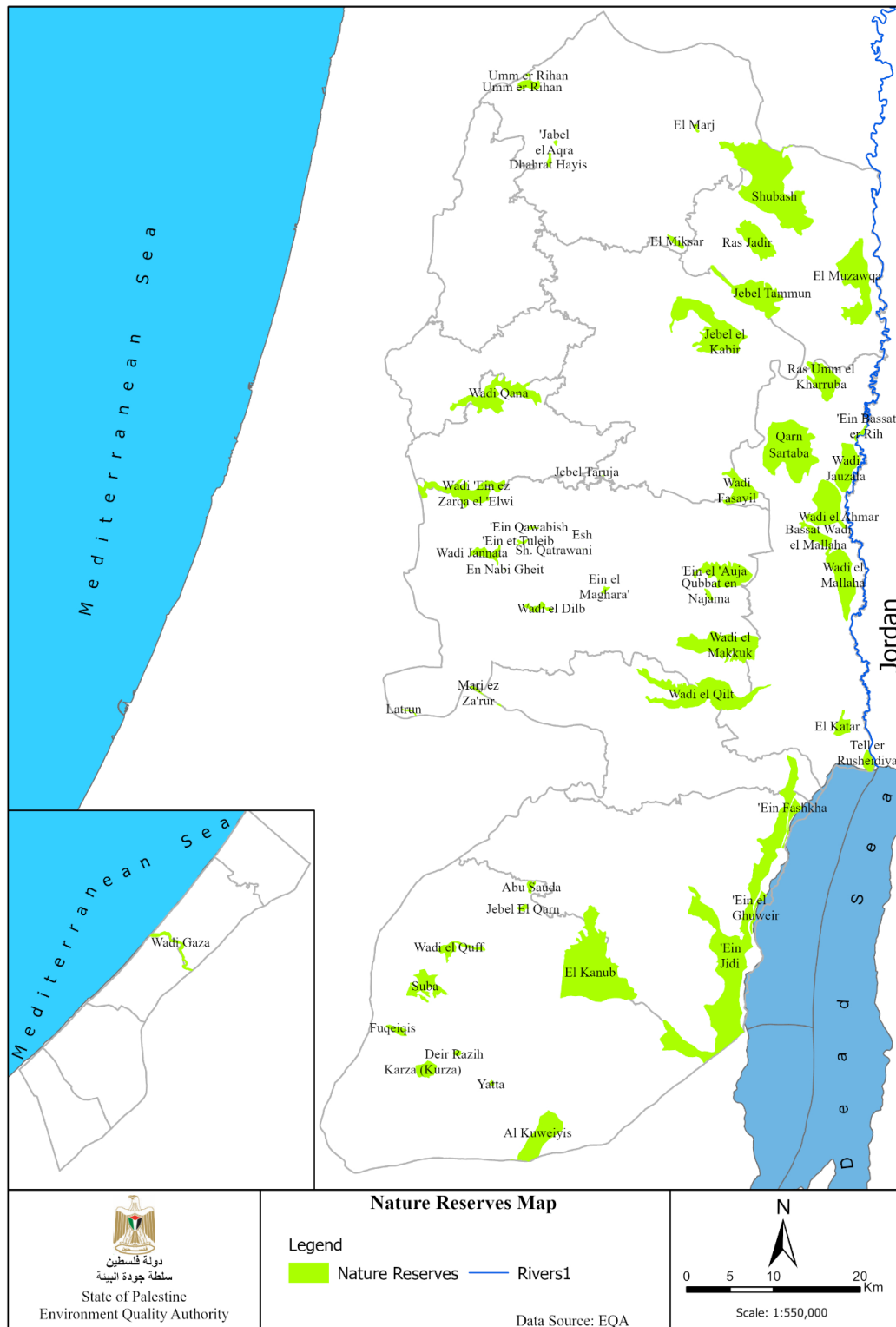


Figure 5 Nature Reserves Map, simplified

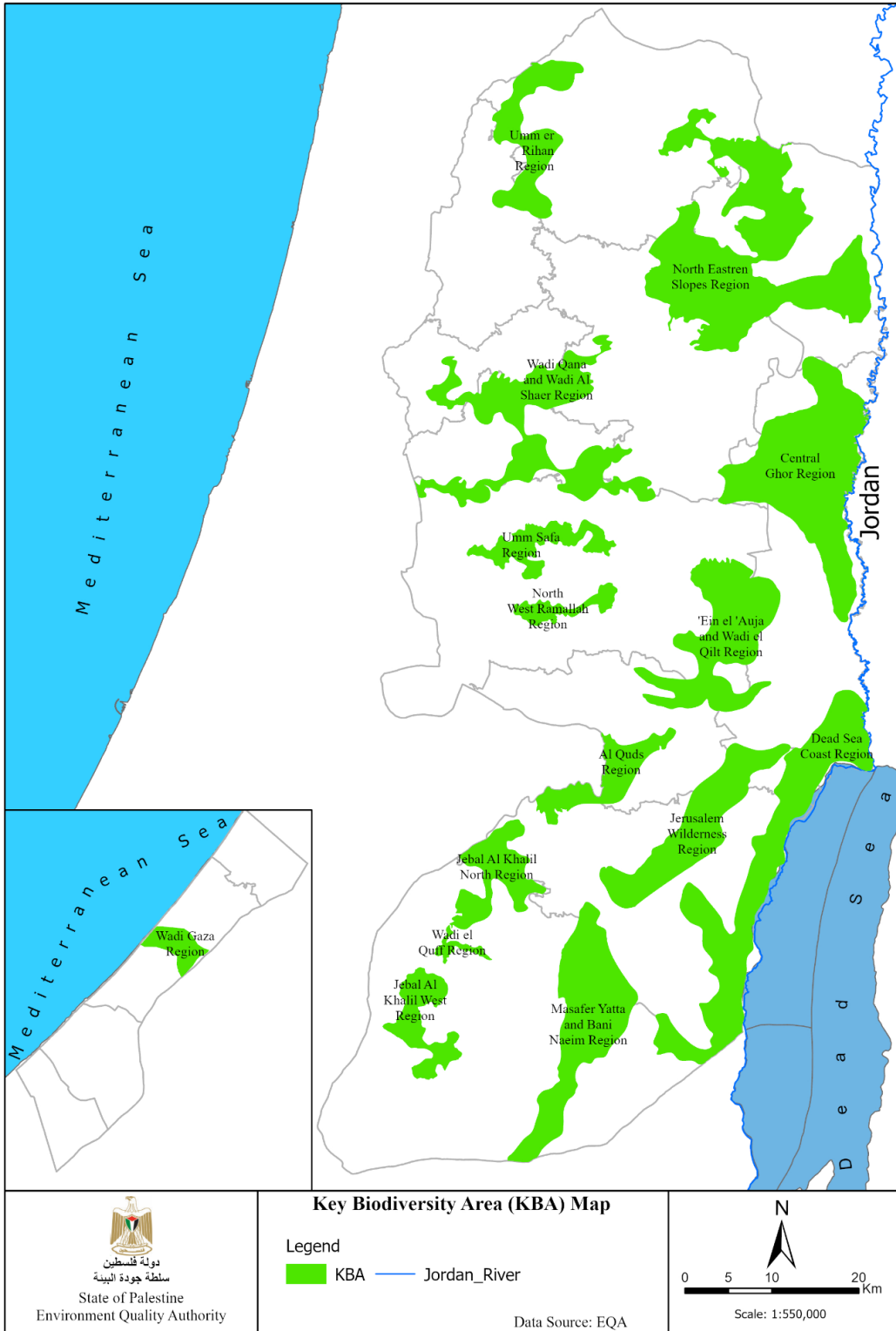


Figure 6 Key Biodiversity Area (KBAs) Map

Clearly protected area coverage from the KBAs is small (Figure 6). Spatial overlaps between digital polygons for Protected Areas and KBAs are done per global standards (<https://unstats.un.org/sdgs/metadata/files/Metadata-15-01-02.pdf>), and <https://unstats.un.org/sdgs/metadata/files/Metadata-15-04-01.pdf>

Many new studies start to appear on the biodiversity, environment, and conservation of protected areas in the West Bank of Palestine after the fifth national report in 2015 or where not mentioned in that report.

Wadi Quff in Hebron Governorate: The area was studied by professionals in Biodiversity and covered all fauna, flora, and threats that this Protected areas have and facing, this study translated to several scientific publications in a special issue at the Jordan Journal of Natural History in 2016 covers (Vertebrate, invertebrate, protected area introduction, birds, flora, protected areas) (Qumsiyeh et al., 2016; Qumsieyeh and Amr, 2016; Kahlilieh, 2016; Al shaikh and Mahassna, 2016, Qumsiyeh, 2016). As a conservation first move in Palestine, a management plan for Wadi Quff was published (EQA, 2014). Forested area degradation and fires happen frequently in Wadi Quff (ARIJ 2016). The papers and the management plan were adopted by the relevant ministries (Agriculture and EQA). There was an issue here in that the implementation of the plan was not done and instead, the Palestinian authority turned over the site to the local authority (Hebron Municipality) on the condition of adherence to the management plan of the site!

Wadi Zarka AL Ulwi (on the borders between Ramallah and Salfit): An intensive study for the fauna and flora of this area was done by the Palestine Museum of Natural History and the Palestine Institute for Biodiversity and Sustainability, this study translated in a report send to the EQA and related ministries and stakeholders, an education awareness for local on biodiversity and the important of the area done (PMNH 2018)

Wadi Janata (Al Hashimy): A survey for biodiversity conducted by the PCC under the supervision by Mrs. Roubina Ghattas, provided a management plan that includes fauna, flora, threats, conservation, ecotourism and others (PCC, 2018).

Jinsafut pond, buffer Zone for Wadi Qana: A study was done on a temporarily rain water pond in Jinsafut village near the Wadi Qana protected area. This area shows a important species of fauna and flora only found in this pond from the West Bank and never recorded before elsewhere. This includes the Pond Water-crowfoot (*Ranunculus peltatus*) and the Syrian spade-foot toad (*Pelobates syriacus*) (PIBS, 2018).

Wadi Al Makhrou: This is part of al Quds Key biodiversity area and not a nature reserve yet. It may be important as a protected area in the future according to the IUCN protocol and as the last green area in Bethlehem District, given that the Valley is part of a UNESCO heritage site with Battier Village. The area was studied intensively by experts in biodiversity who developed some management and protection plans for habitat protection and ecotourism. Battir was also recognized as a World Heritage Site in the year 2014. However, the UNESCO state of conservation report 2017 placed Battir and its landscapes on the list of WHS in Danger, as it is affected by a number of threats including: (1) changes in traditional ways of life and knowledge systems, (2) changes in local population and

community identity and social cohesion,(3) invasive/alien terrestrial species and (4) potential construction of a separation wall (<http://whc.unesco.org/en/soc/3541>). Any efforts that would reduce these threats are highly welcomed by UNESCO. See also Abu Hammad (2016).

Far'a and Jerash: an integrated watershed management plan was developed and partially implemented (EQA + MoENV 2004 and stakeholder feedback)

Wadi Gaza: Located in the Eastern Mediterranean biodiversity hot-spot, it's recognized by the BirdLife International as an IBA and a station point for the migratory bird routes (Skinner and Zalewski 1995; EQA 2002; HSS 2017). This site is on the tentative list of UNESCO world heritage sites (<https://whc.unesco.org/en/tentativelists/5722/>). 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). The Palestinian Authority established the Wadi Gaza protected area in June 2000 containing 1.25 km² 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 not implemented (MedWetCoast 2003; UGEC 2004; EQA 2015). 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 despite that Palestine did not sign the Ramsar Convention (<https://medwet.org/2014/01/training-program-on-the-sustainable-development-of-coastal-areas-for-the-mena-region/>). It seems there are few 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).

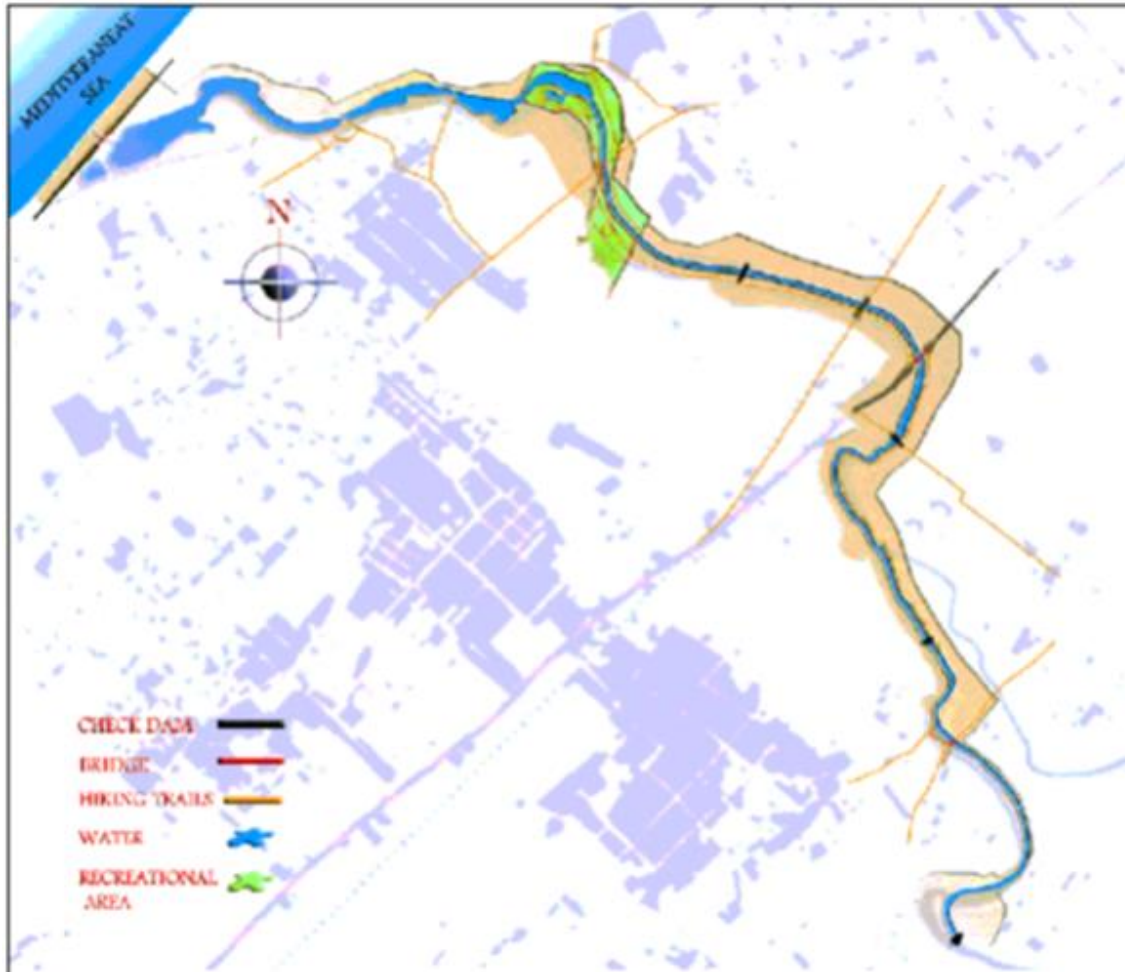


Figure 7 Proposed development of the valley as a nature park (AlAgha 2003)

There are other plans that are not implemented in other valleys that could impact biodiversity. For example, in Wadi Nar/Kidron master plans <https://bit.ly/39vTmN7>. There are current plans for a network of protected areas that would be better managed but much of this is dependent on acquiring full sovereignty by the State of Palestine.

The Jordan River basin needs special attention. Significant depletion of its water was done because of mega-projects like the draining of the Hula Wetlands and the diversion of significant amount of water from upstream (Lake Tiberias) (Messerschmidt and Shelby 2015; Figure 8).

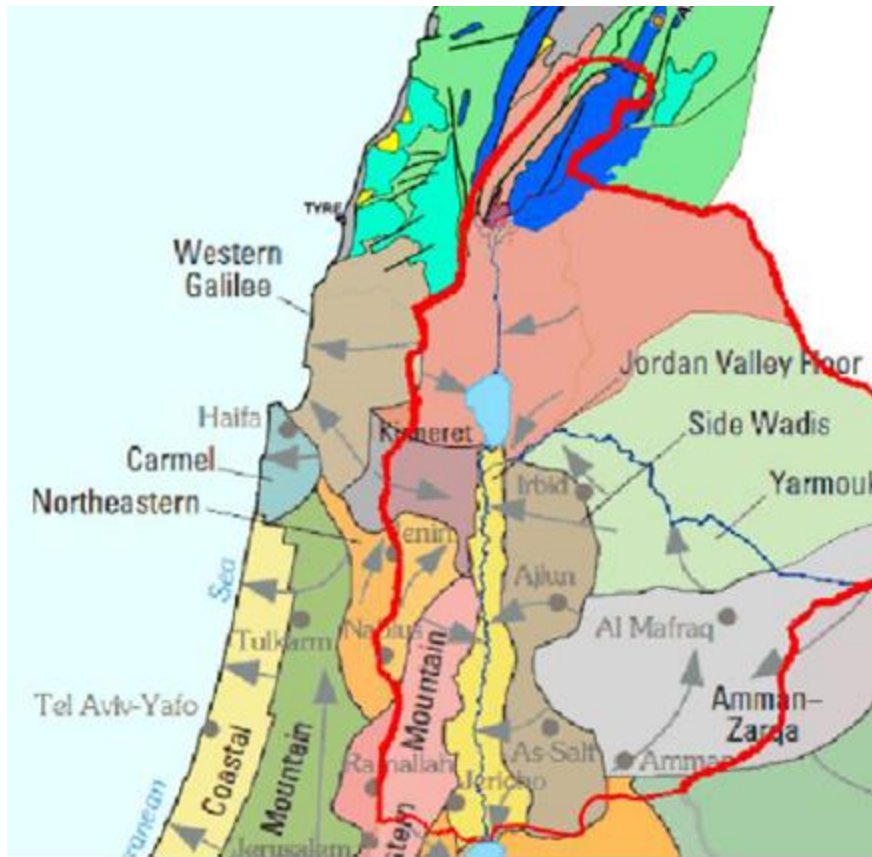


Figure 8 Aquifers in our area and their drainage – most of the water is taken by Israel from Palestine, Jordan, Lebanon and Syria (Messerschmidt and Shelby 2015)

Palestine adopted a National Spatial Plan (NSP) which includes protection of natural resources and historic sites as well as protected areas (SP 2014). The Ministerial Cabinet approved the NSP in January 2014 (<http://www.nsp.pna.ps/en/>) in order to balance intended development with the protection of limited natural resources to ensure sustainability for future generations. The NSP included limits on land use and proposed that there would be high and medium sensitivity areas for agriculture, for open spaces, for forests, for biodiversity and natural conservation areas, for cultural and historical areas, and for archaeological sites. Implementation of the plan began in 2014 but one way to spur implementation is to merge the NSP with the Palestinian National Development Plan whose first key policy priority is: “In line with the two-state solution and on the basis of the 1967 border, establish state sovereignty and assert control over natural resources. Special attention will be paid to area C, particularly the Jordan Valley and Dead Sea Area, as well as to development of East Jerusalem and Gaza” (MOPAD, 2014). In addition, MOPAD, EQA, MOA, and other government agencies must implement the policies they have already agreed to especially in terms of protection of key areas. The figure below shows this in detail.

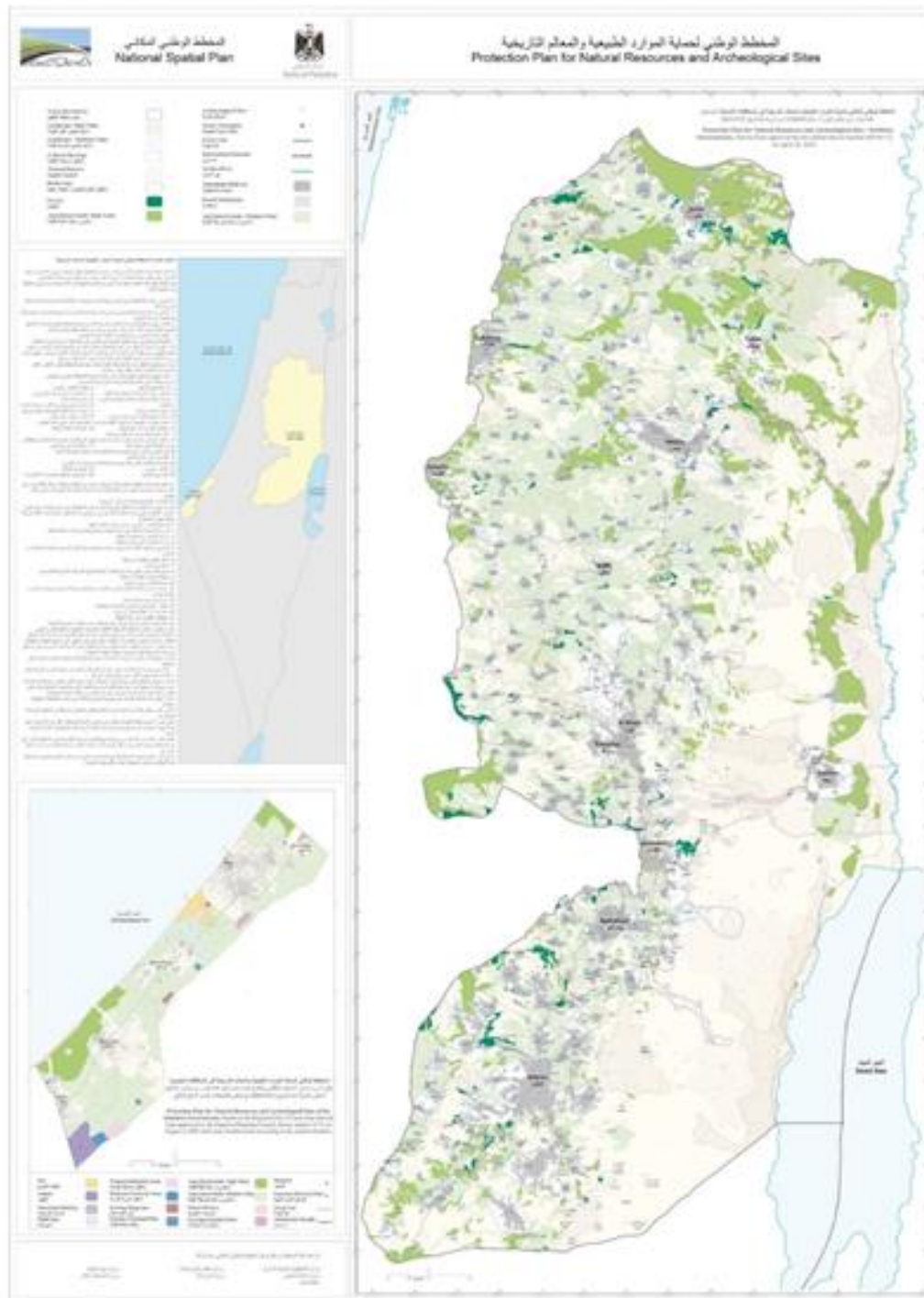


Figure 9 National Spatial Plan

The current EQA (<http://environment.pna.ps/ar/>) had the responsibility to develop legislations, strategies and policies for the Palestinian Authority system, in the context of overall environmental policy development in the West Bank. It is linked directly with the Ministerial Council. The EQA is responsible for implementing all articles in the

Environmental Law for the Year 1999. In 2010, the EQA developed a three year strategy for 2011-2013 that identified and prioritized objectives for itself and for the Palestinian environment as a whole (EQA, 2010). EQA put 48 specific objectives, of which the following seven objective are among them: Issuing legal and other directives; Issuing information bulletins and statistical and other data information; Building human capacity at EQA; Documenting Israeli violations of the Palestinian Environment; Founding of an environmental information center which issues regular reports; Review and modernize the Palestinian Environmental Laws; Review and evaluate institutional structures related to the environment

Table 5: National Policies and Policy Interventions under National Priority 10	
National Policy	Policy Interventions
<ul style="list-style-type: none"> Ensuring Community and National Security, Public Safety and Rule of Law 	<ul style="list-style-type: none"> Implement measures to enhance community security and public safety. Strengthen capacity for disaster response and crisis management. Improve the governance of Palestine's security sector, strengthen institutional capacity and ensure efficient use of resources.
<ul style="list-style-type: none"> Meeting the Basic Needs of Our Communities 	<ul style="list-style-type: none"> Expand community access to clean water and sanitation. Expand community access to reliable energy. Improve public transportation and road safety. Support affordable, safe housing. Ensure food security.
<ul style="list-style-type: none"> Ensuring a Sustainable Environment and Adapting to Climate Change. 	<ul style="list-style-type: none"> Reduce and effectively control pollution and greenhouse gas emissions. Expand solid waste management and recycling. Expand wastewater management, treatment and reuse. Manage, protect and promote sustainable use and conservation of natural resources (land, water and energy). Keep Palestine green (conserve biodiversity, establish nature preserves and expand green spaces). Increase energy efficiency and reliance on renewable energy.
<ul style="list-style-type: none"> Revitalizing Agriculture and Strengthening Our Rural Communities 	<ul style="list-style-type: none"> Increase agricultural plant and livestock production and develop value chains. Protect and support farmers, particularly in areas under threat.
<ul style="list-style-type: none"> Preserving Our National Identity and Cultural Heritage 	<ul style="list-style-type: none"> Support cultural innovation and production. Implement initiatives to preserve and develop Palestine's cultural heritage. Develop traditional handicrafts. Promote Palestine as a tourist destination.

Palestine with a total of 49 existing protected areas found all over the West Bank, covering all habitat that is found in Palestine. Nineteen protected areas were turned over to the Palestinian authorities and in 2010, the EQA add seven protected areas to become 26 in total, in 2015; The Palestinian ministerial committee approved a list of 49 protected areas, but most of them fall under area C (see Qumsiyeh and Amr, 2016).

The IUCN did a survey of biodiversity in 2010 for 15 protected areas (Al-Hashmee, Deir Ammar, Ein Darra, Fahmeh, Jabal Alkabeer, Jesrualem Wilderness, Sheikh katrawny, Sheikh zeyd, Shoubash, Sirris, Tammoun, Tayyasir, Um Al Tut, Wadi Al Dilb, Wadi Zarqa Ulwi), this study that conduct at 2010 (Garestecki et al., 2010) was incomplete and need to be approved to make it more scientific. Data were obtained from several resources, including BirdLife International for the important bird areas, Radford *et al.* (2011) for the important plant areas, Ghattas *et al.* (2006) for the natural forests, Garstecki *et al.* (2010) and the Palestinian Ministerial Cabinet (2015) for the protected areas. Detailed information on the protected areas was obtained from EQA.

“There is only national list of threatened species available for Palestinian flora and there is no national list for Palestinian threatened fauna due to lack of comprehensive surveys of fauna species. There are two published lists of threatened plants: one Israeli and one Palestinian. Based on IUCN global guidelines and criteria and Red List publications there are only 24 species were listed as globally threatened as published on the official website of IUCN Red List. From these 24 species there are: 10 birds, 4 reptiles, 3 mammals, 2 fishes, 2 molluscs, 1 amphibian, 2 other invertebrates, and there is no plant recorded in the IUCN Red List website although there are two published lists of threatened plants as indicated earlier” **EQA report to CBD (2015)**

Al Shaikh (2011) identified six Important Plant Areas of the West Bank. These areas host a variety of plant species many are considered endemic to Palestine. In general, the Palestinian IPAs are dominated by maquis vegetation, with trees such as the Palestinian Pistachio (*Pistacia palaestina*), Palestine Buckthorn (*Rhamnus palaestinus*), Palestine Oak (*Quercus calliprinos*) and Boissier Oak (*Q. boisseri*). But each of the areas selected were selected for having unique phtogeographical flora and some endemic plants and vulnerable plants. Al-Shaikh does state that more studies are needed to evaluate these areas. We also need specialized plant taxonomists and quality herbaria to really iunvestigate the largely ignored fielf of plant biodiversity in Palestine.

Table 3 Designated IPA’s of the Palestinian Territories.

Location	Endemic or Protected Species	Governorate
Faqoua` - Jalaboun	Delphinium ithaburensense	Jenin

Wadi Alharamayah - Wadi Elbalat - Um Safa - Beit Illo - Ein Samya	NI	Ramallah
Wad Qana- Wad Eshai`r	Ophrys sp. and Tulipa agenesis	Salfit
Yaseed-Ibzeik	Ferula orietalis, Iris atrufusca, Iris lortetii, Biarum pyrami, Teucrium montbretii, and Phylitis sagitata.	Nablus
Dead Sea Coast	NI	Bethlehem, Jericho
Khalil (Hebron)	Iris atrofusca, I. vartanii, Petrorhagia arabica and Suaeda palaestina.	Hebron

Four IBA's are recognized by Birdlife International (BI) with a total area of about 21,500 ha (<http://www.birdlife.org/datazone/country/palestinian-authority-territories/ibas>).

Main Threats to Biodiversity

The ranking of threats to the Palestinian Environment according to the 5th national CBD report are available and seem reasonable though could be adjusted when and if additional data become available (EQA 2015; Table. 1). Another report used the Delphi approach to ask some ‘experts’ what the main threats are and came up with a somewhat different answer (Abdallah and Swaileh 2011; AlHirsh et al. 2016). But the key threats need not even be prioritized to be analyzed. AlHirsh et al. (2016) used interviews with selected individuals involved in environmental issues in Palestine to see what are the threats that are most prominent to the majority of those individuals.

Table 4 Selected threats to the Palestinian environment (after EQA 2015)

Threats	Threat ranking	
	West Bank	Gaza

Habitats fragmentation (due to urbanization, destruction of forests, climate change, desertification, Israeli colonial activities)	Very High	Very High
Desertification and soil erosion (due to overgrazing, climate change, infrastructure construction etc.)	High	Very High
Urbanization and population growth	Very high	Medium
Removal of rocks for construction (stone quarries etc.)	Very low	Very high
Uprooting trees	Low	High
Overgrazing	Low	Very low
Land degradation (poor planning, soil erosion etc.)	High	Very High
Invasive alien species	Medium	Medium
Climate change	Low	Medium
Overexploitation (including poaching, overfishing etc.).	High	Very High
Pollution (waste water, solid waste, use of chemical pesticides/insecticides/fertilizers)	Medium	Very high
Colonial residential and industrial settlements and associated infrastructure (like the Segregation wall) and its associated adverse effects including vegetation cover shaving, waste water pollution, and habitat fragmentation	Very high	Very low

Here we highlight some of the main threats to habitats:

Climate Change

Human induced climate change will drastically effect the Arab world (Verner 2012). A World Bank study shows impacts include water resource decline will be drastic by 2040. In the West Bank and Gaza, while demand will double, supply will shrink dramatically!

When coupled with population growth and habitat destruction (see Table 4), both the World Bank (Verner 2012) and the UN predict situation to become unlivable (UN 2012). Newer models attempt to integrate species own responses (ecologically, genetically etc.) in predicting changes in species distribution following climate change and its impact on the habitat (Lavergne et al. 2010). But preliminary data in Palestine in at least one study shows decline in vertebrate biodiversity as desertification spread into the Bethlehem District (Qumsiyeh et al. 2014).

Water and Liquid Waste

Data from the Ministry of Local Government indicate that the percentage of solid waste that is dumped in a sanitary manner out of the total waste produced in 2019 was about 98%. This percentage is expected to reach 100% in 2023. According to the same source, and in regards to the percentage of waste that is recycled out of the total waste produced, it ranged from 1.5% in 2019 to 10% during 2023. According to the Environment Quality Authority data, the percentage of hazardous waste that is treated out of the total waste produced reached 2% during 2019, , where this percentage, according to the data of the Environment Quality Authority and the Ministry of Local Government, is expected to reach 10% by 2023. There were some improvements in the past few years in terms of controlling random dumping sites and directing them to landfills and other facilities operated by Joint Service Councils. Here are select examples: Ubeidiya random dump site rehabilitated (ARIJ 2016). Under the ministry of local government there is a general directorate of joint services councils. These JSCs work to manage solid waste for groups of population centers (MoLG & JICA, 2015). The actions of JSCs is also described in detail in the Solid Waste Management Strategy (MoLG, 2016).

The situation of water is becoming very critical in the MENA region. While it is clear how it impacts human health and wellbeing, it is also critical for the ecosystem. The government of the state of Israel which controls Palestinian (native) water claims there is a water shortage but the reality is there is simply unequal distribution (Stauffer 1996). For example, Israel diverts and uses most of the water resources of the Jordan River basin for irrigation farming through the so called “Israel national water carrier/canal” (Elmusa 1998). From 1250 million cubic meters (mcm) per year the river’s flow decline to < 20 mcm (Soffer 1994). Palestinians used 140 pumping units along the Jordan river before 1967 and all were. destroyed or confiscated by the occupation authorities. Now Palestinians use <0.5% of the river basin waters. After a thorough review of the hydrological data, Elmusa (1998) concluded that: “Israel takes 80-90% of the freshwater resources of geographic Palestine. ... The disparity in extraction between the two sides has translated into a conspicuous water gap in all sectors. ... The gap is even more conspicuous between the Palestinians and the Israeli settlers who consume five to six times as much per capita as do the Palestinians and are profligate irrigation water users (Elmusa 1998). The UN Commission on Human Rights reported in 2000 that: “The Palestinian use of the Jordan River before 1967 was through 140 pumping units. Israel either confiscated or destroyed all of those pumping units. In addition, Israel closed the large, irrigated areas of the Jordan Valley used by Palestinians, calling them military zones that later were

transferred to Israeli settlers. At present Israel extracts more than 85 per cent of the Palestinian water from the West Bank aquifers”

Through military orders, all water in the occupied territories is designated “state owned by Israel” even though this violates the fourth Geneva Convention (UNEP 2003). Palestine (a state not recognized by Israel as the occupying authority) did attempt to draft water and other natural resources’ laws. The Palestinian authority even failed to get Israel to agree to many waste water and solid waste projects. As Israel takes 91% of the West Bank Water resources, it provides much of it to illegal settlers (UN Commission of Human Rights 2000). It is obvious that all these measures contravene International law and conventions such as the 4th Geneva Convention and the International Covenant on Economic, Social and Cultural Rights (Elmusa 1998 Israel also declared places like the Jordan valley closed military zones. Vast tracks of Palestinian agricultural lands were thus essentially confiscated and many of them turned to Jewish settlements (Daibes and Daibes-Murad 2003).

The Oslo agreements was supposed to lead to ending the occupation but simply entrenched it with all attendant strengthening of Israeli control over the Natural resources including water. International treaties and laws pertaining to water were ignored in deference to “might makes right” (Tamimi 1996). Regardless of political outcomes, there is simply a very small geographic territory (historic Palestine) with one hydrological system (Elmusa 1998; Daibes and Daibes-Murad 2003). One democratic state ensuring distribution of water to its citizens based on international guidelines is actually most logical. The situation in Gaza is now catastrophic and cannot continue (Baalousha 2006; UN 2012). Water desalination projects as solution in Gaza have their own environmental issues, see (Assaf 2001).

The Israeli actions toward water sources have been catastrophic for nature biodiversity since the creation of “State of Israel”, starting from drying out al Hula wetlands which eradicated life there and not ending with the Red Sea - Dead Sea Canal project. The latter is a prime environmental problem and should not have been implemented (the project already started). Its impact in the OPT will be most acutely felt in the unnatural “replenishment” of the Dead Sea while leaving the Jordan valley essentially dry and with continued environmental deterioration. We did some work on this but much more research needs to be done and the summary of these things are beyond the scope of this report. More on these issues of water and waste are available under ABT8.

Occupation/colonization

Palestine had an indigenous Canaanitic population going back thousands of years and living in small village communities with few urbanized areas (like Jerusalem, Hebron, and Nablus). At the dawn of the industrial revolution, the population was a few hundred thousand (3% Jewish, 13% Christian, 80% Muslim, 4% other). The industrial age and improvement in health resulted in population expansion but the Zionist project resulted in ethnic cleansing of most of the natives to be replaced by an immigrant mostly European Jewish population (Pappe 2006). Over 500 villages and towns were destroyed (most in 1948-1950, some in 1967). When Israel was created on 78% of Palestine, the remaining

22% was occupied in 1967. In 1967, Imwas village was depopulated and in its place Canada Park was built. In all other areas of the occupied territories, forests and vegetation cover was removed to build the Israeli settlements which now house hundreds of thousands of Israelis (Fig. 2). Simultaneously, rules were introduced that prevented Palestinians not only from doing much of their usual agriculture but also from managing forested lands or building in open spaces. Currently nearly one million Israelis live in the occupied West Bank (WB). The WB is also divided into several categories: Jerusalem annexed to Israel, area C under Israeli civil and military control, area B under Israeli military control only (18.3%) and Area A under Palestinian civil and partial security control (17.7%) (Isaac and Hilal, 2011; ARIJ 2015). 30% of the territory is designated as closed military zones and “nature reserves” (these are occasionally reclassified to allow colonization). Israeli colonies were built on hilltops to fit into a pattern as to control the natural resources and control the native Palestinians (Benvenisti 2002; Weizman 2012). Environmental and human sustainability were not taken into considerations in these political decisions (ARIJ 2015). Untreated sewage water is discharged by settlers on Palestinian areas (ARIJ 2005; Newman 2009). Israeli polluting industries were built near Palestinian communities in the occupied territories (due to tax incentives and lax laws). Gishuri Industries as an example manufactures pesticides and fertilizers next to Tulkarm. Significant pollution from this and other companies in this area has damaged citrus and vineyards (ARIJ 2015). We also showed significant genotoxic effect of the Barqan Industrial settlement on Burqeen village (Hammad and Qumsiyeh 2013). Israel built “by-pass” roads and other infrastructure in the occupied areas to serve the Jewish colonies. Lands were confiscated to build these, including extra “security zones and buffers” around roads, walls, etc. The landscape was severely damaged 51.2 km² were destroyed just in 2000 for roads that do not served the local population. Land that was used by Palestinians or by wildlife thus was urbanized. Palestinians in the West Bank make 2.5 million people living in a built up area of 367.7 km²; a density of 6800 Palestinians per square kilometer which is 10 times more dense than for Israelis (ARIJ 2015). The disparity between settlers and natives in land control, economy, and access is also compounded by disparity in use of natural resources discussed earlier (Gordon 2008; Weizman 2012). There are many other issues where the occupation negatively impacts sustainable development and the environment (MOPAD 2014). For example, tourism industry was mostly taken over and it is supporting Israeli economy while negatively impacting the Palestinian economy and the Palestinian environment (Shay 2016; Isaac et al. 2016). Another example is the destruction of Bedouins life in the Negev (creating “concentration areas” for them)h.(Weizman et al. 2015). Politics trumping facts can be devastating to understanding of issues like environment and water. For example, deliberately misstating facts, hiding them, selectively representing uncertainty and much more was done by Israeli officials to serve their political interests in the Jordan River basin (Messerschmid and Selby 2015). Israel’s unilateral actions of colonial settlement expansion and destruction of native lives has had devastating impacts on the Palestinian environment and raises significant questions about the possibility of planning let alone sustainability under occupation (Isaac et al. 2004). There may be good reason to engage in legal proceedings that would be backed by good research and enlisting the services of good legal scholars and lawyers to pursue claims of environmental injustice and damages at local, national, and international fora. The term “Green-washing the occupation” comes to mind when we realize that in many cases Israel takes land on the pretext of protecting it only to

build colonies on it (Etkes and Ofran 2007). Ras Imweis and adjacent areas is a good example of this (became the settlement Nahal Shilo). “Nature Reserves” and closed areas became pretexts for land confiscation. Such exploitation was obvious in Bethlehem Governorate, when Har Homa settlement was established in 1997 on Abu Ghneim Mountain

Invasive Species

Alien (non-native) species increasingly form an increasing percentage of local fauna and floral species around the world posing threats to biodiversity (Sandlund and Johan 1999). Nearly half a million species are reported as invasive (Pimental et al., 2001). The invasiveness threat increased because of ease of transportation and human habitat destruction that opens many avenues for invasive species to get established around the world. In fact, these invasive species are now considered the second most important threat to biodiversity after direct habitat destruction by humans (Kettunen et al., 2009). There is still some debate on the issue of whether increased local biodiversity protects from invasive species or not and how best to deal with this phenomenon (Levine, 2000)

Massive changes in landscape in historic Palestine included introduction of non-native species (by the British then by the Israelis) which caused destructive effects on the local fauna and flora. The biggest was the planting of European trees to cover-up the remains (including native trees) of over 500 Palestinian villages and towns depopulated in 1948-1950. Israel did a similar process after 1967 with three Palestinian villages creating the “Canada Park” area (NW Jerusalem). Calling this “afforestation” and writing articles that hides its true devastating environmental impact is now common place (Ginsberg, 2006). Many plants and animals are invasive in Palestine. Invasive bird species include *Pistaccula krameri*, *Acridotheres tristis*, and *Lonchura malabarica*. Bird species escape from human captivity and in the case of the myna are highly adaptable and significantly impacted local species. Invasive plants species includes about 50-species, the species of high invasiveness include *Prosopis juliflora*, *Acacia saligna*, *Ailanthus altissima*, *Conyza bonariensis*, *Cronquist*, *Nicotiana glauca*, *Oxalis pes-caprae*, *Solanum elaeagnifolium*, and *Ambrosia confertiflora*. The invasive species in Palestine are increasing both in the number of species and in the degree to which some of them have proliferated. The main restrictions on the import of species into the country are those of the Ministry of Agriculture but Israel remains the authority in charge of borders (EQA, 2015a). But we need better surveys, assessments, and research studies of invasive species and how to control them. The result according to UNEP-WCMC (2015) is an estimated loss of 15% in biodiversity. The PIBS/PMNH work in the field of faunatic invasive species in the West Bank of Palestine and found several invasive insect species such as *Leptoglossus occidentalis* and *Deroplax silphoides* (Handal, 2017; Handal and Qumsiyeh, 2019). Moreover, several studies are in progress to understand the distribution and ecology of some other species and the effect on native species, environment and humans, such as invasive bird species (Myna Bird).

Habitat destruction and urban expansion into the protected areas in Palestine remains a major threat. Mitigation requires new laws and regulations as well as enforcement of existing laws. One aspect that will help is the adoption of the national spatial plan (Fig. 9) and its attendant regulations regarding protected areas and KBAs discussed earlier.

Review of the NBSAP Related to PA

The first and only NBSAP was drafted in 1999; we are currently working on a new strategy which will be published in 2022. The main instrument for implementing the CBD, the new NBSAPs will follow COP decisions, pertaining to thematic areas, cross-cutting issues and stakeholder processes, indicating those areas that Parties have suggested should be included in NBSAPs. The main COP decisions that provide direct guidance for NBSAPs are decision IX/8 and decision X/2. Parties are encouraged to review these decisions for consolidated guidance on the NBSAP process, substance components, support systems, and monitoring and review systems. Palestine was not listed at CBD as having NBSAP (<https://www.cbd.int/nbsap/about/latest/>) because the NBSAP was developed in 1999 before accession to the treaty. Even though it has been 21 years since NBSAP (1999), the EQA included biodiversity planning in the environmental sector strategies. Since NBSAP (1999) much has changed including new threats to biodiversity, new opportunities, and new and updated methodologies and data that could make for a far more effective NBSAP. The new NBSAP should be revised to be aligned Aichi Targets and With CBD's post 2020 biodiversity framework, Ramsar Convention, World Heritage Convention, CITES, CMS, and Global Assessment of Biodiversity carried out by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).” Thus, the national strategy serves the state of Palestine taking into account local needs, international legal (convention) obligations, and actual changes in the past three decades is essential.

The NBSAP was immediately followed with the Palestinian Environmental Strategy (MoEA 2000). After articulating the local situation (environmental status, political, socioeconomic, legal and institutional frameworks, driving forces, and resources). It articulated these targets but without specifics relating to implementation:

1. To achieve a balanced situation in which the Palestinian water rights are effectuated and the total Palestinian water demand is met under the condition that annually the total abstractions (Palestinian and Israeli) from the water resources system do not exceed the natural and artificial recharge of the water resource system.
2. To protect the quality of the water resources in order to be suitable for the desired or designated uses of water. The sustainability is expressed as maximum allowable concentrations of various substances or groups of substances for particular uses of water resources.

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3. Utilization of the natural resources is done in a way that is not conflicting with the environmental values that are associated with these resources. The exploitation process itself does not harm the environment or the public health.
 4. Abandoned sites are rehabilitated in a sound way from the viewpoint of the environment and landscape.
 5. The environmental impacts of socio-economic activities and related land use may not exceed the natural 'carrying capacity' of the land and soil.
 6. Ambient noise levels should not exceed those levels that are associated with nuisance for the society or the natural environment. These levels are expressed as maximum allowable noise levels and exposure periods for different categories of receptors.”
 7. To reverse and prevent pollution, or risk for pollution of the shoreline and the coastal marine environment to protect the marine ecosystems and public health and to enable a sustainable economic, recreational and touristic development of the area.
 8. The sound use and conservation of nature and biodiversity, within the context of a sustainable socio-economic development of the Palestinian areas.
 9. To protect and rehabilitate the landscape and aesthetic values of the living and natural environment.
 10. To raise public awareness of landscape value and the importance to maintain and protect it for the future generations of Palestinians.
 11. To preserve the rich cultural heritage and historic monuments for the current and future generations and to exploit this heritage for recreational purposes and tourism in a sustainable manner

EQA has published Environment Sector Strategy in 2010 that included a SWOT analysis and identified six national priorities (EQA 2010). There were 48 specific recommendations for interventions listed by order priority for the EQA and 19 ones to be implemented at the general environment sector level (EQA 2010).

Six priorities and objectives identified by Environment Sector Strategy (EQA 2010) are as follows:

1. A Palestinian environment that is clean, safe and pollution free
2. Natural environment and cultural heritage in Palestine are preserved and maintained
3. Palestinian natural resources are managed in a sustainable manner
4. All measures required to cope with climate change, combat desertification and confront environmental and natural disasters are taken
5. The institutional and legal environmental framework is strong, effective and working in an integrated and concerted manner

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6. The State of Palestine is committed to international conventions and treaties on environment

Expert evaluation of the challenges narrowed down 100 questions of importance to conservation of Biological diversity (Sutherland et al., 2009). We can classify these questions under the following categories: Ecosystem function and services, climate change, technological change, protected areas, ecosystem management and restoration, terrestrial ecosystems, marine ecosystems, freshwater ecosystems, species management, organizational systems and processes, societal context and change, and impact of conservation measures.

The most recent report (EQA, 2015) from the state of Palestine in compliance with CBD had the same priorities as the NBSAP (1999):

1. Basic faunal and floral studies at specialized centers to understand exactly what exists and where and how best to manage these natural resources.
2. Development and Management of a Palestinian Protected Areas System.
3. Development of Management Plans/Structures in Designated Protected Areas Based on Biodiversity Surveys and Inventories.
4. Protecting and Using Traditional Indigenous Knowledge and Property Rights for Biological Diversity.
5. Implementation of Biosafety Measures on Biotechnology in SP.
6. Habitat Restoration (including rangelands, forests, wetlands, sacred groves and integrated agro-ecosystems).
7. Collaborative Management of Biodiversity.
8. Combating Desertification and Coping with the Adverse Effects of Climate Change.
9. Elaborating and Enforcing National Legislation/Legal Frameworks on Biodiversity.
10. Establishing a Biodiversity Information and Social Education Centre (Available as the Palestine Museum of Natural History).
11. Promotion of Eco-tourism/Economical Aspects of Biodiversity.\
12. Coastal Zone Management in the Gaza Strip and the Dead Sea.
13. Establishment of a Gene Bank in SP.

Laws and regulations

Local Laws

Jordanian laws on the environment were applied in the West Bank while the Egyptian laws applied in Gaza after the 1949 truce and until 1967. The occupation of these areas in 1967 by the state of Israel is subject to the rules set in the 4th Geneva Convention but Israel refused to follow these and acted as if much of the area (the 22% of Palestine occupied in

1967) is either Israeli (the illegal annexation of Jerusalem and areas around it) or is “disputed”. The occupying power thus proceeded to settle the occupied areas with colonial settlers in contravention to international laws and many UN General Assembly and UN Security Council resolutions. Israel also took control of local natural resources including all the key areas for biodiversity. The Second Israeli Military Order designated immediately after the occupation in 1967 that all water resources in the newly occupied Palestinian Territories were to be “state owned by Israel” (UNEP, 2003). In 1993-1994, Israel signed agreements with the PLO for limited self-governance by the Palestinians in areas (designated area A). Most of the West Bank was left as designation C or annexed to Israel where Israel retains civil and military control). The new Palestinian authority did attempt to legislate on issues relating to natural resources but these are meaningless considering Israel still retains sovereignty.

Oslo I (1993) and Oslo II (1995) agreements between the PLO and Israel were supposed to be interim five-year arrangements pending conclusions of negotiations on final status issues which include statehood, borders, security, refugees, and Jerusalem. As part of these agreements, the two parties agreed to protect the environment in compliance with International standards, conducts EIA, protect soil, and other natural resources etc. (UNEP, 2003a). As early as January 1995, ARIJ and the Environmental Law Institute (Washington DC) drafted an environmental law for consideration by the nascent PNA (Amra, 1998). In 1995, the environmental planning directorate (EPD) was established within the Ministry of Planning and International Cooperation (MOPIC). In December 1996, the Palestinian Environment Authority was created and it was elevated to the Ministry of Environmental Affairs (MOEA) in 1998. A presidential decree in June 2002 created the Environmental Quality Authority (EQA) as a successor to the MOEA. The EQA mandate derives from the above mentioned law in addition to the national environment strategy (Amra, 1998).

In 1995-1996, the Ministry of Planning and International Cooperation developed an Emergency Natural Resources Protection Plan to counter environmental concerns that will result development of the newly established State. According to this plan, Gaza and the West Bank were divided into three regions according to their environmental sensitivity (high, medium and low). These regions were divided based on field studies for their importance in terms of biodiversity, protected areas, water resources, agricultural land and landscape preservation (Amra, 1998). The aim of this plan was to direct all forms of development away from environmentally sensitive to the least sensitive areas.

Besides the laws listed below (especially the Palestinian Environmental Law), there are other laws relating to environmental issues that have indirect impacts on biodiversity; such as the Palestinian Local Government Law No. 1 of 1997, the Industrial Estates and Free Industrial Zones Law No. 10 of 1998, Natural Resources Law No. 1 of 1999, the Palestinian Water Law No. 3 of 2002, and the Protection of Animal Wealth Law No. 8 of 1998.

The Palestinian Environmental Law (http://environment.pna.ps/ar/files/Law_No_7_For_The_Year_1999_Concerning_The_Environment.pdf) was approved by the PLC on 6th of June 1999 and signed by the Palestinian President on the 28th of December 1999. It consists of 82 articles. It states that the Palestinian national authority (PNA) has the right and responsibility to study and asses

any project for environmental impact and to protect the environment. The following are few examples of the PEL:

Article (2) the objectives of this Law:

- Protection of the environment against all forms and types of pollution;
- Protection of Public health and welfare;
- Insertion of the bases of environmental protection in social and economic development plans; and encouragement of sustainable development of vital resources in a manner that preserves the rights of future generations;
- Protection of biodiversity and environmentally sensitive areas, as well as improvement of environmentally harmed areas;
- Encouragement of collection and publication of environment-related information to raise public awareness of environmental problems.

Article (5) This law shall guarantee protection of the country's natural fortunes and economic resources, the preservation of its historical and cultural heritage without any harms or side effects that are likely to occur sooner or later as a result of the variant industrial, agricultural or constructional activities, with an impact on the quality of life and basic ecosystems such as air, water, soil; marine resources, animals and plants.

Article (6) The specialized agencies, in coordination with The Ministry, shall devise the public policy for land uses taking into account the best use thereof and the protection of natural resources and areas with special natural characteristics as well as the conservation of the environment.

Article (32) It shall be forbidden for anyone to perform any action which may cause pollution of sea water in a manner that contradicts with the standards, directives or conditions prescribed for the purposes of marine environment protection against pollution.

Article (40) The Ministry, in coordination with specialized agencies, shall prescribe bases and standards for the protection of natural reserves and national parks, additionally tell about and supervise them, and establish, designate the national parks and supervise them.

Article (41) It is prohibited to hunt, shoot, or catch the birds, marine and wild animals, and the fish specified in the regulations of this law. Moreover, it is prohibited to possess, transport, walk with, sell or offer them neither dead nor alive, as well as it is forbidden to damage the nests or the eggs of these birds.

Article (42) The Ministry, in coordination with the specialized agencies, shall specify the conditions are necessary to guarantee the preservation of bio-diversity in Palestine.

Article (44) It shall be forbidden for any person to conduct activities or perform any action that may cause damage to the natural reserves, forests, public parks or archaeological sites, or affect the esthetical aspects of such areas.

Article (72) Any person violates the provisions of Article (44) of this law shall be penalized by paying a fine of not less than 20 and not more than 200 Jordanian Dinars, or the equivalent thereof in the legally circulated currency, and the imprisonment for a period not less than three days and not more than one month, or one of the two penalties.

The EQA was given the task to “...prescribe bases and standards for the protection of natural reserves and national parks, monitor and declare them, and establish and designate the national parks and supervise them.” Violations of the law theoretically would include penalties of fines and even imprisonment. But violations are common and we could not even find good examples of any successes in courts dealing with environmental law violations. Another example is designating protected areas. In June 2000, the Palestinian Authority designated Wadi Gaza as a protected area containing 1.25 km² of a coastal wetland but since then little has changed and the deterioration in the condition of this area continued (Auda et al., 2009; Rabou et al. 2015). A firm implementation of the designated bases and standards for protection implicates the need for reforming of the existing Environmental Law and that will possible only after revitalization of the Palestinian Legislative Council.

Agriculture Law No.2 for the Year 2003 is the legal reference for some aspects of agricultural capital, natural resources, protected areas and sustainable use. Article (1) of section (1) defines a protected area as: “*A geographically delineated area that is organized and managed for the purpose of its protection and to conserve its biodiversity*”. Article (9) of section (1) of this Law states that: “*The Ministry in cooperation with other competent authorities shall develop nature reserves management plan and conserve all plants and living organisms living in protected areas*”. These “other authorities” to cooperate with MOA theoretically include the EQA. However, there is no memorandum of understanding between MOA and EQA to identify the role of EQA in management or any role in protected areas. There is actually a recent move to get the first well-studied protected areas out of MOA and EQA authority to move to the municipality of Hebron responsibility (Wadi Al-Quff.).

The **Natural resources law No.1 for the Year 1999** demands the establishment of the General Administration of Natural resources (Chapter 2) and addresses its functions that entail exploration and use of natural resources (Metallic and non-metallic natural minerals) and necessary legitimate licenses. Article 3 defines the duties of the General Administration of Natural resources that coordinate with other concerned authorities, the duties shall be the following:

1. Preparing scientific studies and research pertaining to natural resources and shall issue
2. directions for geological search and excavation for surface and ground resources.
3. Preparing geological maps and issuance of academic studies findings.
4. Geological exploration and search for natural resources.
5. Listing quantity and quality of natural resources.
6. Supervising natural resources investment, according to systems and laws in force.

However, the law failed to deliver the criteria and foundation of article 19 that states the allowance to prohibit any use of minerals or natural resources of importance for public policy or national economy. The law also does not state the correlation between exploitation of natural resources and the equitable and effective use, which may disregard the environmental balance, as well as correlation to the environmental impact on climate change.

International Conventions Related to Natural Reserves

The NBSAPP of 1999 coincided with publication of the environmental law for Palestine. Yet even as early as 2005, the EQA started to address the gaps in the law and especially areas to comply with newly signed international conventions (most signed from 2005 onward). That is why a decision was made in 2020 to review all international treaties (signed ones for obligations and unsigned ones for benefit and responsibility if they are signed) and also review local laws and regulations to ensure concordance and smooth aspects of implementation relating to environment in general including biodiversity. This includes harmonization of local laws with signed agreements as well as considering signing additional conventions.

International agreements to which the State of Palestine is a party

[Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer](#): Parties to the agreement (adopted in 1985) are to take appropriate measures in order to protect human health and the environment from the harmful effects that result or are likely to result from human activities that alter the ozone Layer. The agreement and the complementary protocols aim to reduce the emission of greenhouse gases to a level that does not negatively affect the ability of natural ecosystems to adapt and maintain these gases (sinks and reservoirs) and increase green cover to absorb the emission of greenhouse gases and developing environmentally friendly technologies to reduce greenhouse gas emissions. The agreement also aims to raise the ability of countries to adapt to climate change.

[Convention on Biological Diversity \(CBD\) and Subsequent Protocols \(Cartagena\)](#): The CBD reflects the global community's growing commitment to sustainable development. It constituted a qualitative step in the conservation of biological diversity, the sustainable use of its components and components, and the fair and equitable sharing of the benefits resulting from the exploitation of genetic resources. It is an international agreement sponsored by the United Nations, and it is the international legal instrument that aims to conserve and preserve biological diversity and ensure the sustainable use of its components and the fair and equitable sharing of benefits arising from the use of genetic resources in it. The agreement has set some measures that the signatory parties must take, such as: conserving biological diversity, cooperating with other countries, developing and preparing national strategies for conserving biodiversity and its sustainable use, engaging in scientific research and training, promoting education and raising awareness, in addition to developing and adopting incentives to preserve and sustain biodiversity and develop the necessary legislation. The agreement reflects its commitment to achieving a balance

between the need to preserve biological diversity and the reasons for development as part of the national and international interest in sustainable development.

United Nations Convention to Combat Desertification: This agreement aims to unite global efforts to combat and reduce desertification, as well as to stop land degradation and mitigate the effects of drought in arid lands, and to address the multiple causes and effects of desertification and land degradation, to support the fight against poverty and reach sustainable development. The agreement requires signatory countries to encourage good governance practices and take measures towards strengthening decentralization, developing land and the tenure system, and enhancing the role of women, farmers and herders. In addition, the agreement requires developed countries to assist developing countries in implementing plans and strategies to combat desertification. The agreement has an implementation mechanism, which is the global mechanism and aims to increase the efficient management of the available financial resources. The ultimate objective of the Convention is to combat desertification and mitigate the effects of drought in arid lands, and it is concerned with the need to address the overlapping, multiple causes and effects of desertification, land degradation and drought in an integrated and sustainable manner.

Agreements to which the State of Palestine is not a party

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): CITES treaty protects all endangered species of animals and plants, and is considered one of the most important treaties aimed at protecting wild species from the threat of extinction, as it works to preserve wildlife and regulate its trade within strict laws. The benefits of this agreement include achieving ecological balance by preserving the survival of the species in nature, regulating international trade between countries and eliminating illegal trade, and achieving effective and integrated global systems for trade in wildlife, with the aim of preserving nature and the sustainable use of resources, as well as seeking international cooperation. In trade and conservation of wildlife, the development and implementation of legislation in this field, resource management and scientific research.

Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Convention on Wetlands): The Ramsar Convention on Wetlands is considered the oldest global agreement in the field of environment, and it serves as a framework for international and national cooperation for the conservation and rational use of wetlands and their resources. It was developed on February 2, 1971 in the Iranian city of Ramsar, and entered into force on December 21. Since 1975, it is considered the only international agreement in the field of environment that deals with a special ecosystem, and it was amended by the 1982 Protocol and the 1987 amendments. 171 countries have joined it. The State of Palestine is not a party to this agreement. Wetlands are among the most diverse and productive ecosystems, providing essential services and a source of freshwater. However, we are witnessing the continuous degradation and loss of these lands and their conversion to other uses. The Convention adopted a broad definition of wetlands that includes all lakes and rivers, groundwater, ponds and swamps, wet grasslands, peat lands and oases, estuaries, deltas and tidal flats, mangrove forests and other coastal areas, coral reefs and all artificial sites such as fish ponds and rice fields, reservoirs and salt marshes.

This agreement aims to encourage the conservation and sustainable use of wetlands through measures taken at the national or national level and through international cooperation in order to reach sustainable development in all parts of the world.

Convention on the Conservation of Migratory Species of Wild Animals (The Bonn Agreement): Signed in 1979 in Bonn and entered into force 1983, this treaty provides a global basis for the conservation and sustainable use of migratory animals and their habitats. The list of migratory species threatened with extinction is found in Annex I of the Convention. The parties to the convention strive to strictly protect these animals, conserve or restore the places in which they live, mitigate obstacles to migration and control other factors that may put them at risk. The migratory species that most need or will benefit from international cooperation are listed in Annex II of the Convention. For this reason, the Convention encourages the countries concerned to conclude global or regional agreements. The agreement considers the condition of maintaining a migratory species positive, while the information indicates that the individual or migratory group has multiplied in the area and that it is still and will remain in the long term as an element capable of life and growth in the ecosystems to which it belongs, and if the extent of the spread of this species is not currently decreasing and not decreasing. In the long term, and if there is a sufficient habitat for a group of this migratory species to survive in the long term, in addition to that the ecosystems to which it migrated are appropriate with their needs and in line with the principles of wise management of biodiversity in the region

The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention): The agreement includes the obligations required to protect and use transboundary watercourses and international lakes by enhancing cooperation by the parties. This is to reduce and prevent significant damage to the environment due to human activities by the parties neighboring these waters, including the environment and the effects on human health and safety, flora, fauna, and soil, air, water, climate, landscapes, historical monuments or other physical structures or the interaction between them. It also includes the effects on cultural heritage or socio-economic conditions resulting from modifications in those factors. For Palestine, according to the definition, the transboundary waterways include the Jordan River Basin and the Dead Sea, in addition to groundwater in the ground.

Nagoya Protocol 2010: The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity addresses Aichi Biodiversity Target 16 of the Nagoya Protocol and states that by 2015, the Nagoya Protocol will be in force and operational, in line with national legislation . The Nagoya Protocol entered into force in October 2014 not only to achieve the first part of Aichi Biodiversity Target 16, but also as a major development in international biodiversity law and the fair and equitable sharing of benefits arising from the use of genetic resources, including through access appropriately over genetic resources and appropriate transfer of related technologies, taking into account all rights over these resources and technologies, and through appropriate financing, thus contributing to the conservation of biological diversity and the sustainable use of its components. Since the

Protocol came into force, this goal has been taken into account in the 2030 Agenda for Sustainable Development and the Sustainable Development Goals mentioned therein.

Agreement on the Conservation of African-Eurasian Migratory Waterbirds: The African-Eurasian Migratory Waterbird Agreement (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterfowl and their habitats throughout Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the Convention on Migratory Species (CMS) and managed by the United Nations Environment Program (UNEP), AEWA brings together countries and the broader international conservation community in an effort to create coordinated conservation and management of migratory waterfowl throughout the migratory range. The Convention covers 254 species of birds that are ecologically dependent on wetlands or at least part of them for a short period during their annual migration. All species covered by the Convention cross international borders during their migrations and require good breeding habitat as well as a network of suitable sites to support their annual flights. Across their entire migratory range as provided by the Convention, essential for the conservation and management of migratory waterfowl populations and the habitats they depend on.

Stakeholders

Academia

The Palestine Institute of Biodiversity and Sustainability (PIBS) and its Palestine Museum of Natural History (PMNH) at Bethlehem University work to research, educate about, and conserve our natural world, culture and heritage and use knowledge to promote responsible human interactions with our environment. It was established in 2014 as an auxiliary body of Bethlehem University. The goals of PMNH/PIBS include:

1. Research and knowledge dissemination on the fauna, flora, and human ethnography of Palestine.
2. Promote environmental protection and responsible interaction between people and the environment, -Use research results in areas such as biodiversity, history, culture, permaculture and biological control to promote sustainable communities, focusing on marginalized communities
3. Develop new educational programs and leverage all new technology in achieving sustainable human and natural communities

Since its founding PMNH/PIBS accomplished:

1. Publishing dozens of research papers on topics ranging from environmental health to biodiversity to museology, to reptiles, to butterflies, scorpions and more
2. Initiating a botanical garden with an integrated water and land ecosystem, community garden and playground for children.

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3. Developing permaculture including bee keeping and aquaponics systems (production, research, and knowledge transfer),
 4. Developing a biodiversity exhibit and ethnography exhibit
 5. Developing an educational program benefitting thousands including hosting summer camps, festivals, workshops and more
 6. Receiving hundreds of local and international visitors who gained knowledge of local challenges and opportunities,
 7. Building partnerships with local and global governmental and non-governmental entities resulting in benefit to environment and sustainability (e.g. consulting services to EQA, MOA, MOH and others),
 8. Developing databases and other resources including collections, photo library, digital library, local biodiversity database, and a seed bank. These will eventually be made public pending development to a level of utility and in a time frame consistent with our resources.

PMNH/PIBS now has an integrated system for research, education, and conservation to address areas in need in Palestine. The museum grounds and its botanical garden is also an oasis for wildlife in Bethlehem and an oasis for young people seeking alternatives and a new way of looking at themselves and their environment (empowerment and nature conservation). For a brief video of activities of PMNH/PIBS, see <https://youtu.be/BPhFLOsEIM0>, for the accomplishments for fiscal year 2019, see <https://www.palestinenature.org/about-us/final-annual-report.pdf> and an example for project <https://youtu.be/MjdvsK6pkec>.

Government Organizations (this section is from Amr and Qumsiyeh 2016)

EQA is the legal successor of the Ministry of Environmental Affairs, and the MOA are the two main governmental bodies with legal authority designated to for nature protection, nature reserves, protected areas and national parks. Although it is not very clear which authority has the delegation over biodiversity and conservation, since both the Environmental Law for the year 1999 and the Agriculture Law for the year 2003 include article related to nature protection.

The EQA invested in the conservation of nature through their current activities and involvement in international conventions and being as the focal points of several initiatives. The EQA is responsible for the development of legislations, strategies and policies pertaining to environmental issues. In 2010, the EQA developed a three year strategy for 2011-2013 that identified and prioritized objectives for itself and for the Palestinian environment as a whole (EQA, 2010). EQA put 48 specific objectives. Here are just some of those:

- Issuing legal and other directives
- Issuing information bulletins and statistical and other data information

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- Building human capacity at EQA
 - Documenting Israeli violations of the Palestinian Environment
 - Founding of an environmental information center which issues regular reports
 - Review and modernize the Palestinian Environmental Laws
 - Review and evaluate institutional structures related to the environment

The structure of the EQA consists of the EQA President, a Vice President and six main administrative departments, each with a set of directorates. The General Directorate of Environmental Resources is the main body responsible for preparation of studies on biodiversity (Fauna and Flora), and cooperates in protecting designated areas. One important function of EQA is to monitor the NGO's related to environmental issues through the Law of Charitable Organizations and National Authorities for the year 2000.

Through the Agriculture Law for the year 2003, the Ministry is responsible to implement Article 9 of section 1 of this Law that states: "The Ministry in cooperation with other competent authorities shall develop nature reserves management plan and conserve all plants and living organisms living in protected areas". Two other laws are the Forest and Afforestation and the Rangelands Bylaws. A draft law for protected areas was prepared in 2005, however, it is still not approved yet. A national committee for nature protection would be formed under that law with membership from MoA, EQA, MOLG, MOT, MOL, MOW, universities, local NGOs and persons with experience. In addition, this national committee has the authority to mandate the protected area issues to national organizations or authorities. The draft law also states "The Ministry is the authorized authority for protecting targeted areas for the purpose of protection and includes nature reserves, protected areas, national parks and the natural heritage".

The Vice Minister of Natural resources of the MOA are responsible for three administrative units: General Directorate of Irrigation and Agricultural Water, General Directorate of Agricultural Land, and General Directorate of Forests, Rangelands and Wildlife. The latter Directorate is the main body responsible for managing nature reserves and protected areas. This directorate includes four divisions or departments: Forestry, Nature Reserves, Rangelands, and Nurseries.

NGOs

Non-governmental organizations (NGOs) proliferated in Palestine after 1967 because the defeat of Arab regimes in 1967 forced remaining Palestinians both in the areas occupied in 1948 and those occupied in 1967 to develop self-reliance mechanisms to cope with Israeli occupation (Qumsiyeh and Isaac, 2012). Initially there were few NGOs dealing with environment or sustainability issues in Palestine. NGOs globally were of high significance (World Wildlife Fund, International Union of Conservation of Nature, Greenpeace, etc.). The latter NGOs were even significant in contributing to development of International environmental laws and treaties (Tarlock, 1992).

The role of civil society in the Palestinian Territories involved in environment issues was addressed by (Majdalani Azzeh, 2012). Majdalani Azzeh (2012) mapped Civil Society

Organisations involved in environmental issues via a desk top review and then interviews of institutions their registration with the Ministry of Interior (MOI) according to Law as well as via the Palestinian NGOs Portal and verified with the Ministry of Environmental Affairs (MoEnA). We used a similar approach. Majdalani Azzeh (2012) concluded that the environment sector was not given enough attention and lacks structure and a clear shared strategic vision. This was mainly due to the very ambitious national plans and a lack of communication within the NGOs. The NGO Development Center (NDC) has updated the NGO sector strategy. This strategy establishes a framework that encourages NGOs to align their current programs and projects as a way to achieve strategic objectives (NDC, 2013). Five main issues were identified through the SWOT analysis for existing Palestinian NGOs. This table shows strategic objectives identified by NDC (2013) for the Palestinian NGOs:

More effective engagement of NGOs in the process of national liberation and democratization based on an internationally recognized legal framework

Streamlined and effective relationships between the NGO Sector and Palestinian Development Partners

Improved access to quality services that are responsive to the needs of the community provided by government and the NGOs

More effective, accountable and transparent NGOs

Secured and adequate financial resources for NGOs

Management of NGOs in developing and underdeveloped countries poses challenges in terms of structure and governance especially in having reliance on foreign aid (Lewis, 2006). There are tendencies towards corruption both in governmental structures and also in NGOs when foreign money is flowing into a country and managed by local NGOs and this is true in many countries (Hellinger *et al.*, 1988). In Palestine, the issues is compounded because of the structures created post Oslo were supposed to be a temporary transitional 5 year arrangements leading to a two state solution and the interim agreements of normalization continued while a Palestinian state did not materialize and yet foreign donors continue giving money in the same normalization direction (Nakhleh, 2012).

In 2012, the Palestinian Authority's Ministry of the Interior registered 2,245 NGOs in the occupied Palestinian territories. Few are focused on the environmental, agriculture and water resources and conservation issues. An initial list including 104 NGOs in the West Bank, Gaza Strip, and East Jerusalem was declared, however, Oberender and Manz, (2012) found only 56 of them to be active. Another study puts the number of active environmental NGOs at 64 (Majdalani Azzeh, 2012). The difference is likely related to differences in definition of "active" NGOs by different investigators.

In this chapter, active NGOs are updated, with reference to those that are directly involved in biodiversity and conservation issues. Other NGOs such as the Palestinian Hydrology Group, the Palestinian Agricultural Relief Committees, and the Land Research Centre were not discussed.

A desk review of existing resources (internet search, Palestinian Environmental NGO Network (PENGON)), web pages for known NGOs were conducted. A list of registered NGOs at the Environment Quality Authority was obtained. Each listed NGOs was contacted either by phone or e-mails. Interviews with key NGOs was carried out to obtain more data on their current projects and activities.

At present, 12 NGOs are involved in conservation, education, ecotourism, training and research related to biodiversity and environmental issues. Table 5 summarizes activities of these key NGOs in Palestine.

Table 5 Summary table for key NGOs activities related to conservation and environmental issue in Palestine (according to these NGOs).

NGO	capacity building	Public awareness	Education	Ecotourism	Research	Conservation
Applied Research Institute-Jerusalem	●	●	●		●	●
Arab Youth Climate Change Movement		●	●			
Biodiversity & Environmental Research Center		●	●		●	●
Center for Environment	●	●		●		
Environmental Education Center		●	●	●	●	●
Environmental Field Research Center	●	●	●	●	●	●
Green Life		●		●		●

MA'AN Development Center	●	●	●			
Palestine Association for Education & Environmental Protection	●	●				
Palestine Museum of Natural History	●	●	●	●	●	●
Palestine Wildlife Society		●	●	●		●

Missions of these NGOs vary from public awareness and education to multiple tasks that cover most of subject matters related to biodiversity and conservation. All the 11 NGOs have interest in public awareness and are a part of their mission and objectives. On the other hand, training and capacity building was the least category of interest among the local NGOs. Some of the listed NGOs stated in their mission and objectives several tasks of which their performance and annual reports did not reflect these objectives. Below are some NGOs which could develop more in the area of management of protected areas.

The Applied Research Institute- Jerusalem (ARIJ): ARIJ was founded in 1990, dedicated to promoting sustainable development in the occupied Palestinian territory and the self-reliance of the Palestinian people. ARIJ is a large NGO well-staffed with professionals covering a wide range of specializations and has memberships in IUCN, GEF NGOs network, PENGON, the Arab Group for the Protection of Nature (APN), World Wide Views on biodiversity and Climate Change Alliance, Mediterranean Wetlands Initiative, Global Soil Biodiversity Initiative and others. ARIJ has been working since its establishment on the conservation of nature; it was the first Palestinian NGO that describes the components and status of the Palestinian environment and continued to research this aspect and produce publications and upgrade relevant databases since 1997. ARIJ is consulted by the PNA ministries such as EQA and MOA and by international organizations such as UNEP and UNDP. The policy consults include developing relevant and sectorial strategies, action plans and national reports in the field of environment and natural resource management

The Palestine Wildlife Society (PWS) was established in 1999 with the mission of “conservation and enhancement of the Palestinian biodiversity and wildlife”. The PWS together with Al Rozana Society for Cultural Architecture Society, Siraj Center for Holy Land Studies and Bethlehem University participated in the development of the Abraham Path (Masar Ibrahim) initiative in the Palestinian regions. This project aims to develop

natural and human resource in these areas. With funding from Hanns Seidel Foundation, PWLS with support from the MOE, MOE and EQA issued an educational matrix in nature protection and environmental education concepts. In this matrix, various aspects on environmental issues, biodiversity, climate, water, and role of local communities in environment protection were highlighted to be integrated in school activities. Specific projects included things like placing boxes for barn owls as potential pest control of rodents in the Jordan Valley. However there needs to be better design and evaluation of such projects to be based on scientific principles.

NATURE PALESTINE SOCIETY (NPS) was established in 2017 with a mission to research, protect, conserve, and educate about nature, biodiversity and environment in Palestine for a vision where Palestinian society where people feel a sense of responsibility for preserving nature and where wildlife, plants, open landscapes, and functioning ecosystems are preserved and protected.

SWOT Analysis and Way Forward

We built a database of stakeholders including NGOs, governmental organizations and academics and had many meetings involving those. The database can be seen at: <https://drive.google.com/file/d/1CIjrbFpJM-KsP8E9rFK2xFzqpFsOZ24M/view>

This database aims to identify the key actors related to this project. Contacts listed in the database belong to people who live near, work with, or depend on the protected areas in any way. Examples include farmers; tour guides; villagers; people who use the protected areas for recreational purposes; NGOs; CSOs; local and national government officials and entities. This database will also be useful in subsequent projects. Data sources for this include the PIBS and PMNH's existing records; contacts within the EQA; chain requests (asking contacts to provide other contacts) and web searches.

The Palestinian NGOs stating they deal with environmental issues are between 56 (Oberender and Manz, 2012) and 64 NGOs (Majdalani Azzeh 2012). Many active ones are in the Bethlehem District. More NGOs need to be established in other areas like Gaza which suffers from isolation and neglect and more NGOs should become inclusive of women and youth. All NGOs relating to the environment (and most other issues) suffer from lack of gender balance (not one had a women executive director). Organizations with more proactive agendas seem to have a better understanding of the relative importance of different environmental stakeholders compared to reactive, defensive, and accommodative groups (Henriques and Sadorsky, 1999). In the case of Palestine, there are some efforts at being proactive but most NGOs are trying to make it in difficult economic situations and their agendas are driven by donor desires rather than cohesively fitting into a national agenda for conservation. The other issue is the lack of cooperation between NGOs working in similar fields. An attempt to rectify this came with the establishment of a network called the Palestinian Environmental NGOs Network (PENGON). PENGON is a partner with Friends of Earth-Palestine. The aim is to “serve Palestinian environmental issues by coordinating endeavors between the member organizations, strengthening and building the efficiency within each organization, and enhancing relations within the Network as well as

with other organizations domestically and abroad, such as local government agencies and international environmental organizations and advocacy groups” (<http://www.pengon.org/>). The member groups as of this year are:

- Al-Ard Society for Environmental Awareness and Protection
- Applied Research Institute--Jerusalem (ARIJ)
- Center for Agricultural Services (TCAS)
- Center for Development in Primary Health Care (CDPHC)- Al Quds University
- Institute of Water Studies, Birzeit University
- Development and Environment Association—Baladna Cultural Center
- Land Research Center (LRC)
- LAW-The Palestinian Society for the Protection of Human Rights and the Environment
- The Local Committee for the Protection of the Environment, Nablus
- MA'AN Development Center
- Palestinian Agricultural Relief Committees (PARC)
- Palestinian Association for Cultural Exchange (PACE)
- Palestinian Hydrology Group (PHG)
- Roads and Environmental Safety Center (RESC)
- The Society for Environmental Protection, Jenin
- Union of Agricultural Work Committees (UAWC)
- Union of Palestinian Medical Relief Committees (UPMRC)
- Water and Environment Department-Ramallah Municipality
- Water and Soil Environmental Research Unit (WSERU), Bethlehem University
- Water and Environmental Studies Center (WESC), An-Najah National University
- Wildlife Palestine Society (WLPS)

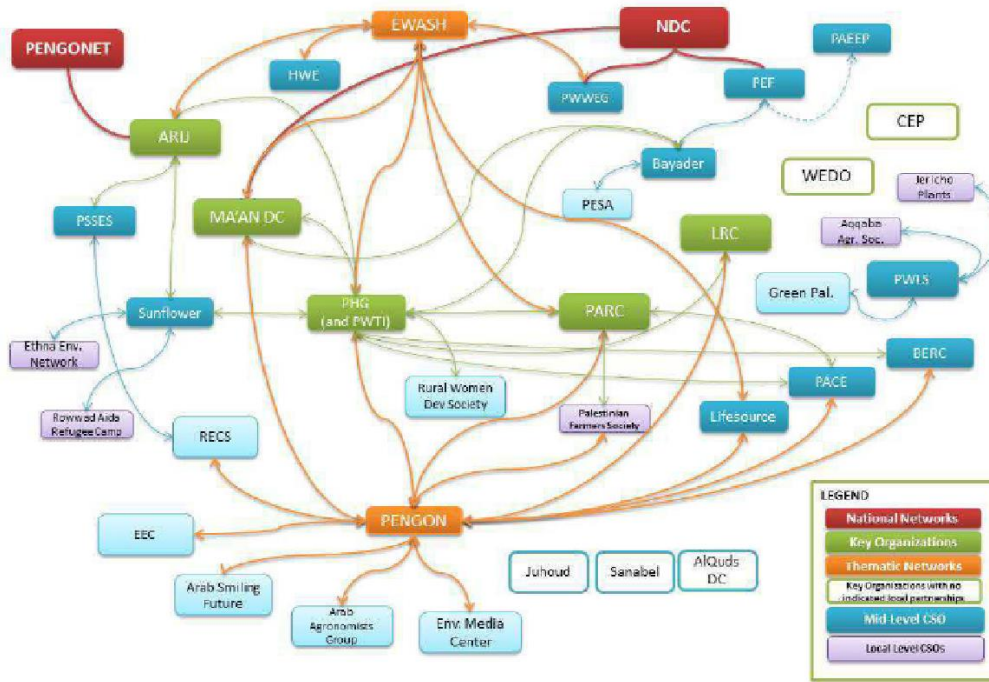


Figure 10 Networking of NGOs dealing with environmental issues (Majdalani Azzeh, 2012).

While there are lines of communications and sometimes coordination between these various NGOs (Figure 10), there is far too much division, many NGOs doing duplicated and inefficient efforts that can benefit from better coordination. This can and perhaps should be done as a matter of priority under guidance by EQA and incentivization by donors (donors sometimes themselves feel rivalry and jealousy of each other and end up duplicating efforts).

Western Aid pumps significant amounts of money in infrastructure and other areas including the environment but many complain this mainly makes life under occupation a little better but without addressing the root problem and thus does not help in long term sustainability (Lagerquist, 2013; Turner, 2012; Associated Press, 2016). Palestine has the highest number of NGOs per capita in the world. Most of the NGO's operating today have not had a change in leadership for >15-20 years. In academia, we see a similar situation where a dean or a president or executive vice president has been around for a long time (sometimes three decades). Is this healthy? Does "experience" trump bringing new ideas? I think this is a debate worth engaging in. We usually have great admiration for leaders who step down and open the door for new leadership. Should a leader of a political party or a country have term limits? Would term limits decrease corruption in government or increase it (because a guy in office wants to get "things" knowing he is not staying)? What is the role of transparency in relation to term-limits for NGOs engaged in environmental work? These kinds of questions require more research. In the interviews with various NGOs done for this consultancy, we noted that leadership of many of them are happy to critique leadership of other NGOs but not to critique themselves on these issues. Perhaps this is understandable but it certainly affects the potentiality of cooperation among NGOs.



Table 6 SWOT analysis (Modified after Qumsiyeh and Amr, 2016, and see also Alhirsh et al., 2016)

<p>Strengths</p>	<ul style="list-style-type: none"> ● More than 10% of the OPT can be actually protected areas ● Rich biodiversity representative of many biomes. We have fragile but promising ecosystems. ● 40 rangers available through Ministry of Agriculture (though they are not always available) ● Presence of legal framework laws and pertaining to nature reserves. ● Presence of national biodiversity strategy and action plan 1999 that is being updated 2021-2022 ● Presence of structured governmental organizations related to conservation and the environment. ● Presence of several active NGOs in environmental issues. ● High educational level and awareness among the local community in environmental issues. ● Integration of environmental concepts in the Ministry of Education curricula.
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	<ul style="list-style-type: none"> ● Presence of research institutions concerned with biodiversity and the environment (e.g. Palestine Institute for Biodiversity and Sustainability). ● Some management's plans for protected areas were done and some also were published ● Ecotourism and cultural tourism that is sensitive to environment are flourishing for local and (before pandemic) global tourists (e.g. phtrail.org) and many pass through PAs ● The establishment of an environmental police and cooperation by enforcement arms of the EQA
Weaknesses	<ul style="list-style-type: none"> ● Environmental Law (1999) is not up to date and does not match with many of the international agreements in terms of obligations on protected areas. ● Weak enforcement of existing laws. ● The Agriculture Law is not comprehensive for nature reserves and their management. ● Weak coordination between the different authorities in the government and non-government sectors. ● Limited research: we need more data on biodiversity including hotspots and protected areas ● Protected areas mostly under Israeli control ● Increasing human pressures and habitat destruction ● Significant deterioration in some areas may be irreversible ● Lack of proactive agendas ● Weak human resources related to natural resource and PA management ● Economic challenges (poverty and decline of economic sources, declining GDP) ● Social challenges (patriarchy, cultural harmful norms, nepotism, corruption). ● When plans and knowledge is available, there is little implementation (science to policy interface is weak) ● Weak involvement of local communities in formulation of policies ● Poor funding allocation and lack of coordination in funding to areas that make a difference in protected area conservation

<p>Opportunities</p>	<ul style="list-style-type: none"> ● Presence of global and international attention and support to environmental issues with promising financial support. ● The possibility of cooperation and coordination with governmental, NGOs and academic research institutions. ● Presence of environmental conventions that guarantee protections even for peoples under occupation ● Potentiality of developing ecotourism and natural park conservation awareness simultaneously ● Available knowledge bases could be mobilized (especially in academia) ● Potentiality of small actions with limited budgets making huge impact on conservation but also potentially linked to poverty reduction (Adams et al., 2004). An example of this also is the good result in the area of Jinsafut (buffer zone to Wadi Qana PA) noted above. ● Development of nature conservation laws ● Developing PAs network ● Potential of capacity building from local academic institutions like the potential MSc program in biodiversity at Bethlehem University and from nearby countries in management of PAs ● Potential of increased database use including those generated by citizens (e.g. iNaturalist.org observation.org) ● Potential leveraging of ministry of agriculture resources for restoration using native trees. (e.g. we did restoration of 3-dunum area in Al-Makhrour https://bit.ly/3zBOZKG) ● Potentiality of large scale fundraising for comprehensive surveys of biodiversity in Palestine
<p>Threats</p>	<ul style="list-style-type: none"> ● Violations and destructions perpetrated by the Israeli occupation against the Palestinian environment. ● Continued occupation/colonization and lack of sovereignty which allows us to act on urgent conservation issues including the lack of control over many of the environmental and natural resources due to administrative divisions of the occupied territories. ● Exacerbation of global environmental problems such as climate change, desertification, fires, and pollution etc. ● Increased social and economic problems

	<ul style="list-style-type: none"> • Increasing urbanization and encroachment by citizens on areas (whether they own land or not) in protected or biodiversity rich area
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Way forward

1) Signing new treaties and adjusting local laws

Prof. Qumsiyeh is working on another project of the EQA that is related to updating local laws and regulations and ensuring compliance with signed international treaties as well as potentially signing additional treaties. Data from the result of this (expected November) will also be included in the NBSAP (a project led by our institute in collaboration with the EQA). One output that is already available was that we came up with prioritization for treaties we think Palestine should sign and those are related to protected areas (see Table 7).

Table 7. Arranging priorities for accession to the agreements to which the State of Palestine has not joined. Significance to sign: 10 Very important to 1 Not important

Agreement Name	Significance to sign	Notes
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	9	It is possible to join the treaty after amending the Palestinian law to be a deterrent to the protection of living organisms
Convention on Wetlands (RAMSAR) 1971	9	You need to start preparing for what it takes to sign the agreement
CMS (Convention on Migratory Species) - Bonn	8	Preparations are being made to sign it after completing the work on the national biodiversity strategy
Agreement on the Conservation of African-Eurasian Migratory Waterbirds	8	It must be signed after signing the Ramsar Convention and implementing the obligations towards the Ramsar Convention
Nagoya Protocol on Access and benefit sharing 2010, Japan	7	You need to start preparing for what it takes to sign the agreement
The Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention)	7	In the event that there is a complete administration of the Palestinian coast by the State of Palestine, the agreement can be signed

Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, Aarhus, 1998	6	The principles, strategies and directives contained in the agreement may be implemented without actual accession to it
International Treaty on Plant Genetic Resources for Food and Agriculture	6	After two years to prepare
Kyoto Protocol - greenhouse gas emission reductions	5	
Protocol Concerning Cooperation in Combating Pollution of the Mediterranean Sea by Oil and Other Harmful Substances in Cases of Emergency	5	Needs a discussion session with the Environmental Quality Authority to discuss its merits and take a final decision to sign it or not
Espoo Convention Convention on Environmental Impact Assessment in a Transboundary Context, Espoo, 1991	5	
Convention on Fishing and Conservation of Living Resources of the High Seas	4	
Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter	4	
Geneva Protocol (Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare)	3	
Convention on the Protection and Use of Transboundary Watercourses and International Lakes (ECE Water Convention), Helsinki, 1992	3	
Convention on the Transboundary Effects of Industrial Accidents, Helsinki, 1992	3	
FAO International Code of Conduct on the Distribution and Use of Pesticides, Rome, 1985	3	
Migratory Bird Treaty Act of 1918	1	
International Convention for the Prevention of Pollution from Ships	1	

While the state of Palestine needs to develop better plans for managing the resources, a big impediment to implementation of the many existing plans (e.g. for water resources) stems from the fact that the State essentially has no control over most of its natural resources (due to the Israeli occupation). The report by the UNEP (2003) made over 100 recommendations to address the environment in Palestine and seven of them deal with natural resources (1, 2, 3, 4, 21, 23, 31, 40) but none could be implemented without having sovereignty over our

land and resources. Further, the Israeli occupation is one of causes of habitat destruction leading to a decline in the biodiversity of Palestine. There are many ways how Israeli occupation affects the Palestinian nature and natural resources (ARIJ, 2007, 2015).

The EQA recommended in 2016 the designation of a national flower which is the Faquoa (*Iris hayenae*) and a national bird which is the Palestine Sunbird (*Cinnyris osea*). The ministerial committee/cabinet adopted a resolution regarding this matter. This increased awareness not only of those two species but also of the importance of protecting biodiversity in general.

A comprehensive review and assessment of current environmental and agricultural laws are urgently needed to update and to resolve conservation issues. Revise and update Palestinian Environmental Law (1999) to create a stronger law in line with Palestine's obligations under international treaties signed and others potentially to sign. For example the current lacks more detailed guidance on how the EQA should fulfill its obligations as stated mainly in Article (40) regarding the management of protected areas

2) Controlling fires

Over 200 forest fires are raging in Palestine (now renamed the Jewish State of Israel including its occupied Palestinian territories). Many countries are helping put out the fires including four teams of Palestinian firefighters (no body helped Gaza when it was being fire-bombed by white phosphorous). But the fascist racist government of "Israel" blamed the Palestinians for the fires! Even some decent Israelis pointed out that fires are raging across Western Asia (aka the "Middle East"). Here is a map put out by one Israeli website of location of fires across the region including in Lebanon, Syria, and Turkey: <http://bit.ly/2gGbqJU>

Perhaps coincidentally or otherwise, right after war criminal Netanyahu blamed Palestinians, new fires erupted near Palestinian communities. If you really want to know who is to blame for the damage, it is clearly Zionism as I wrote in many articles and books before. In 1901 at the World Zionist Congress and despite objections of conscientious Jews, a Jewish National Fund (Keren Keyemet Li'Israel, or KKL) was establish to further "Jewish colonization" (the term they used) of Palestine. One of the tasks was to raise money and they used the gimmick of collecting money for trees. Indeed they did plant trees but it was unfortunately the highly flammable European pine tree. After 1948-1949 when some 500 Palestinian villages and towns were depopulated, their lands (cultivated with figs, almonds, olives and other trees) were razed to the ground and again resinous and inflammable pine trees were planted. The same happened after 1967 when here Palestinian villages were demolished and their village lands planted with the same European pines, one of those villages s the biblical Imwas (see photos before and after here: <https://freepaly.wordpress.com/tag/environmental-racism/>).

The choice of European pine trees was because a) they grow fast, b) they give a European look to the otherwise "Arab" landscape, c) their leaves on the ground make acidic preventing growth or regrowth of endogenous trees. In total KKL boasts that it planted 240 million pine trees. Resinous pine is like petrol and burns with a ferocity. This was not the

only environmentally catastrophic decision by the Zionist movement in Palestine (others include draining the Hula Wetlands and the diversion of the water of the river Jordan and now the Red Sea-Dead Sea Canal). Environmentally, the current fires are deadly to all living creatures regardless of their origins and they do spread to the remaining few indigenous forests and to human dwellings (Jewish, Christian, Muslim, Atheist without distinction).

We environmentalists (Palestinian and Israeli) have longed warned of the catastrophic consequences of politically driven decisions guided by colonial ideology but devastating to native animals and plants. So here we are the remaining native Palestinians watching our lands go up in flames and being blamed for it. This is not unusual and we are the victims of others from long ago. We even paid the price of what happened in WWII (by Europeans to fellow Europeans). I am thinking now if a meteor hits earth, we Palestinians will also pay a disproportionate price. 7 million of us are refugees or displaced people.

<http://www.jnf.org/about-jnf/>

<http://israelpalestine.liveuamap.com/en/2016/25-november-wildfires-in-northern-israel-november-24-2016>

3) More research and better planning

Palestine needs scientific data covering all areas of protected areas and potential protected areas by using the best available data collection methods on areas like geography, geology, hydrology, fauna, and flora. Such data can also help identify biodiversity hotspots for conservation priorities (Myers et al. 2000).

Due to limited resources, it is critical to identify hotspots and key species to direct resources for conservation (Myers *et al.*, 2000) and to use buffer zones around parks with local buy-in

Perform more detailed studies on human impact on the environment caused by Palestinians or Israeli settlers (see Tal 2002; Ginsberg 2006; Abdullah and Swaileh 2011; Al-Haq 2015; Qumsiyeh 2017).

There needs to be more vigorous and effective action by the EQA based on its mandate for example with regard to regulation of NGOs and regulation of industries based on solid EIAs and solid scientific data

There needs to be better coordination and consultation with academia especially to better utilize existing data and encourage collective acquisition of new

4) Reforms at different societal levels

Reform and strengthen governmental agencies especially in regard to enforcement of laws. Allocate resources for implementing laws and policies (no law or policy should be issued

or revised without clear mechanisms of implementation) (see Esty and Porter, 2005). This also includes more informed spatial planning and clarification of responsibilities.

5) More mainstreaming of biodiversity especially in communities around PAs

As a second step we need to develop management plans that use ecosystem approaches and take areas like social, cultural and economics into consideration (Slocombe 1993; Adams et al., 2004;).

The most critical is to solve the conflict between the MOA and the EQA and designate an authority responsible for managing protected areas effectively. There is talk of turning the first protected area properly studied, Wadi Al-Quf to the municipality of Hebron for management. This is devastating to environmental issues. Local municipalities are subject to various pressures which cannot result in sustainable conservation efforts

6) Enhanced environmental awareness and education programs

Programs in EE in and around the protected areas need to be developed with a cohesive strategy that also helps creativity, innovation, and sustainability strategies. This includes comprehensive public engagement with the parks service resources to ensure communities benefit from protection of their natural resources.

7) Capacity Building

We need a system of building capacities for developing leaders who are able to take on tasks on protected area management and strategies at a local regional and global scale. Towards that, we also decided to develop a master program in Biodiversity and Sustainability at Bethlehem University.

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