

Chapter 1

Biodiversity and Environmental Conservation in Palestine



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1.1 Introduction

In the late twentieth century, the conservation of biological diversity became a main goal of global actions for a sustainable planet. This followed significant decline in biodiversity accompanying the industrialization that spread widely in the nineteenth and twentieth centuries resulting in climate change and habitat destruction (Nurlu et al. 2008). Two key organizing documents emerged to set the stage for global actions: the Global Biodiversity Strategy and the Convention on Biological Diversity (CBD) (both in 1992).

Palestine connects Africa with Eurasia, and it is where the first humans migrated out of Africa and also where the first human agriculture developed. The geologic history especially the formation of the Great Rift Valley formed varied topography and evolutionary changes with a rich fauna and flora. There are diverse habitats covering five ecological zones (Central Highlands, Semi-coastal Region, Eastern Slopes, Jordan Rift Valley, and Coastal Regions) and five phytogeographical areas (Coastal, Mediterranean, Irano-Turanian, Saharo-Arabian, and Sudanese/Ethiopian) (Qumsiyeh 1985; Soto-Berelov et al. 2015). Mild weather, rich soils, rich wildlife, and presence of wild edible fauna and flora 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 transition to agriculture from hunter-gatherer communities also allowed increase in population and more time for people to develop civilizations.

Our region has undergone significant human-induced environmental changes including those caused by migrations, industrialization, climate change, and colonization, among others. This had a huge impact on biodiversity, but few studies have

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addressed this. Just this year (2019), we noted numerous ecologically destructive incidents: trees were uprooted and agricultural lands ravaged by the Israeli army in Battir and Nahalin in Bethlehem governorate; wastewater dumped by colonists from “Betar Illit”; seedlings sabotaged by settlers in Burqa, Nablus governorate; continued environmental siege on Gaza that is devastating the environment; and much more.¹ Israel’s tendency to put polluting industries in Palestinian areas has unsurprisingly produced negative health consequences for the people living there as well as for the local ecosystem. For example, significant genotoxicity is caused by Israeli industrial settlements on the Palestinian villagers near Salfit (Hammad and Qumsiyeh 2013), and recycling of e-waste that mostly originates in Israel in Idhna in the Hebron District impacted local health and environment (Khlaif and Qumsiyeh 2017). Also the local people engaged in many practices that impact the environment. Thus, in this chapter, we review data on what is known about threats to biodiversity in Palestine (a small but critical part of the Fertile Crescent) and discuss opportunities for conservation and sustainable living for both people and fauna and flora.

1.2 Status of Key Taxa Related to Conservation

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 (e.g., Harrison and Bates 1991). In the 1950s and 1960s, there were some studies of fauna and flora by the Israelis. 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 1980; Yom-Tov and Tchernov 1988; Zohary 1973; Werner 1988).

Due to the colonization and occupation, research here still lags behind in Palestine (Qumsiyeh and Isaac 2012). Among native Palestinian zoologists, Dr. Sana Atallah (d. 1970) focused on mammals (Atallah 1977, 1978). Key taxa/groups that are useful for measuring environmental threats and thus important for conservation status were studied in Palestine. These include mollusks (Amr et al. 2018; Bdir and Adwan 2011, 2012; Handal et al. 2015, 2016; Heller and Arad 2009), amphibians (Salman et al. 2014), birds (Khalilieh 2016; Awad et al. 2016), and mammals (Atallah 1977, 1978; Qumsiyeh 1985, 1996; Werner 1988; Harrison and Bates 1991; Whitaker et al. 1994; Qumsiyeh et al. 1996; Qumsiyeh et al. 1998; Mendelsohn and Yom-Tov 1999; Benda et al. 2010). For example, earlier studies on the freshwater snails of historical Palestine include those of Tristram (1884) and Germain and de Kerville (1922) and were supplemented by work of Abdel-Azim

¹See, for example, <http://www.lrcj.org/publication-3-1169.html>, <http://www.lrcj.org/publication-3-1170.html>, <http://www.lrcj.org/publication-3-1171.html>.

and Gismann (1956), Heller et al. (2005), and Handal et al. (2015). Those clearly show the utility of these taxa in assessing water quality.

So far, 373 bird species belonging to 23 orders, 69 families, 21 subfamilies, and 172 genera have been recorded from the occupied Palestinian areas (Awad et al. 2016). Birds of prey can be of good utility in assessing environmental changes (because of their position in the food web) (Brett 1988). Amr et al. (2016) showed a decline in biodiversity in the Bethlehem district evidenced by the study of old and newer food pellets of the Eagle owl. Saeed and Qumsiyeh (2020) compared records of birds reported by the first studies done in the nineteenth century with what is found today and showed significant negative trends (related to human effects) such as the disappearance of the brown fishing owl. It is then clear that a study of the threats to biodiversity is critical.

1.3 Environmental Threats in Palestine

Environmental threats are global in nature but are exacerbated in developing countries especially in regions of conflict. In Palestine, even in ancient times, there is evidence of Canaanitic villages stripping their populations of gazelles. In the more modern era, forests in the Eastern Mediterranean region were cut down for household, industrial, and commercial uses. Under British occupation (1917–1948), and Israeli and Jordanian rule (>1948), destruction continued, but also interventions that were supposed to be beneficial like forestation were done mostly with European pine trees (monoculture of *Pinus halepensis*) (Qumsiyeh 1996).

Under Israeli occupation and colonization, Palestinians were prevented not only from doing much of their usual agriculture but also from managing lands. Many forested hills were converted to residential Jewish-only colonial settlements (e.g., Jabal Abu-Ghneim became Har Homa colony near Bethlehem) and generated far more pollution than similar settlements inside Israel.

The modern threats were not unanticipated. For example, Ives (1950) discussed the land's capacity and the fact that trends which started in the 1930s if continued would devastate the area. Not only was he right, but more threats evolved since the 1950s (Qumsiyeh 1996; Tal 2002; Qumsiyeh 2004). Alon Tal acknowledged even before he wrote his book (2002) that: "We came here to redeem a land and we end up contaminating it" (Beyer 1998).

The main threats to doing better conservation efforts can be simply categorized as issues that are peculiarly Palestinian (like occupation/colonization) or global issues. Anecdotal notes and opinions on the Palestinian environment are not reviewed in this work (for an example of the genre of this kind of work, see Alleson and Schoenfeld 2007; Abu Safieh 2012). The ranking of threats to the Palestinian Environment according to the fifth national CBD report is available and seems reasonable though could be adjusted when and if additional data become available (EQA 2015; Table 1.1). Another report used the Delphi approach to ask some "experts" what the main threats are and came up with a somewhat different answer

Table 1.1 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, 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	No data	No data
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)	Very high	Very low

(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 threats are most prominent to the majority of those individuals.

Here we highlight three of the main threats to the Palestinian environment (climate change, water and waste water, and occupation/colonization) taken as key examples that set the stage to discuss interventions. But even here we will have to be limited because of space.

1.3.1 *Climate Change*

Climate change has a significant effect on biodiversity, human health, and sustainability (Harvell et al. 2002; Portnov and Paz 2008; Rinawati et al. 2013; Altay and Ozturk 2018; Imanberdieva et al. 2018; Ozturk 2018; Ozturk and Altay 2018; Ozturk et al. 2020), and this requires us to integrate educational, evolutionary, and ecological responses into models and potential remedies (Settele et al. 2017; Lavergne et al. 2010; Sternberg et al. 2015). The joint statement by world science academies warns that “Developing nations that lack the infrastructure or resources to respond to the impacts of climate change will be particularly affected..”² We in

²<http://nationalacademies.org/onpi/06072005.pdf>.

countries in the southern Mediterranean areas, the MENA region, will be particularly vulnerable (Sala et al. 2000).

Human-induced climate change will drastically effect the Arab world (Verner 2012). A World Bank study shows impacts including 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 1.1), 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 (Ozturk et al. 2004, 2012a; 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).

1.3.2 Water and Liquid Waste

The situation of water is becoming very critical in the MENA region. While it is clear how it impacts human health and well-being, it is also critical for the ecosystem. Open water sources if closed off to use only for humans will impact a diversity of organisms. The government of the state of Israel which controls Palestinian (native) water claims there is water shortage, but the reality is that there is simply unequal distribution. 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 declined 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 Fourth 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.

The Oslo agreements were 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.” Regardless of political outcomes, there is simply a very small geographic territory (historic Palestine) with one hydrological system (Elmusa 1998). 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.

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.

But there is also mismanagement of the shrinking and limited water resources on the Palestinian side. A decaying water infrastructure is not upgraded because state funding has other priorities (like security, education, and healthcare). So there is some loss of water through the existing pipeline structures. In some areas, there is poor protection to freshwater supplies. For example, in the biodiversity important area of Al-Bathan near Nablus, the sewage water course merges with the freshwater spring course just below the picnic and park areas (ARIJ 2015). Further, there is no organized program to alert tourists to conserve water even as the ministry of tourism pushes hard to increase number of pilgrims to the Holy Land. Clearly some things can and should be done regardless of the status of the occupation.

The situation for sewage management in the occupied Palestinian areas is critical. In Gaza, a significant portion of the sewage flows untreated to the Mediterranean Sea. According to UNEP (2003), 70% of solid waste in the occupied Palestinian territories is organic waste. This is a very high number and one that gives us an opportunity for significant reduction via composting to generate fertilizers. Sewage can also be treated, and other solid waste like metals and plastics and glass can be recycled. Waste water is dumped on some significant supposedly protected areas like Wadi Qana, Wadi Nar, and Wadi Far’a (Bathan), around Salfit (EQA 2015), and into the Mediterranean Sea where it is highly damaging to the environment (Akram and Cheslow 2016).

There is a real crisis in logistics and financing for proper solid waste disposal in Palestine (Abu Thaher 2005; Al-Khatib et al. 2007). The majority of solid waste disposed of in Palestinian areas like Nablus is organic which indicates a great potential for resource utilization such as for composting/fertilizer generation (Al-Khatib et al. 2010). But as in many developing countries, management of such solid waste lags behind significantly (Ahmed and Ali 2004).

1.3.3 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). While Israel was created on 78% of Palestine, the remaining 22% was occupied in 1967 (Masalha 1992; Qumsiyeh 2004). 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. 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%) (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). 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 Burqueen village (Hammad and Qumsiyeh 2013).

Israel built “bypass” roads and other infrastructures 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).

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) (Weizman and Sheikh 2015).

Politics trumping facts can be devastating to understanding of issues like environment and water. For example, deliberately misstating facts, hiding them, selectively using (mis)information, and much more were 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 have had devastating impacts on the Palestinian environment and raise significant questions about the possibility of planning let alone sustainability under occupation (Isaac et al. 2004). There may be a 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 Ofra 2007). Ras Imweis and adjacent areas are a good example of this (became the settlement Nahal Shiloh). “Nature Reserves” and closed areas became pretexts for land confiscation. Such exploitation was obvious in the Bethlehem Governorate, when Har Homa settlement was established in 1997 on Abu Ghneim Mountain (Fig. 1.1).

1.4 Biodiversity Conservation Strategies in Palestine

The key vision that drives or should drive environmental conservation in Palestine as elsewhere should be a vision of a sustainable human population in a sustainable diverse natural environment. The latter must protect all elements of the ecosystem including plant-animal interactions. Since the industrial revolution, sustainability of ecosystems around the world has eroded due to human activity that causes habitat loss and environmental degradation. In the last few decades and especially with the growing realization of global human-induced climate change, there has been increased awareness and efforts focused on environmental conservation and at least



Fig. 1.1 The Israeli colony of Har Homa which was built and is still being expanded on a forested Palestinian Hill (called Jabal Abu Ghneim)

trying to halt destruction and mitigate effects with even some efforts going toward reversal of human-induced habitat changes. Most efforts are focused on in situ conservation of natural resources (Adams et al. 2004; AlHirsh et al. 2016).

The Governing Council/Global Ministerial Environment Forum in Cartagena, Colombia, asked the United Nations Environment Program (UNEP) to look at the state of the environment in Palestine. The results of a detailed study (UNEP 2003) led to more work and finally summarized in the Fifth National Report to the Convention on Biological Diversity (EQA 2015).

In 2015, EQA, through funds from the Belgian Cooperation Program, conducted a study of rich biodiversity areas. A total of 50 proposed protected areas were listed in the occupied Palestinian territories (Table 1.2); several of them are already listed as protected or important plant areas. Results of this study excluded some of these sites, since they are located within towns or cities or used as quarry pits. A detailed report is still under revision at the EQA. Boundaries of 29 areas were modified; three were not modified, while 18 were excluded from the proposed list. Two additional sites were suggested: Dura al Qare'a and Um al Safa 2. We also have a new study in the Wadi Makhroul area near Bethlehem that proposes it as a protected area (PIBS unpublished data).

Biodiversity conservation and protected areas in particular are covered by the National Biodiversity Strategy and Action Plan (NBSAP). The Plan focuses on protected areas and participation by the local and encourages capacity building in areas of biodiversity conservation. The Plan also addressed gaps that are very essential to develop concepts in biodiversity and protected areas conservation. These gaps include

Table 1.2 Key biodiversity areas that were listed in the Palestinian territories

Governorate	No.	Area
Bethlehem	7	Al Jaba'h, Jabal Abu Ghunaim, Mar Saba, Suleiman pools, Wadi Herodian, Wadi Makhrur, Wadi Fouqin
Hebron	11	Adderat-Yatta, Al Fawwar, Beit Fajjar, Beit Kahil, Beit Umar, Beit Ummar, Deir Razeh, Ithnah-Souba, Kanar, Tarqoumia, West Karma
Jenin	5	Aqqaba, Kufer El Rai, Qufien, Um Al Rihan, Um Al Tut
Jericho	3	Ain Esultan, Deir Hajalih, Wadi Auja
Jerusalem	8	Abu Deis, Anata, east of Aza'ym, Hizma, Mar Elias, Nabi Musa, north Tuur, beginning of Wadi Ennar
Nablus	6	Aqrabaniya, El Mizrab, Ein Sabastia, Salman Faresi, Talouza, Wadi Faraa
Qalqilya	2	Azzoun, Jayous
Ramallah	6	Al Jalazon, Ain Qinia, Beir Zeit, Jabal El Nijma, Turmus Ayya, Um Safa
Salfit	2	Al Matwi, Wadi Esha'ir

lack of primary scientific data, information, and documentation on biodiversity in Palestine and lack of and/or limited human resources. There are very few biologists especially marine and wildlife biologists and taxonomists, oceanographers, conservation managers, etc. and adequate legal frameworks and environmental policy and legal framework on which to base all activities for the conservation and sustainable use of biodiversity in Palestine, lack of coordination among national and local stakeholder agencies in biodiversity, and inadequate awareness and commitment to biodiversity. The objectives of the NBSAP for Palestine are in line with other countries in environmental conservation and sustainability. Now the EQA is engaged with us to build an updated and new NBSAP and produce the Sixth National CBD Report.

The earlier report from the state of Palestine in compliance with CBD listed many priorities ranging from basic research in biodiversity, threat assessments, better private-public relationships, using cultural heritage, better protected area management, stemming desertification, mitigation and adaptation to climate change, and habitat restoration (EQA 2015). The report lists in its executive summary 14 recommendations. Here they are paraphrased:

- Collaborative Management of Biodiversity
- Updating NBSAP
- Meet Aichi targets
- Mainstream biodiversity
- Better research to fill the gaps in knowledge
- Emphasize ecosystem services
- Work on areas like poaching (see, e.g., Helal and Khalilieh 2005), wildlife trade (e.g., Yom-Tov 2003), genetic diversity, biosafety, genetic modified organisms (GMOs), invasive species, and mitigation and adaptation
- Better investigations and rankings of threats as well as modeling and structuring responses scientifically and with community involvement

The five NBSAP objectives were identified with very limited progress achieved since the Fourth National Report. The only thing mentioned elsewhere in the same report but not clearly mentioned in these five objectives is the value of doing

research; see above also from (EQA 2015). Vulnerable areas are of particular interest for further study because environmental degradation in Palestine has been accelerated with industrialization and large-scale deforestation.

In terms of conservation, there are even fewer scientific research studies published in the last 25 years. However, there were important larger reports that we considered that contributed to our understanding of environmental issues in the OPT, including biodiversity conservation. There were of course hundreds of other documents and research reports consulted during the course of this study (list of references cited at the end of the chapter). Two key factors that enter into success of environmental conservation in any country are economic and social factors. As noted above, the level of GDP is directly correlated with environmental concern (Mills and Waite 2009). The 13 million Palestinians in the world are now dispersed in many countries with 7.5 million being refugees or displaced people. In historic Palestine, over 6.2 million Palestinians still live, but nearly 30% of them are internally displaced or recognized as refugees. The GDP per capita of Palestinians is 1/8th that of Israelis who share with them the space of historic Palestine, but this gets more distorted during the cyclical uprisings against the occupation (Hever 2010). This has impact on environment and R&D (Qumsiyeh and Isaac 2012). For example, according to UNEP (2003), the GDP of the OPT which grew at 6% in 1999 shrunk by 6.5% in 2000 due to Israeli measures in response to the 2000 uprising. Further, there was a decline in GDP growth in the past few years as population grew while the economy did not expand (MOPAD 2014). There was some evidence that poorer communities and countries do worse in protecting their own environments, but this has been challenged, and richer countries may be fueling their own prosperity via exploitation of natural resources in poor countries (Mills and Waite 2009).

There has to be benefit sharing from conservation and biodiversity. Gorchach et al. (2011) summarized potential economic benefits from environmental conservation efforts (if successful) in the OPT. Though this benefit assessment was mostly based on little data collected on the ground, it does highlight the significant potential impact of saving our environment financially. Here are examples:

- Air: If air pollution is cut by 50%, modeling suggests premature mortality could decline by 220 and morbidity by 440 per year. Monetary benefit could be of 68 million euros per year.
- Water: Improved access to water services could significantly improve the quality of life for 1.2 million Palestinians. Improved wastewater treatment (perhaps concomitant with reduction of waste water in general) could have significant impacts on biodiversity, groundwater quality, and human health.
- Waste: Reducing solid waste would have significant impact on air quality, on environmental health, on human economy, and on biodiversity.

The use of plants and animals for humans is a field that needs much examination as it related to environmental conservation directly especially in terms of sustainable use of resources (Nurlu et al. 2008; Gucl et al. 2006, 2012; Khan et al. 2014; Altay et al. 2015; Ozturk et al. 2012b, 2014, 2017a, b). In Palestine as elsewhere, there is an interest in ethnobotany and ethnozoology (Ali-Shtayeh and Jamous 2006; Ali-Shtayeh et al. 2014; Palevits and Yaniv 2000; Said et al. 2002).

Poverty reduction and environmental conservation are directly linked, and we are not able to do proper conservation without tackling poverty in developing countries (Adams et al. 2004; Ozturk and Kebapci 2005; Ozturk et al. 2010; Ozturk 2013). Further it is possible to use socioeconomic incentives at periphery of protected areas or even allow managed use of natural resources as a form of poverty reduction which also incentivizes the local people to protect their environment (Ozturk and Kebapci 2005; Sunderlin et al. 2005; Ozturk et al. 2010).

Modern conservation philosophy argues that the local buy-in is critical for success of conservation efforts. We in Palestine certainly need to think strategically about how people around protected areas are to benefit from protection. There are models in nearby areas, for example, the way the Royal Society for Conservation of Nature worked with local communities to ensure active buy-in via direct benefit from things like ecotourism and environmentally sensitive agriculture.

Religious attitudes can be of potential use to promote environmental awareness and conservation. Religious clerks (Muslim and Christian) can introduce many concepts of conservation and environmental practices in the Friday and Sunday sermons. Several authors dealt with the ethical and divine relation of Islam to environment conservation (Amr and Quatrameez 2002). Islamic teachings are full of orders and events that encourage conservation as the concept of “Al Himma,” to save water, clean environment, and many others. Similarly, in Christianity, basic teachings include many environmentally friendly practices. In Palestine, The Holy Land, with so many religious connections and about a million devout pilgrims per year, it is incumbent upon policy makers and stakeholders to research ways to reach out to those who are religious with the message of environmental conservation.

The Palestinian Environmental Law needs to be updated. Violations of the law should include higher penalties. Obstacles to implementation include the fact that most (81%) of the protected areas are in Area C under Israeli rule. For example, the nascent state of Palestine cannot plan or protect its natural resources including areas like the unique corridor of Ein Fash’kha to Ein Jedi along the Dead Sea if it cannot access them (Garstecki et al. 2010; EQA 2015; <http://www.nsp.pna.ps/en/>). It is also worth noting that 36.2% of the designated protected areas overlap with Israeli settlements and 39.5% overlap with closed military areas and bases. Such utilization of a protected area confirms that their declaration does not respond to the international definition of a protected area, which calls mainly for biodiversity conservation (Ghattas 2008).

Despite all these obstacles, we think some things can still be done. The Palestine Institute for Biodiversity and Sustainability (PIBS), the Palestine Museum of Natural History (PMNH), and the Palestine Conservation Botanical Gardens (PCBG) were started at Bethlehem University with a vision of sustainable human and natural communities and ecosystems. The mission focuses on research, education, and conservation. The motto is RESPECT—for ourselves, for others, and for the environment. Via working with mainly school children, we do education tailored to different ages (Figs. 1.2, 1.3 and 1.4). We also built educational material via intensive research to assess need and local cultural peculiarities. For example, we developed six educational modules in the areas of agriculture, biodiversity, geogra-



Fig. 1.2 Children learning via playing, for example, imagining being a scorpion

Fig. 1.3 Museum staff member (Elias Handal) with students in show and tell





Fig. 1.4 Girls at the museum showing their gifts and decorations made from recycled solid waste



Fig. 1.5 One of many locally sensitive educational modules (in this case a poster on biodiversity) done related to climate change and conservation

phy, energy and transportation, waste and chemicals, and climate change (see the example in Fig. 1.5). PIBS/PMNH annual report is found here: <https://www.pal-estinenature.org/about-us/final-annual-report.pdf>.

For short videos about other activities/accomplishments, please see <https://youtu.be/BPhFLOsEIM0> and <https://youtu.be/AZOoOzXU7tQ>.

1.5 Discussion

Palestine (renamed Israel in 1948) now has over 12 million people. Half the population is Israeli-Jewish, and they control 91.7% of the land, and the other half are native Christians and Muslims who control less than 8.3% of the land. Additionally, close to 6 million Palestinians live outside the country (mostly refugees). Israel is trying a three-pronged program: (a) preventing refugees from returning, (b) incentives and other tools to lure in as many Jewish (or even non-Jewish but not native) immigrants who identify with Zionism, and (c) making life so hard for the remaining Palestinians that they leave (or even outright removing them) (Qumsiyeh 2004). Environmental destruction is related to instability, inequality of resource distribution, and habitat destruction in Palestine (Kelly and Homer-Dixon 1996; Qumsiyeh 2013). Solving this requires addressing these issues.

Alatout (2006) showed that differences in perception of power relationships impact perceptions of issues of environmental justice between Palestinians and Israelis. Basically those in power view environmental issues in terms of improvements in their quality of life, while Palestinians view them as issues of sovereignty, property rights, and mere survival.

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.

A big challenge to the EQA and relevant agencies working on Palestinian diversity is that there are so few baseline studies on where are the rich biodiversity areas and what they contain in the OPT (a gap of knowledge). Recent work in the past 5 years on protected areas and their buffer zones in Palestinian areas can provide a model for biodiversity conservation while promoting ecosystem services. Two prominent examples from our work is Wadi Al-Quff (Qumsiyeh 2016a, b; Qumsiyeh et al. 2016; Khalilieh 2016) and Wadi Makhrou. Al-Makhrou is the last remaining biodiversity-rich area in the Bethlehem district, 2.6 km² of natural areas interspersed with agriculture and rich flora and fauna and an equivalent buffer zone of more than 5 km². It is also one of 13 important bird areas in Palestine rich in cultural heritage, including old Roman tombs, ancient wells, old Palestinian watchtowers, and a part which is considered a World Heritage Site by UNESCO. However, no management plans or conservation programs have been implemented by any organization in the area. The valley suffers from habitat loss and land fragmentation, causing biodiversity loss, and from challenging livelihood conditions as a result of (among others) the lack of economic motivations, no subsidies for farming practices, and inadequate markets for extra production. A project initiated by our institute there showed that we can use education, permaculture, agricultural, and ecotourism to actually make a difference even under these difficult circumstances of occupation and colonization.

1.6 Recommendations

1.6.1 Research

Palestine needs scientific data covering all areas relevant to protected areas and potential protected areas by using the best available data collection methods. We recommend this effort to collect baseline data be led by qualified academic centers covering areas like geography, geology, hydrology, fauna, and flora. The only protected area where such data was collected is Wadi Al-Quff (Qumsiyeh 2016a, b; Qumsiyeh et al. 2016; Khalilieh 2016). With upward of 48–51 areas in need of protection, the work ahead of us is daunting and will take a few years. We suggest prioritizing the work in the next 5 years to study Al-Qarn, Wadi Haramya, Wadi Al-Qelt, Um Al-Tut, and Wadi Qana. The studies must use experts after proper announcements of funding availability.

1.6.2 Management Plans to Deal with Threats

Management plans must use ecosystem approaches and deal with social, cultural, and economic issues. Designing Management Plans for protected areas are done by trained experts (we have so few of those in the Middle East). Thankfully, groups like the RSCN (Jordan) are willing to help. The conflict between EQA and the MOA in terms of authority over parks should be resolved one way or another. That the EQA with help of some experts came up with a draft management plan for Wadi Al-Quff is a first step. That project costs over \$100,000 and 2 years of work for just one locality. The next should be sitting down at high-level government officials to decide how to and who should implement the plan. There is unfortunately a failure to do that, and instead there is now a plan afoot to transfer the responsibility of Wadi Al-Quff PA to the municipality of Hebron to manage it. Local municipalities are subject to various pressures which cannot result in sustainable conservation efforts. This would be a very bad omen for this rich area with key endangered species like raptors. It could also set a very bad precedent.

1.6.3 Economy and Ecotourism

Strategies for conservation that also enhance local economic development (e.g. through use of permaculture) must be developed. Much can be done in promoting tourism even under occupation if partnerships are built such as what happened with Masar Ibrahim between academia and NGOs. Other possible partnerships are the ones involving the private sector and civil society groups and the government ministries with civil society groups in more official capacities. The most important is to

revive and invest in the capacity of a restructured EQA to oversee these partnerships and ensure outcome-driven projects are implemented without duplication of efforts and with maximum efficiency. Tourism must be developed only if it is sustainable. We believe in developing areas like agricultural tourism, ecotourism, cultural tourism, and other forms of alternative/sustainable tourism. Similarly, much can be done to make sure that conservation is beneficial to the local community rather than harmful to their economy.

1.6.4 Conservation Mainstreaming

Knowledge base of conservation issues in Palestine linked to global conservation efforts (mostly developed by researchers with some support from NGOs and EQA and MOA) must be expanded. Conservation awareness must be structured in a unified way to (a) explain what conservation is, (b) why we need it, and (c) how each of us can affect the change in behavior. Existing officials in NGOs, academic institutions, and governmental bodies must prioritize conservation. In 2005, 170 Palestinian civil society organizations called for using the strategy of boycotts, divestments, and sanctions as a peaceful non-violent strategy to end the occupation and achieve other internationally recognized rights of the Palestinian people. Since then, thousands of NGOs and all major academic institutions in Palestine have adopted this call (see bdsmovement.net). Credible environmental groups did join this campaign. Environmentally sensible choices of consumers can also be encouraged that are protective of the environment/ethical consumerism (see Dajani and Isma'il 2014). The EU and other funders must stop any and all efforts to promote normalization because they do not lead to peace. Peacemaking in situations of occupation and colonialism has a very well-developed theoretical and practical body of knowledge that can be evaluated but is beyond the scope of this work. Further such efforts only make the environmental situation worse by delaying freedom and sovereignty for the native people.

Acknowledgments We would like to thank Prof. Zuhair Amr, Elias Handal, Mohammad Najajrah, and our PIBS team for their support. Thanks are also due to the Environmental Quality Authority (esp. Dr. Issa Baradiya and Mohammad Mahasne) for their help. Funding for part of the work came from the City of Geneva, the Darwin Initiative, and the EU Peace Initiative (project Unity and Diversity in Nature and Society).

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