Palestinian National Authority
Environment Quality Authority

Global Environment Facility

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Third National Report on Biodiversity Conservation

Third National Report
on the Implementation of Article 6 of the Convention on Biological Diversity

Environment Quality Authority

Palestinian National Authority

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List of Abbreviations

AEZ	Agro-Ecological Zoning
ARIJ	Applied Research Institute of Jerusalem
BERC	Biodiversity and Environmental Research Center
CBD	Convention on Biodiversity
CEOHS	Center for Environmental and Occupational Health Sciences
CSB	Community Based Seed Bank
EQA	Environment Quality Authority
GEF	Global Environment Facility
GEF/SGP	Global Environment Facility Small Grants Program
GIS	Geographical Information System
IPM	Integrated Pest Management
IUCN	International Union for the Conservation of Nature and Natural Resources
IYM	International Year of the Mountains
MEnA	Ministry of Environmental Affairs
MOPIC	Ministry of Planning and International Cooperation
NBSAPP	National Biodiversity Strategy and Action Plan of Palestine
NGO	Non-Governmental Organization
NHPU	Natural Heritage Protection Unit
PBHC	Palestinian Biodiversity Higher Committee
PCBS	Palestinian Central Bureau of Statistics
PNA	Palestinian National Authority
ROTEM	Israeli Land Information Center
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization

EXECUTIVE SUMMARY

INTRODUCTION

Although small in area, Palestine's varied topography and associated climate—ranging from Mediterranean to desert—make it one of the richest in biodiversity in the region and, indeed, the world. Its geographical position, located between the continents of Africa, Asia and Europe, significantly contributes to its rich and varied biodiversity. Various sources estimate plant variety at 2780[1] species belonging to 126 families. Palestine's wild plant species are thought to be the origin of some domesticated crops found worldwide, and wild species are still considered genetic reservoirs for possible improvement of existing crops because of their potential capacity to contribute pest and environment-resistant genes. There are 511 reported bird species, 116 mammals, 97 reptiles and 7 amphibians. In addition, there is a wide assortment of marine species, including fish, mollusks, crustaceans, and polychaeta, as well as marine mammals.

Palestine's diverse geography and climate, along with its location, greatly contribute to the large variety and assortment of species within a collection of habitats. Yet this richness in biodiversity has seen a steady and dangerous decline due to human activities. In a small area such as Palestine, the equilibrium between the various habitats allowing for the richness in biodiversity is under serious threat. This equilibrium is rapidly deteriorating, with a negative impact on biodiversity. The main culprit is human activity. Israeli occupation, with its restrictive measures and military activities, has contributed substantially to the deterioration of biodiversity. By way of example, Israeli construction of settlements and bypass roads has cut through many wilderness areas. Such areas were known to be the last refuge of wild species and plants—their habitats were fragmented and their viability affected. The rapid and expanding construction of the Israeli "annexation and expansion wall" has likewise fragmented many ecosystems (if not totally eliminated some). Such activities have caused some wild animals to seek refuge in urban areas. A small but noticeable example is the "population explosion" of wild boars. Wild boars were forced out of their natural habitats by the aforementioned Israeli activities and are now attacking Palestinian farms in search of food.

Israel's excessive pumping of water from Palestinian aquifers has caused many springs that previously flowed year round to dry up, also affecting biodiversity—especially among amphibians and much of the fauna that depended on the springs for survival in a harsh, semi-arid environment. It is well documented that Israel takes more than 80 to 85 percent of Palestinian water resources for its own use. Even on a good wet year, many of the springs have largely dried up. Israelis' unwarranted per capita water consumption is devastating to many ecosystems, including those in the Dead Sea region and the Jordan Valley. Not only is there a shortage of water for resident species; unwise consumption is likewise associated with increased salinity in the aquifers. This increase has been detected not only in the Jordan Valley ecosystem

[1] The number of reported floral species varies, with other sources placing it at 2953 or 2500.

but also in the mountain aquifers. Again, biodiversity is suffering and the delicate ecological balance built over thousands of years is rapidly deteriorating.

Palestinian urbanization is also to blame, though this is linked to Palestinian reactions to Israeli measures on the ground. As expanding Israeli land seizure leaves little territory for Palestinian building, urbanization is threatening agricultural areas. The situation is becoming increasingly similar to that of the Palestinians who remained in Israel after 1948—as their lands were seized, their towns and villages became severely overcrowded.

Despite this dire situation, Palestinians are endeavoring to cope with the disaster and conserve whatever biodiversity remains. Government and non-governmental and research institutions have begun addressing biodiversity concerns in a variety of ways. Yet, as has occurred in many countries, there are shortcomings in the volume of work and in coordination among those involved. The Palestinian Environment Quality Authority (EQA) cannot do the job alone. Shortage of funds and personnel are among the major handicaps. Coordination among EQA staff is difficult in light of Israeli restrictions on mobility. Recurrent Israeli violations against the Palestinian environment aggravate the situation and make it increasingly hard for EQA to function. EQA is forced to communicate via videoconference with its two main offices, in Gaza and Ramallah. It has also opened many offices to follow up on its activities instead of relaying solely on few regional ones. Donor attitude in choosing projects or institutions for funding sometimes leaves EQA out of the picture so far as biodiversity conservation is concerned.

LEGAL AND POLICY BACKGROUND

EQA as well as other government ministries, such as the Ministry of Agriculture and the Ministry of Local Government, have laws or bylaws for protecting aspects of natural heritage. EQA has also established a biodiversity unit within the General Directorate of Environmental Resources; this unit needs to be activated to coordinate and follow up on biodiversity activities nationwide. It could be expanded to form the proposed Natural Heritage Protection Unit (NHPU), which would include biodiversity among its activities. This is preferable to the setup suggested in the first and second Convention on Biodiversity (CBD) reports, which proposed forming a body called the Palestinian Biodiversity Higher Committee (PBHC). The NHPU was proposed during preparation of laws by Birzeit University for the protection of cultural and natural heritage. These proposed laws, which were to be submitted to the Palestinian Legislative Council, could be incorporated into the existing environmental laws of EQA.

Creating the NHPU would greatly enhance the EQA's role in biodiversity conservation. This implies reorganization at EQA, allowing this unit to undertake the activities involved in protecting biodiversity and enforcing laws. Enforcement of laws still remains a top priority for the Palestinian National Authority (PNA), though Israeli occupation and the division of Palestinian territory into A, B and C zones

impedes this task. The proposed NHPU would be able to integrate existing and proposed laws under one department, thus ensuring that policies and procedures concerning biodiversity and other aspects of natural heritage protection are uniformly applied. The setup of NHPU will be discussed subsequently.

OBJECTIVES OF PALESTINE'S BIODIVERSITY STRATEGY

Palestine has an important role to play in preserving its biodiversity and ensuring its sustainability—regardless of obstacles imposed by Israeli occupation. Towards this end, a number of objectives have been proposed, some of which are currently being implemented. These include:

- Compiling all existing environmental legislation and bylaws as well as new laws and incorporating them into one law under EQA's jurisdiction. Such laws should be aligned with international biodiversity and natural heritage conventions.
- Improving coordination among Palestinian government and non-governmental stakeholders and EQA, acting within a comprehensive biodiversity plan.
- Strengthening ties with Arab countries and the region in areas related to biodiversity.
- Establishing a comprehensive biodiversity plan to ensure sustainable use of natural resources.
- Improving biodiversity data collection to ensure that such data is relevant and falls within the comprehensive plan.
- Establishing an updated emergency intervention plan to deal with natural areas damaged by Israeli occupation activities, including those related to the annexation and expansion wall and bypass roads.
- Stepping up the pace of expertise capacity building at all stakeholder levels. EQA will encourage donors to fund scholarships for its staff and distinguished students to specialize in biodiversity-related areas (e.g., environmental management, ecosystem and forest management, population biology, statistics, entomology, taxonomy, wildlife veterinary science, marine biology and genetics).
- Establishing environmental education and public awareness as part of EQA's biodiversity and environmental protection strategies within the recently established National Environmental Education Committee. In coordination with the Ministry of Education, environmental education is becoming part of school curricula but is not yet widely taught at the college and university level.
- Lobbying for a more central role in decision-making and a larger budget for EQA, facilitating its crucial role in protecting biodiversity.

IMPLEMENTATION OF PALESTINE'S BIODIVERSITY STRATEGY

One element that is crucial to comprehensive implementation of Palestine's biodiversity strategy is having full jurisdiction over its territory. All strategies and

plans have the potential to fail if Israel continues its expansionist policies. Full jurisdiction implies having the freedom to select natural heritage sites, according to set criteria, for the preservation of Palestine's rich biodiversity. Thus far, Palestine has not officially declared any area a natural reserve except for Wadi Gaza, which the PNA declared a nature reserve. The Ministry of Planning as part of the 1999 *Emergency Natural Resources Protection Plan*, the Ministry of Tourism in 2005, and non-governmental organizations (NGOs) have identified some natural heritage sites, but such selection was not part of a formal process based on United Nations Educational, Scientific and Cultural Organization (UNESCO) criteria and international standards. This does not mean that these areas are not significant but that the process needs formalization. Selection of natural heritage sites must be a priority in the preservation of biodiversity. Official selection of such areas would prohibit their use for other purposes, thus assisting in preservation. Selection should be listed with relevant local government institutions as well as relevant international organizations, such as UNESCO. This should be an urgent priority for Palestine.

The Ministry of Planning also completed landscape assessment for various governorates in Palestine and published the results in 1999, as part of the *Emergency Natural Resources Protection Plan*. Though this activity would have helped protect the natural landscape and biodiversity, the comprehensive land use plan of which it was a part disintegrated as a result of Israeli measures on the ground (ranging from land confiscation to the building of settlements and their associated roads, fences, walls and buffer zones).

One important issue to address is ecosystem fragmentation (as opposed to ecosystem integrity). Ecosystem fragmentation is a major cause of biodiversity deterioration. As a result of land confiscation, the building of settlements and "security" areas, and Palestinian and Israeli urbanization, macro and microhabitats have been fragmented to the extent that their viability has become of great concern to naturalists. Urgent intervention measures must be instituted, including establishing "secure" ecological zones, such as natural reserves and managed parks. Intervention may also entail rehabilitating damaged ecosystems and reintroducing species that once lived in these areas. Such measures require rigorous natural heritage policies as well as qualified personnel to oversee them and adequate funds to carry them out.

At present, Palestine has little control over the introduction of transgenic species or the spread of such species from neighboring countries. Such control can only be established through mutual agreements. The possibility of the spread of such species in the region is real and should be regulated.

1.INTRODUCTION

1.1HISTORICAL ROOTS OF CONSERVATION IN PALESTINE

For thousands of years, Palestinians inhabiting this rich land exploited its natural resources in a sustainable way. Fertile land allocated for agriculture was well tended, and building on that land was socially unacceptable. Villages were built on barren hills, thus supporting land preservation. Water resources were carefully managed and channeled to urban areas when needed. Wilderness areas were kept as such and were used to gather needed herbs and natural products. Traditional houses were designed to conserve energy through natural cooling or heat trapping.

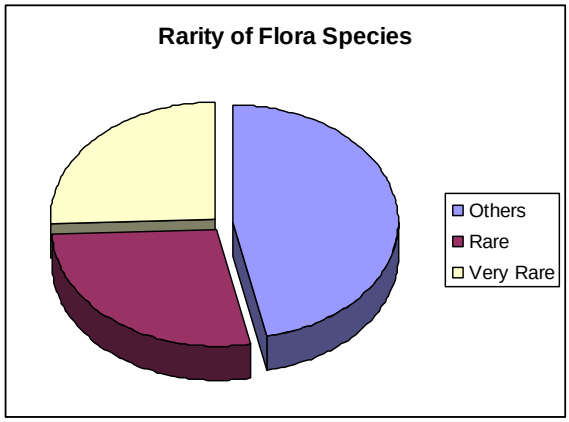
Palestine's productivity was mentioned in the Bible, which described it as the "Land of Milk and Honey." Historians celebrated Palestine's beauty, with its varied geophysical formations and mild climate. Many ancient mosaics and, more recently, drawings by visitors to the Holy Land depict Palestine's wild flowers, fauna and features.

Palestinian folklore as well as indigenous knowledge is rich in stories related to the area's of biodiversity, with particular emphasis on fauna, such as wolves and hyenas. Wildflowers are used in dying clothing material as well as eggs during Christian and Muslim religious festivities. As part of folkloric medicine, wild herbs were used to soothe many ailments, both in the home and by herbal doctors *(tabibs)* scattered throughout the country. Even traditional Palestinian dresses reflected the biodiversity of fauna and flora, which were depicted in embroidery.

Only with the advent of occupation did overexploitation of natural resources rapidly impact conservation. This was coupled with social and economic pressures that fragmented the social web that had previously checked infringements on natural resources.

BIOLOGICAL DIVERSITY IN PALESTINE

The geographical location of Palestine, on the Mediterranean and between the major continents of Africa, Asia and Europe, is the source of unique geophysical characteristics and climate, resulting in rich biodiversity rarely matched in other countries. The close proximity of varied landscapes is stunning to Palestine's visitors.



Various sources place Palestine's flora at 2780 plant species, while others estimate it at 2953. These species belong to 126 families. Rare species account for 27.8 percent and those classified as very rare account for 25.6

percent. These percentages are considered high and are directly related to habitat. Some of these habitats are relatively small and varied; the flora that occupies them is thus varied and rare. Land-based fauna comprise 730 species, including 116 mammals, 511 birds, 96 reptiles and 7 amphibians.

Amphibians are under direct threat due to disappearance of the wetland habitats they occupy. Various pretexts are used to justify this encroachment on biodiversity but the end result is the same: common species are under serious threat of becoming rare, and rare species are disappearing altogether. This threat has accelerated in the past two years, with the building of the Israeli annexation and separation wall and bypass roads as well as the expansion of Israeli settlement activities in Palestine. Habitats are becoming fragmented, resulting in a serious loss of biodiversity. There is also real danger to the viability of species. Fragmentation of habitats and the isolation of species as a result of walls, roads, and so forth—in effect creating "mini-islands"—are bound to affect genetic exchange and, as a result, weaken species over time and precipitate genetic erosion. Such a scenario is not far-fetched.

Pesticides use likewise poses an ever-increasing threat and is another direct cause of biodiversity loss in Palestine, especially among predatory birds and insects. Although there was movement towards reducing the amount and type of pesticides used through adoption of the Integrated Pest Management (IPM) Strategy, this trend has seen a regression in the past few years. Much of the progress and acquired knowledge on IPM has dissipated. Many environmental agriculture projects lost impetus due to marketing difficulties resulting from Israeli-imposed road closures and restrictions on mobility. Pesticides continue to be a threat for endemic and migratory species and for their natural resources and habitat. Moreover, beneficial insects have seen a drastic drop in their numbers due to pesticides. This has meant economic catastrophe for farming communities, whose crops are increasingly devastated by newer and newer pests (some of which have become resistant to a cocktail of pesticides). Unfortunately, marketing of pesticides follows free-market rules, especially given that Palestinians have no control over their borders due to Israeli occupation and border control. Such "liberal" use of pesticides throughout the region should be strictly regulated.

PALESTINIAN BIODIVERSITY IN THE CONTEXT OF THE CONVENTION ON BIODIVERSITY

The Convention on Biodiversity (CBD) aims at conservation of biological diversity, sustainable use of its components and fair and equitable sharing of benefits arising from utilization of genetic resources. It encourages countries to work actively towards these ends through a variety of intervention measures. Conserving biodiversity should become part of any country's rules and regulations, with active intervention measures in place. Biodiversity affects the concerns of day-to-day life, ranging from food supply to medicines. Many medicines in circulation trace their origins to plants. Microorganisms are used to

produce antibiotics and genetically engineered drugs. Biodiversity provides organisms to fight pests and diseases as well as to provide food, shelter, recreation, entertainment, medicine, clothing and so forth.

Palestine joined the CBD as an observer nation and thus has an obligation to work toward preserving biodiversity. Under EQA guidance, several activities have been taking place recently at the Palestinian NGO and university level and with funding from United Nations (UN) agencies or donor countries. These activities relate to determining the biodiversity of Palestinian flora, establishing a floral "red list" of threatened species, identifying ecologically important areas and surveying migratory birds and the dynamics of some bird populations. A seed bank to preserve native species is already in place. The Environmental Field Center, set up to preserve Palestinian biodiversity, was recently inaugurated in Jericho.

Such activities notwithstanding, Palestinians are facing difficulties in implementing the CBD. These difficulties are related to the availability of expertise, funding, university and NGO project priorities (often unrelated to biodiversity) and accessibility to study areas. Accessibility is of major concern to those working in biodiversity as a result of severe restrictions on mobility throughout Palestine due to Israeli military orders and prohibitions. In addition, a substantial knowledge gap on many biodiversity-related issues separates scientists and the general public. While there has been some progress, especially in the areas of floral and bird biodiversity, NGOs rather than universities carry out much of this work. The bulk of it is funded by the United Nations Development Programme (UNDP) Global Environment Facility Small Grants Program (GEF/SGP), which has been wrongly excluding universities from their grants, especially over the past two years. Universities could enrich much of the biodiversity work.

Some NGO projects are environmental sciences based, but there is a pressing need for surveys of biota population and distribution in Palestine; funding must be directed toward this priority. Palestine cannot continue to depend on Israeli surveys and figures, which may or may not reflect facts on the ground. Various species indices are needed, such as a red list of threatened Palestinian species, a protected areas index based on extent and natural heritage classification, classification of habitats, a marine trophic index and an index of marine species. To compile such indices, Palestinian researchers need funding, free access to their land and freedom to carry out necessary biodiversity work.

2. LEGAL AND POLICY FRAMEWORK FOR PALESTINE'S NATIONAL BIODIVERSITY STRATEGY PLAN

2.1 PALESTINE'S NATURE PROTECTION LEGISLATION

In 1999 the Palestinian Environmental Authority (subsequently EQA), with funding from the Global Environment Facility (GEF), published the *National Biodiversity Strategy and Action Plan for Palestine* (NBSAPP). It also completed the unpublished *Palestine Country Study on Biological Diversity,* which now needs updating. In spite of some weaknesses, NBSAPP provides a starting point to build upon. Yet events on the ground, including the second intifada and the repressive Israeli measures that followed, precluded implementation.

In April 2005 the Ministry of Agriculture, with assistance from GEF, issued *The National Policy and Legislation for Promoting the Conservation of Agro-biodiversity in the Palestinian Authority.* This document contains a wealth of figures and data but lacks laws to enforce biodiversity plans.

The main challenge to law enforcement is the existence of a large number of laws for the protection of biodiversity, some Palestinian and others dating from the British mandate, the Jordanian and Egyptian eras or Israeli military orders. Regulation and enforcement of the laws is thus difficult for any authority. The Institute of Law and the Center for Environmental and Occupational Health Sciences (CEOHS) at Birzeit University worked on a draft law for the protection of natural heritage in Palestine. This draft law condensed, integrated and enhanced all applicable laws while also adding new provisions. It, together with a law for the protection of cultural heritage, was to be presented to the Palestinian Legislative Council and, subsequently, the Cabinet for approval in the framework of creating an entity for protecting cultural and natural heritage in Palestine. This entity would be responsible for many aspects of natural heritage, among them biodiversity. It was proposed that its board include representatives from EQA. An alternative proposal is that a unit be created at EQA and assume sole responsibility for protection of natural heritage, whereupon biodiversity-related activities would fall within its purview. All applicable rules, regulations and laws would fall under the proposed unit's jurisdiction. It would also have the capacity to award permits and impose fines. Regardless of the set-up, coordination between entities responsible for the protection of natural heritage and those responsible for the protection of cultural heritage is essential due to the linkage between them. In Palestine, a substantial number of cultural heritage and archeological sites fall within natural heritage areas.

During the course of its project on setting up laws for the protection of cultural and natural heritage, the Institute of Law at Birzeit University issued a 19-page internal guiding document for project participants (among them CEOHS) on the legal aspects and operative laws in Palestine. The document was divided into five sections, as follows:

1. Constitutional status: Although there is no clear reference to natural heritage, Article 33 of the Basic Law states that a "clean and well-balanced environment is a human right and the preservation and protection of the Palestinian environment for present and future generations is a national duty."
2. Legislative protection for natural heritage components: Various pieces of legislation, some dating from the British mandate over Palestine, are still in effect. These also include Israeli occupation military orders. They concern:

a) Protection of natural areas, such as those included in zoning laws: These include Israeli Military Order 363 for the West Bank and Military Order 353 for Gaza regarding the preservation of natural areas, as well as the most recent Palestinian Environment Law, issued in 1999.
b) Protection of water and other natural resources: The most recent of these is the Palestinian Water Law, issued in 2002. Prior to that, Law No. 1 of 1997 for Palestinian Local Government (municipalities and village and local councils) prohibits the pollution of springs and other water resources. During the Jordanian era, Law No. 16 was issued to penalize those polluting water resources. Law No. 15, concerning reforestation, was also issued to protect elements of natural heritage.

3. Protection of natural resources: Law No. 1 was issued in 1999 for the protection of natural resources in Palestine, to be implemented by the Natural Resource Authority under the jurisdiction of the Ministry of Industry. This is in addition of the 1999 Palestinian Environment Law.
4. Protection of wildlife: This area was primarily addressed as part of the 1999 Palestinian Environment Law. Prior to that, there were the Jordanian Laws Nos. 8 and 92 of 1966 controlling hunting and the British mandate Law of 1924 regulating hunting.
5. Protection of plants: This was incorporated into the 1999 Palestinian Environment Law. Again, there were additional laws from the time of the British mandate as well as those issued by Israeli military orders.

Obstacles to the above strategy include inter-ministerial conflict related to jurisdiction and legal authority, funding difficulties and facts on the ground. Inter-ministerial conflict was the main barrier to adopting the proposed Cultural and Natural Heritage Protection Authority. None of the ministries involved or existing authorities were ready to transfer part of their jurisdictions to the proposed authority, especially in the area of natural heritage. The second obstacle was funding. The PNA was and still is trying to merge "authorities" into existing ministries for budgetary and administrative reasons (e.g., the Tobacco Authority and the Petroleum Authority were both merged with the Ministry of Finance). The third problem stems from facts on the ground. An entity for the protection of natural heritage must be able to exercise its authority by enforcing laws and imposing fines. The Oslo agreements divided the occupied territories into A, B and C zones, where area A is under full PNA control, area B is under Palestinian civil control and Israeli military control (with areas A and B mainly composed of built up areas) and area C, which comprises approximately 71 percent of the total

area of the West Bank and Gaza, is under full Israeli control. This partition of authorities and jurisdictions constrains law enforcement, and laws without enforcement are of no value. This is what in fact is currently occurring. Biodiversity is being threatened by lack of enforcement on the Palestinian side coupled with insensitivity and expansionist settlement activities on the Israeli side. As a large part of the West Bank falls within area C, where Palestinians have no legal jurisdiction, Israel is to blame for the destruction of biodiversity by constructing settlements and bypass roads in ecologically sensitive areas.

Even if division of the land into areas A, B and C is maintained, it should in no way deter Palestinians from setting up legal structures for the protection of natural heritage, including biodiversity. After all, the West Bank and Gaza are part of the Palestinian areas occupied by Israel in 1967. By setting up such structures, there would be grounds for legal action against those who break the law and negatively impact biodiversity. As such there is a real priority for integrating all relevant laws into one and forming a strong government entity with jurisdiction over all activities related to protection and preservation of biodiversity and aspects of natural heritage.

The current setup at EQA does not permit it to undertake comprehensive protection of biodiversity and natural heritage. It lacks specialized personnel, funds and facilities to assume this role. This is an important consideration when planning the institution's future development. EQA must be empowered to function properly and to protect Palestinian biodiversity and natural heritage.

2.2 Environmental Planning and Biodiversity Conservation

A national environmental planning and biodiversity strategy for Palestine is not well defined. This is related to the aforementioned limitations on EQA's capacity and division of responsibility for biodiversity among numerous stakeholders. The NBSAPP of 1999 and the 1999 Palestinian Environmental Strategy need to be reviewed and updated to better focus on policies and clear implementation strategies.

One of the most important issues is empowerment. Circumstances do not allow for continued infringement on natural resources, be it in area A, B or C. A clear, comprehensive and precise master plan must be set up for all of Palestine.

2.2.1 National Biodiversity Master Plans

2.2.1.2 *National Parks, Nature Reserves and Landscape Reserves*

The Palestinians have not yet set up their own national parks, nature reserves and landscape reserves. Those that do exist were set up by the Israeli civil administration. Although the Ministry of Planning issued publications on ecologically important areas and landscape areas, no legal setup has been

proposed for any of them. NGOs and academic institutions have likewise identified many ecologically important areas. These areas need to be evaluated for their national or local significance to natural heritage and ranked accordingly. Such ranking is important in order to classify them as national parks, nature reserves or landscape reserves and offer the requisite level of protection. This should be followed by officially declaring them as such if they meet necessary evaluation criteria. It should be noted that some of the areas mentioned by the Ministry of Planning publication are only of local significance if any.

2.2.1.3 *Coastal and Marine Environment Master Plan*

The Ministry of Environmental Affairs (MEnA; now EQA) published the *Gaza Coastal and Marine Environment Protection and Management Action Plan* in December 2001. The stated overall objective was to "reverse and prevent further depletion and deterioration of the Gaza Coastal and Marine Environment." For this action plan to be effective, many stakeholders, such as relevant ministries and institutions, must implement projects for the rehabilitation, restoration and protection of said environment. Such projects include, among others, effective wastewater treatment, solid waste management, sand dune management, water resource management and fisheries management. The action plan needs to be revised and updated to reflect events on the ground and changes that have occurred since publication.

It is imperative that a national master plan be crafted to protect natural heritage and biodiversity in Gaza. This proposed plan should designate coastal areas as nature reserves and protect wetlands, such as Wadi Gaza, and their biodiversity. In addition, the master plan should take into account regional projects that could affect biodiversity and coastal management in Gaza. One example is the building of a coastal sea wall by Israel and its implications for sea currents, marine biodiversity, sand deposition and coastal erosion. Egyptian activities for water harvesting from the Nile River and the Nile Delta must also be taken into account; the negative impact of Egypt's Aswan High Dam on the Gaza and eastern Mediterranean coasts and marine environment is well established. A national oil spill response plan, whether formulated separately or as part of the master plan, is urgently needed as well. Should an oil spill reach Gaza, with its limited cleanup facilities, it could mean serious ecological and human disaster. Regional agreements are likewise needed to deal with such an event.

2.2.1.4 *Long-Range Master Plan*

A long-range master plan for Palestine is needed regardless of the outcome of final status negotiations between Palestine and Israel. To set up such a plan various stakeholders from the private and govern
ment sectors must be involved. They should represent a range of disciplines and should include planners, architects, engineers, ecologists, environmentalists, biodiversity specialists, agronomists, toxicologists and others. The objective

would be to preserve Palestinian natural heritage for future generations, taking into account projected population figures and land use.

It is high time to switch from planning based on responses to current conditions (i.e., a "reactive" approach) to proactive planning. Such planning should aim to preserve open spaces on the macro and micro levels. Palestinians are beginning to recognize the importance of open spaces, as reflected in their active emphasis on setting up public parks and gardens. This approach should be further developed to include natural open spaces, with minimal interference in nature's design except, where needed, active regeneration of designated areas.

Successful implementation of any master plan requires creating new institutions, empowering existing ones and achieving full coordination among them. As mentioned previously, the best approach to achieving such success entails forming an empowered body for the protection of natural heritage.

3. PALESTINE'S BIOTIC ASSETS

3.1 ORIGINS OF BIODIVERSITY IN PALESTINE

Many factors contribute to the rich biodiversity of species in Palestine. Some of these factors include its geographic location along the eastern Mediterranean coast, its proximity to the African, Asian and European continents, its topography and human influence.

3.2 BIOGEOGRAPHICAL ZONES

Within Palestine there exist a number of biogeographical zones, with their associated climates and biodiversity.

3.2.1. The Central Highlands

This includes the mountainous portion of the West Bank. This region is approximately 3500 square kilometers in area and 120 kilometers in length. Elevation reaches slightly more than 1000 meters above sea level. Average annual rainfall ranges from 400 to 700 millimeters. Most of Palestine's natural and planted forests are located in this area. Agriculture depends on rainfall.

3.2.2. The Semi-Coastal Region

This area, located in the Jenin and Tulkarem districts, is an extension of land inside the Green Line (the 1967 borders). It is 120 square kilometers in area and has an average annual rainfall of 600 millimeters. Most agriculture is irrigated, with heavy pesticides use.

3.2.3. The Eastern Slopes

This area runs from Jenin in the north to Hebron in the south. It is often referred to as the "Jerusalem wilderness." Traditionally, this was the winter grazing area for native sheep; shepherds used to move their flocks there during winter due to the moderate climate and grazing pastures. The eastern slopes are also home to most of Palestine's wild mammals and much of its native flora. The area is under substantial development pressures due to Israeli occupation activities (e.g., intensive building of settlements and associated roads and related activities).

3.2.4. The Jordan Rift Valley

This is a unique area that lies east of the West Bank highlands, between the eastern slopes and the mountains of Moab in Jordan. A semi-arid region with mild to warm winters and hot dry summers, it is a continuation of the African Rift Valley. Israel has expropriated much of this zone's land for settlement activities,

and Israeli settlers as well as Palestinian farmers practice intensive agriculture in the area. Many winter crops for export are planted using irrigated open and greenhouse agriculture, with heavy pesticides use. Water resources are under serious threat of contamination by salt as a result of the intensive agricultural practices. Palestinians draw their water from the few remaining local wells in the shallow salty zone and from the remaining springs. The Israelis pipe their sweeter water from the eastern slopes and from deep wells in the north of the Jordan Rift Valley. This region falls along bird migration routes. The heavy use of pesticides is negatively affecting endemic and migratory birds, with harmful consequences for biodiversity.

3.2.5. The Gaza Strip

This is the coastal zone along the eastern Mediterranean. The area has one of the highest population densities in the world, with the bulk of the population being refugees from 1948 Palestine. Unemployment and poverty are high. The area was environmentally affected by the construction of the Aswan High Dam in the 1950s, which hurt the biodiversity of marine species and caused the loss of sand. The Nile is the main source of the minerals comprising biodiversity's building blocks as well as the source of sand for the coast and its dunes. The bulk of sand and nutrients are trapped behind the dam, depriving the region of the most vital elements for marine life. Some migratory birds land in Gaza to rest and feed en route from Africa to Europe or vice versa. Excessive pumping of aquifers and the resulting saltwater intrusion has caused a dramatic increase in the salinity of water resources. Israeli water pumping activities within Gaza for their settlements as well as outside Gaza are a major factor contributing to increased salinity. Added to this is an increase in nitrate levels, thought result from leaching from sewage and the use of nitrate-based fertilizers within and outside Gaza. Aquifer recharge largely depends on rainwater flowing underground from the Hebron hills and west.

3.3 ECOSYSTEMS BIOGEOGRAPHY

3.3.1. The Mediterranean Territory

The Mediterranean territory extends along the coastal plain to the north of Gaza, the Galilee Mountains, the northern part of the Jordan Valley and the western slopes of the Nablus and Jerusalem Mountains, ending 65 kilometers south of Jerusalem. Its boundaries with the adjoining Irano-Turanian territory cannot be drawn with exact precision because humans, over many millennia, have caused heavy damage to Mediterranean territory vegetation. As a result, plants from the adjacent territories penetrated and extended into this area, resulting in a fairly broad belt of mixed flora and vegetation (Ishtayia, 1995).

The climate of this area is typical of the Mediterranean region, with a minimum annual rainfall of 350 millimeters. Its vegetation includes forests and *maquis*,

garigue and *batha* (low, scattered and often spiny shrub formations), of which *Quercus calliprinos* and *Pistacia palaestina* are the dominant species. The plants of this area have the largest number of associations and are found mainly on terra rosa soil and, to a lesser extent, on rendzina and consolidated sandy soils or sandstone (Ishtayia, 1995).

3.3.2 The Irano-Turanian Territory (Oriental Steppe)

This territory consists of a narrow longitudinal belt to the east of the Mediterranean area. It covers the southern parts of the West Bank (the Jerusalem desert, central Jordan Valley and adjacent steppes and rocky areas facing the southern part of the Jordan Valley). Annual rainfall ranges between 150 and 300 millimeters. Its dominant soil types are gray calcareous steppe and loess soils. Due to low rainfall, rain-fed cultivation is untenable except in the depressions. Plant cover consists of steppe desert, thorny and broom-like brushwood and dwarf shrub communities. Trees are rarely associated with this area (Ishtayia, 1995).

3.3.3 The Saharo-Arabian Territory

The Saharo-Arabian territory is characterized by large expanses of hammada, salines, and sand dunes along with `the complete lack of cultivation, except for a considerable number of seasonal plant communities in and around springs and some trees near frequent water resources. This territory expands from the Jerusalem desert to the south of the Nagab desert. Annual rainfall ranges between 50 and 150 millimeters.

3.3.4 The Sudanese Penetration Territory

This territory is a transitional zone between the Sudanese area and the Arabian desert. Its high winter temperatures support the growth of many Sudanese species in Wadi A'rabba, the Dead Sea area and south of the Jordan Valley. Plant cover is restricted to oases, with some plant associations being similar to those of the African Savanna.

3.4 DIVERSITY OF SPECIES IN PALESTINE

3.4.1 Flora and Fauna

Palestinian and Israeli sources report the number of plant species to be 2780 wild plants. As for fauna, Israeli sources state that they are not extensively known. Palestinian sources do not list the number of species but rather the number of families of birds, mammals, reptiles and amphibians. The similarity in numbers for plants results from Palestinian reliance on Israeli survey figures. The Israeli figures only include plants found in PNA areas. The reason is that many Israelis consider geographic Palestine to be the land of Israel and thus include species surveys as part of those in Israel. In addition to depending on Israeli studies, the

majority of existing Palestinian literature on biodiversity describes only the current status of biodiversity; there are limited studies of biodiversity prior to the division of Palestine in 1948.

There is a genuine need to conduct surveys to determine actual fauna and flora biodiversity in Palestine as a whole as well as in the five aforementioned biogeographical zones. Such surveys should include freshwater and marine species. Fish and crustaceans residing in freshwater streams are not mentioned in the sources surveyed, though some are under serious threat of extinction due to human activities and excessive depletion of the water resources on which they depend. In addition to surveys, bibliographical research and personal interviews with locals and elders should be conducted to better understand the status of biodiversity in the past.

For further details on the diversity of fauna and flora species, the reader is referred to both Palestinian and Israeli sources. There is no need to list related figures here—suffice to say, Palestine, with its varied climates and biogeographical zones, is characterized by a vast assortment of species. These species are under real threat due to human activities, especially the encroachment of Israeli settlements and related activities in wilderness areas considered these species' last refuge.

3.4.2 Human Impact, Israeli Occupation and Other Threats to the Biodiversity of Species

Biodiversity in Palestine and Israel are intertwined. The territory comprises one geographical zone, with free genetic exchange among species residing in the various habitats and niches. Yet, as mentioned, this rich biodiversity is under serious threat. The causes of this threat and decline in biodiversity can be stated in simple terms. The Israeli occupation and associated activities and military orders restrict Palestinian land access. Most of Palestinian building activities are restricted to areas A and B under the Oslo agreements. These zones represent around 29 percent of the Palestinian territories. Within this area, approximately three million people must reside and survive. Area C falls under full Israeli control; access is often restricted for building and agricultural activities. There are scores of restrictive military orders controlling every aspect of Palestinian life, including mobility and freedom of movement. With hundreds of checkpoints set up throughout the occupied territories and the need to obtain permits from Israel, Palestinians are barred access to many ecologically sensitive and biodiversity-rich areas. At the same time, Israel is encroaching on these areas through its settlement construction, annexation and expansion wall bypass roads, military bases, exploitation of water and intensive agriculture (with associated heavy pesticides use, including aerial spraying in some locations).

3.4.2.1 *Agricultural Practices*

A few examples suffice to illustrate this disregard for biodiversity. In the Jordan Valley, vast areas of Palestinian land have been expropriated for building (primarily) agricultural settlements, where intensive agriculture is practiced. These settlements produce, among other crops, flowers, ornamentals, dates, grapes, herbs and some vegetables. Production is highly dependant on agrochemicals and irrigation. Water in the Jordan Valley is mostly saline and cannot be used for some of these crops. Israel is extracting sweeter water from sources on the eastern slopes and piping it to the valley. In addition, some deep wells were drilled in the northern valley, where water is less saline. The Jordan Valley is an arid area with little rainfall to wash away the salts that accumulate as a result of irrigation. Replenishment of Jordan Valley water resources is dependant on percolation of fresh water from the mountain aquifers and eastern slopes. This is turning all soil and water resources in the valley saline. With time, the type of vegetation that thrives in less saline soils will change. Wildlife that is dependant on such vegetation will be affected and its population size and biodiversity negatively impacted. It is feared that in the not-so-distant future the Jordan Valley will turn into a salt pan, with soils becoming sodic and too saline to sustain other than salt tolerant and hardy vegetation.

Excessive pesticides use is affecting resident and migratory wildlife species in the area. According to data gathered internationally, the number of migratory birds is declining. Agricultural activities in the Jordan Valley and north are partly to blame. Pesticides enter the food chain and affect birds and other animals more generally. The few studies conducted by Palestinian NGOs indicate a trend towards reduced biodiversity in the region.

3.4.2.2 *Urbanization*

The eastern slopes leading to the Jordan Valley are home for much of the remaining wildlife, including some mammals, such as wolves, coyotes, foxes and hyenas. With the building of settlements, bypass roads and military outposts, coupled with expanding human activities in the area, the wildlife population is diminishing rapidly. At the same time, a few species, such as wild boars, are experiencing unusual population growth. Previously keep under control by predators, wild boars are now moving into semi-urban areas. This movement is primarily due to Israeli encroachment on their natural habitats. Gazelles, a protected mammal, are also experiencing cyclic population explosions due to the diminishing predator population.

Due to confiscation of their land for building settlements and related agricultural and industrial activities, Palestinians have been largely restricted to areas A and B. With a high birthrate and the need for housing and buildings for other activities, the remaining agricultural land is under pressure from Palestinian construction. This has resulted in serious loss of fertile agricultural land.

Moreover, with restrictive Israeli military orders controlling Palestinian mobility over roads and closing some roads, new roads were built to connect villages to each other and to urban centers. Most of these roads were and are being built in wilderness areas—home to much of the wildlife in the mountainous region. Israeli actions are thus precipitating a Palestinian reaction, placing severe stress on biodiversity and natural heritage areas.

3.4.2.3 *The Annexation and Expansion Wall*

The Israeli annexation and expansion wall is yet another issue of concern. It consists of a cement separation wall reaching nine meters in height, with 150 to 200 meters of restricted buffer zone on each side, covering large portions of the West Bank and Jerusalem. It is planned to extend parallel to the Green Line and at some points juts 15 kilometers into West Bank territory, engulfing vast areas of Palestine. Some sections of the wall consist of roads and barbed wire; regardless of what the wall is made of, however, it will have a long-term impact on biodiversity and genetic exchange among wildlife in Palestine as well as in Israel. It is conceivable that genetic exchange among populations of the same species will be severely restricted and possibly curtailed—as if such populations were living on an island with little contact with their relatives. Over time this is bound to manifest in genetic problems similar to those that occur in any closed society.

The same could be true for humans. Limited genetic exchange and its effect on human diversity are certain to create many unanticipated problems. Restrictions on Palestinian movement are leading people to marry within their residential localities. In addition, Israel has instituted racial laws preventing Palestinians from marrying other Palestinians who hold Israeli passports. There is thus justifiable fear that genetic diversity among the Palestinian population will be severely curtailed.

3.4.2.4 *Poverty*

Unemployment in Palestine has reached unprecedented levels, with some data indicating it exceeds 50 percent. This is coupled with increased poverty; according to World Bank reports, many Palestinians are living in extreme poverty, with an income of $2 or less per day. As they seek new sources of income, many Palestinians are compelled to exploit natural resources (physical and biological), which in turn affects the natural environment that supports biodiversity as well as biodiversity's components (i.e., flora and fauna). Moreover, in order to find food for their families, many Palestinians are exploiting marginal land still in their possession for agriculture. Because marginal land is home to some wild species, biodiversity will be negatively affected. Other practices include removal of trees, such as citrus trees, especially in northern semi-coastal areas, and replacing them with greenhouses for vegetable production. This has had an impact on birds that typically use these trees as their habitats.

3.4.2.5 *Other Factors*

The following factors also pose threats to biodiversity:

A. Destruction of natural habitat.
    a. Uncontrolled grazing.
    b. Improper land use.
    c. Unsound management of wastewater and solid waste.
    d. Unsound management of natural resources.
    e. Pollution from vehicles and various human activities, especially particulate matters from stonecutting industries.
    f. Insufficient and/or ineffective public awareness about the importance of biodiversity.
    g. Desertification due to extensive felling of trees and soil erosion.

B. Absence of enforcement of laws and regulations for conservation of biodiversity and its habitat.

C. Uncontrolled hunting.

D. Disturbance of wildlife due to Israeli military training.

E. Population growth.

3.5 ORIGINS OF BIODIVERSITY IN PALESTINE

Thousands of years of human settlement in Palestine, coupled with its geophysical and geo-climatic conditions, have contributed substantially to its vast biodiversity of species. As mentioned previously, Palestine's proximity to Europe, Africa and Asia, as well as its location along the Mediterranean coast and its topography have also contributed to this diversity.

Geological events likewise contributed by helping shape Palestine's features and soil. For example, the Jordan Valley is part of the Great Rift Valley extending from Zambia in Africa to Turkey in Asia. The Dead Sea is located in this valley. The climate in this area is hot and arid, giving rise to unique fauna and flora (some of which are extinct due to human impact). The origins of some current species in the area can be traced to the African content.

The fauna and flora of Palestine are divided into three categories:

1. Endemic: These are defined as fauna and flora species with origins in ancient Palestine.
2. Opportunists: These species entered Palestine during a later period. They generally originate from surrounding continents and settled in Palestine when climate conditions changed, making settlement more favorable.
3. Introduced: Humans introduced these species over the millennia that Palestine was inhabited.

The type and composition of species that inhabit the country are influenced by many factors, including elevation and geographical location. Some species are found in most zones while others are restricted to certain elevations or geographical locations. The contrast in land and species can be striking. For example, the difference in elevation between the hills around Jerusalem (800 to 850 meters above sea level) and the Dead Sea (415 meters below sea level) is particularly dramatic. The associated change in biota is likewise very apparent.

3.5.1 Biodiversity of Flora in Palestine

Palestinians have not conducted extensive surveys of plants inhabiting their region. As mentioned previously, all available data comes from Israeli sources that do not differentiate between PNA areas and Israel proper. The absence of Palestinian surveying is attributed to many factors, among them Palestinian universities' lack of suitable infrastructure to perform such a huge and expensive task. The necessary infrastructure includes skilled personnel, such as taxonomists, ecologists and population biologists. Funding, which also plays an important role in activating biodiversity research, is limited and sporadic. In 2000, Al Quds and Hebrew University published the joint report *Preliminary Checklist and Ecological Data-Base of Plants of the West Bank*. This publication is based on *Flora Palestina*, the Flora of Palestine and Israeli Land Information Center (ROTEM) database, with Arabic translation of the names of the plant species. Annex II includes a review of plant biodiversity derived from some available sources.

3.5.2 Biodiversity of Fauna in Palestine

Biodiversity of fauna in Palestine is not well researched, as no global surveys have been conducted. Most recent works concentrate on birds, migratory and endemic, in the Jordan Valley. Such works, conducted primarily by the Palestinian Wildlife Society, lack data on population numbers and the actual range and number of observations. Yet, while far from comprehensive, these works represent a small step towards further studies.

Unfortunately, no data is available on the biodiversity of other fauna. The decline in observation of many Palestinian fauna species is an indication of the threat to their populations and biodiversity, but this must be established by surveys and

scientific studies. Again, the institutional setup for such work is needed, including scientists from a variety of disciples and adequate funding.

According to Israeli sources, there are 106 species of terrestrial mammals (some sources report 116); 511 species of birds, including 162 species of breeding birds, and 410 Mediterranean fish species. The number of aquatic invertebrates is difficult to derive from Israeli sources, as these relate to inland surface water bodies, which are relatively few in Palestine.

3.5.3 Palestinian Red List of Species

The only red list of threatened species available is for Palestinian flora; none exists for Palestinian fauna, as there are no clear surveys of fauna species available. There are two published red lists of threatened plants—one Israeli and one Palestinian (published by the Biodiversity and Environmental Research Center [BERC]). The *Palestinian Red List*, issued in 2002, is primarily derived from published sources (mostly Israeli) with some field surveys. The report does not indicate where the surveys were performed or the methodologies used, but it is a good starting point for further, more comprehensive surveys. Again, establishing a red list has to be preceded by establishing a database of plant species as a basis for determining which species are under threat and should be included. In general, the Palestinian report mentions 334 species of threatened plants within 81 families. The Israeli red list, derived from the ROTEM database, refers to 371 threatened plant species with 156 species under protection by Israeli law. The number of threatened fauna is not well documented by Israeli sources. Earth Trends reported in 2003 (using 2002 figures) that threatened species include: 14 mammals, 12 birds, 4 reptiles and 1 fish. Unfortunately, there is no Palestinian law indicating what species should be protected. This would be a potential task for any biodiversity committee or subcommittee.

3.5.4 Biodiversity of Genetic Resources in Palestine

The large diversity of habitats within the various geophysical regions of Palestine has contributed to its wide genetic diversity. The origins of some domesticated plants and animals are traced to Palestine. These include, among others, wheat, barley, lentils and chickpeas, along with sheep and goats. Among the fruit trees domesticated thousands of years ago (7000B.C.) are olives, date palms, almonds grapes, figs, apples and quince.

The wild relatives of domesticated plants are valuable gene pools, with potential for supporting improvements in domesticated cultivars through isolation of genes that may provide added forms of resistance to such variables as drought, salinity and diseases. There are efforts to collect the seeds of some wild plants into a seed bank, yet such attempts are modest and should be further encouraged and funded. Among the institutions that are working or have worked in this area are BERC and the Applied Research Institute of Jerusalem (ARIJ).

With regards to Palestine's wealth of medicinal plants, there are many isolated attempts, some successful, to raise them commercially. Of particular importance is the work done in Jericho by a group of farmers belonging to the Medicinal Plants and Organic Products Society. Popular medicinal plants that are cultivated commercially are zaatar (thyme, *Origanum syriacum*, or *Majorana syriaca*) and meramyyeh (sage, *Salvia fruticosa*) and babounej (chamomile, *Matricaria chamomilla*). A number of Palestinian researchers have experimented with extracts from wild and domesticated medicinal plants for possible use in antibacterial and anti-cancer drugs and have published their findings in international journals.

Trade in wild medicinal plants and herbs has not been critically evaluated, but it is believed to have a significant impact on the biodiversity of some insect species. One such species is the honeybee, which depends during part of its lifecycle on pollen and nectar collected from some medicinal plants.

There is an increase in the use of herbicides in agriculture to control weed growth. This normally occurs in early spring, when insects and herbivores are active. Over the long term, non-selective use of herbicides will have a negative impact on the biodiversity of both flora and fauna. In addition, it will encourage the emergence of herbicide-resistant weeds that are difficult to control. The dynamics of plant and animal populations will likewise be affected; certain populations will increase at the expense of others.

4.OBJECTIVES OF PALESTINE'S BIODIVERSITY STRATEGY

4.1 NATIONAL VISION

Palestine aspires to protect its national biodiversity assets through a variety of intervention measures that aim to assess and protect what exists, regenerate what is declining and reintroduce what has disappeared.

Israeli occupation and disregard for the national aspirations of an independent, territorially cohesive Palestine has had and continues to have a destructive impact on biodiversity. As mentioned repeatedly, biodiversity is under dire threat due to Israeli expansionist activities, with their lack of regard for the ecology, topography, biodiversity and beauty of the land. Yet Palestinians are hopeful that this situation will one day come to an end. When it does, Palestinians must revive their vision of a beautiful land and rehabilitate whatever can be rehabilitated. There are internationally accepted measures that will, over the long run, restore some semblance of normality to Palestine's shattered biodiversity. Such intervention measures relate to the protection of natural heritage, of which biodiversity is an important component.

Even when Israeli occupation ceases, implementation of the national vision requires setting up extensive infrastructure for the restoration and protection of biodiversity. The optimal model, as mentioned previously, entails creating a national entity for the protection of natural heritage.

The future of Palestinians on their land is largely dependant on that land's biodiversity. Thus, the conservation of this biodiversity and the sustainable use of its components are integral to the national vision. The preservation of our natural heritage as a repository of biodiversity and for its own sake is likewise central to this vision.

To better understand biodiversity, further fieldwork is needed. Of course, the ability to meet this need is highly dependant on independence, freedom of movement and access to the land.

4.2 GOALS AND OBJECTIVES

To support implementation of their national vision, Palestinians set forth a number of objectives aimed at protecting and preserving biodiversity. These objectives are scattered over a number of reports and publications and some laws. Drawing from these sources, common objectives include the following:

- Protecting biodiversity through education and awareness.

- Instituting countrywide policies and laws for proper planning while protecting biodiversity, including "greening" government policies and aligning them with the CBD.
- Setting up biodiversity indicators for monitoring progress on implementation of relevant policies and laws.
- Preserving biodiversity for future generations to enjoy through a balanced approach to resource use and sustainability.
- Establishing a series of protected natural heritage sites.
- Protecting Palestine's natural assets and natural resources.
- Developing Palestinian institutional and human resources in the field of biodiversity.
- Implementing reasonable, biodiversity-oriented coastal and marine zone protection policies.
- Establishing clear biodiversity baselines and change indicators for key and sensitive species.
- Encouraging research and studies into taxonomy, biodiversity, ecology, habitats and wildlife population.
- Promoting landscape preservation and rehabilitation where damage has caused significant changes to ecology and habitats.

4.3 TARGETS

The targets for achieving the established goals are many and varied. These range from ecosystem preservation to public education to policy implementation. Some of these targets are immediate, and others are intended for implementation in the short term. The majority, however, must be implemented over the long term. Of primary importance are the following:

- Setting up natural heritage areas in the form of national, regional and local parks, with various protection levels to serve the intended needs; implementing appropriate biodiversity policies in these areas.
- Rehabilitating natural areas to encourage the natural reemergence or reintroduction of lost species.
- Implementing field measurement and assessment surveys to better understand existing biodiversity and to identify species under threat or presumed lost or extinct.
- Building on previous work for establishing a species list and a red list of threatened species of fauna and flora.
- Setting up the NHPU within EQA (or the entity decided upon).

Such targets are an integral part of any biodiversity policy and are crucial to its success. For example, under the current situation the various environmental and biodiversity laws fall under the jurisdiction of the Ministry of Local Government, Water Authority, Ministry of Agriculture, Ministry of Planning and EQA, among others. Local councils also have legal power over part or all of areas under their jurisdiction. Although these layers of bureaucracy are inevitable, the laws should

be aligned to prevent further loss of biodiversity and harm to ecological areas where such biodiversity is found.

An investigation into the current status of natural areas and their biodiversity is a priority target, to be followed by official declaration of natural heritage areas (whether in area A, B or C). These zones were intended as temporary rather than permanent measures and were not meant as barriers to the protection of biodiversity as a result of Israeli actions.

As a result of many years of neglect of the Palestinian environment, certain negative and exploitive attitudes are emerging among sectors of the population, with negative implications for biodiversity. In order to stem this destructive trend, an educational campaign along with field trips, when possible, must be put in place. While there have been moves towards instituting environmental education in schools, the program is weak and not universally applied. Our environment is our future: this needs to be instilled in K–12 classrooms at all schools and to become part of required university curricula. Over the long term, education is central to stemming environmental deterioration. Such support for environmental education has proven successful elsewhere, and there is no reason why it should not be implemented in Palestine (regardless of the environmental destruction wrought by Israeli occupation).

4.4 Central Components of the National Strategy

- Establishing natural heritage/biodiversity protected areas.
- Encouraging field measurements and surveys of biodiversity indicators, such as a red list, marine trophic index and habitat classification.
- Creating an inventory of species biodiversity and a map of species richness.
- Protecting existing open spaces as biodiversity reserves.
- Balancing exploitation of natural resources with protection of biodiversity.
- Integrating environmental protection laws under one authority with enforcement powers, especially as regards the protection of natural heritage and the prevention of pollution.
- Managing biodiversity collaboratively on a national and international scale, in accordance with CBD guidelines.

4.5 Criteria for Setting Priorities for Ecosystem Conservation

Protection of natural heritage encompasses protection and conservation of ecosystems. This is directly related to conservation of biodiversity. The criteria for setting priorities for ecosystem conservation are similar to those for natural heritage protection. These criteria prioritize ecosystems that:

- Serve as the habitat for rare or endangered species.
- Contain unique natural resources used by diverse species.
- Possess ecological significance.

- Are used by migratory species.
- Have national and political value.

For species, the following criteria apply:

- Rarity.
- Vulnerability.
- Economic significance.
- Genetic reservoir.
- National significance.

5. TOWARDS A BIODIVERSITY STRATEGY IN PALESTINE

Biodiversity relates to the variability among living organisms and the genetic variability within one species. Biodiversity as it exists today took millions of years to evolve, and many believe the evolutionary process is ongoing. Biodiversity is associated with and cannot be separated from ecosystems and habitats, for they are the direct cause of species variability and genetic diversity, shaping organisms into what they are. Conserving ecosystems and habitats or natural areas is thus an integral part of any country's strategy for conserving biodiversity. In Palestine, much work is needed to realize the goals set by the CBD, and, as discussed previously, numerous obstacles stand in the way. This notwithstanding, the following are recommended starting points for moving toward these goals:

5.1 ASSESSMENT OF SPECIES DIVERSITY

Due to the widespread loss of biodiversity in Palestine there is a little information available to make a comprehensive judgment of its existing status. The CBD sets 2010 as the target year for taking effective action to slow or even halt the downward trend in biodiversity levels. Meeting this target requires greater understanding of the existing situation so that it may serve as a baseline for monitoring future changes. Knowledge of the current status of biodiversity allows for more informed decision-making as regards conservation. It will assist in establishing policies that support successful implementation of CBD goals.

Biodiversity assessment is only possible through the use of indicators. The existing situation can be used as a baseline from which to proceed, as it is very difficult to determine the characteristics of past biodiversity in the absence of data. A practical and workable solution is to use the present baseline, with the assumption that biodiversity was richer in past millennia. One can then refer to previous observations when assessing the current situation.

Biodiversity indicators will provide policymakers with the knowledge needed to make decisions regarding conservation of biodiversity on national and local levels. Deriving such knowledge is not simple, however, as assessing indicator data is a complex, though necessary, process. The 13 indicators set by the CBD, include the previously mentioned red list of species, marine tropic index and habitat classification. Information on biodiversity can be compiled on a micro level and multiple micro surveys merged to give a wider picture of the situation. Many of these indicators relate to changes in biomass, habitat and ecosystems.

A number of Palestinian institutions, government bodies and NGOs alike, have worked on aspects of biodiversity and possess relevant data. At present, however, the data is scattered and of limited use; it provides an incomplete picture of a

wider and potentially more serious situation. The creation of a national database is thus among the starting points and priorities. This entails collecting all relevant biodiversity data, sorting it, determining what weaknesses exist and addressing those weaknesses. A central body needs to be set up in the form of the aforementioned NHPU to gather and process all data dealing with biodiversity.

Methods

Reviewing existing information available at EQA, universities and NGOs is among the first prerequisites before conducting expensive, yet necessary, comprehensive field surveys. The available information should be entered into a national database. Currently no institution possesses a comprehensive database; what entity sponsors such a database is not an issue, so long as it is made available on the Internet for all concerned. Sorting through and making sense of existing data is a difficult task to be undertaken by specialists. It is imperative to distinguish data copied from Israeli sources from data of Palestinian origin since biodiversity in Palestine has not been thoroughly researched. Much available data is assumptive, meaning that if the biodiversity profile for a certain species is reported by Israeli sources then it is assumed to have the same profile in Palestine. This may or may not be true and must be investigated. Using Israeli biodiversity figures as a starting point is acceptable so long as they are used wisely and confirmed by field surveys.

As part of data collection, existing public and private collections of fauna and flora, including stuffed birds and mammals, reptiles in formalin or alcohol, insects, arthropods, butterflies and others must be reviewed. This will provide clues as to the presence of certain species that may have become rare or even extinct. Such collections are scattered yet available.

In addition to the above, the methodologies used should include interviews with key knowledgeable people, especially the elderly, to gather knowledge about species. Interviewees should include hunters and fishermen.

Mapping

Mapping is an essential component of creating and improving databases and recording knowledge on biodiversity. Various mapping strategies may be employed, including:

- Maps measuring habitat extent for key species.
- Maps showing species richness, where biodiversity is abundant.
- Maps of natural and semi-natural areas.
- Maps of biodiversity-related natural heritage areas.
- Maps of the habitat range of alien species.
- Maps of threats to biodiversity (e.g., settlements, roads, urbanization and the annexation and expansion wall).

- Maps showing marine species diversity and abundance.

Towards a Biodiversity Plan

The current threats to biodiversity necessitate establishment of a workable biodiversity plan. An essential element of this plan, mentioned earlier, is setting up a system, including requisite infrastructure, for the protection of natural heritage in order to preserve biodiversity. The next logical step is selecting and ranking natural heritage areas, especially those with a biodiversity component, taking into consideration the UNESCO Convention on the Protection of Cultural and Natural Heritage and the directives of the International Union for the Conservation of Nature and Natural Resources (IUCN).

The urgency in adopting a plan is evident from the rapid destruction of many habitats, whether intentionally or unintentionally. The provisional selection of natural heritage sites is less complicated than first appears as governmental and non-governmental institutions have issued many reports on ecologically important areas. These could be considered the initial inventories of areas that, upon official declaration, would be accorded protection. Sorting and ranking these areas would follow at a later stage, identifying the degree of protection appropriate for each. Planned activities in such areas, pending classification, would require a permit from the relevant government authority under whose jurisdiction such permits fall. Once ecologically important areas have been selected and ranked, mapping of species and abundance would follow. All of these activities would culminate in the creation of a red list.

The creation of a gene bank should also be part and parcel of any biodiversity plan. Species are disappearing at a rapid rate, and a gene bank is needed to preserve genetic diversity.

6. CONSERVATION STRATEGY FOR VARIOUS ECOSYSTEMS

Work on Palestinian flora and fauna has only begun, and much additional work is clearly needed. The various ecosystems that contain this biodiversity are not well studied. While a number of publications mention ecologically important areas, no systemic scientific work has been attempted. Thus, selecting ecologically significant areas is a priority within the context of natural heritage protection policy.

6.1 NATURAL HERITAGE AREAS

The Ministry of Planning and International Cooperation (MOPIC) issued *Ecologically Significant Areas in the West Bank Governorates* in April 2000; this is the only publication from which others are quoting. This includes the publication *Biodiversity in the Palestinian Territories,* issued by the Palestinian Central Bureau of Statistics (PCBS) in May 2000. A simple review of these areas indicates that some of the selected sites have local rather than national significance, and others are not natural at all but are planted by humans. Moreover, some are so small that their ecological significance is negligible. It is important to differentiate between recently planted sites and natural ones. There have been and continue to be serious errors in the choice of trees to plant in areas designated for reinstatement. The ecology of Mediterranean flora follows a standard altitude or elevation zone pattern but is also influenced by plant hierarchy or succession for younger green areas. Species diversity changes with elevation and the maturity or age of the ecological site. With time, climax trees take over, with thick under-shrubs that are difficult to penetrate. This is common along the 1948 armistice line, where many areas were left intact, allowing for the reemergence of forests. This is a natural process of regeneration.

6.1.1 Nature Reserves and Parks: Limitations

Various Palestinian publications refer to 48 areas declared by Israel as nature reserves in the West Bank, with a total area of 330,700 dunums. According to these sources, the PNA has not declared other nature reserves in the West Bank. These nature reserves are mostly distributed among the eastern slopes of the West Bank and the Jordan Valley, with a few in the hilly areas of the West Bank. The PNA has designated one nature reserve in Gaza: Wadi Gaza, with a total area of 1250 dunums. Along the Gaza coast, 102 square kilometers have been reserved as a natural resource protection area and areas for tourism.

According to the Ministry of Agriculture, Israel transferred around 25 natural reserves to Palestinians over three phases, in 1995, 1999 and 2000. These reserves, scattered throughout the West Bank, have a total area of 125,542 dunums. ARIJ reports the total area of these reserves at 578,582 square

kilometers. Many of these nature reserves, including the 48 in the West Bank mentioned above, lie in area C, with full Israeli control limiting Palestinian access and restricting possible management.

There are serious obstacles facing the Palestinians in declaring and managing nature reserves, among them the following:

- Many of the actual or potential nature reserves (83 percent) are located in area C, inhibiting Palestinians from officially declaring them as such or even managing them in contradiction of the Oslo agreements of 1993 and the Wye River Memorandum of 1998.
- Around 71 percent of the aforementioned nature reserves are inaccessible due to the annexation and expansion wall Israel is building on much of the Palestinian territories.
- Nature reserves have suffered fragmentation and discontinuity, with destructive environmental consequences, mainly due to the annexation and expansion wall and partly due to infringement on reserves for other purposes.
- The capacity of relevant PNA institutions to manage nature reserves is limited.
- Many stakeholders have "authority" over nature reserves.
- The small size of some reserves creates management problems.
- The reserves must be classified and ranked in order to accord them suitable protection.

6.1.2 The Dead Sea

The Dead Sea should be considered a special natural heritage area as a World Heritage Area. The PNA has filed a request to this effect with UNESCO. The uniqueness of this body of water and the surrounding hills is beyond dispute. It is the lowest and saltiest body of water on earth and is surrounded to the east and west by hills with remarkable geological features. It was mentioned in the old scriptures and referred to by historians. In addition to its natural significance, the Dead Sea has deep-rooted cultural heritage. Further, it is a place of entertainment and joy to its many visitors.

Yet this unique area is under real threat physically and environmentally. Israel's excessive pumping of Lake Tiberias has reduced the flow in the Jordan River, which supplies water to the Dead Sea, to a trickle. Added to that is the excessive pumping of fresh water from aquifers that feed springs surrounding the Dead Sea, thus aggravating the situation. As a result, the sea level has fallen to the unprecedented level of 425 meters below sea level (as compared to around 397 meters below years ago). At the southern end of the Dead Sea, there is a landmass (Al Lisan) that has divided the sea in two.

Exploitation of the Dead Sea's mineral resources predates 1948. This exploitation has intensified with the greater demand on minerals and potash. Table salt is also

extracted from human-made salt pans. These activities also contribute to increased evaporation and the lowering of the water level.

Frequent fires, often caused by picnickers, are damaging some nature reserves, such as Al Fashkha in the West Bank and Ein Gedi in Israel. These two reserves are important for their rare wildlife, as they contain the few exposed freshwater springs in the area. Rather than leave the area in its pristine state, Israel has built settlements and opened roads and practices intensive agriculture of some crops, including date palm. These activities are already affecting biota in this area. Intensive agriculture uses pesticides that are known to disturb ecological balance. Irrigation of agricultural crops exacerbates the situation in two ways: first, by depriving biota of freshwater resources and, second, by causing the dissolution of salt and fine particles deposited over millennia, leading to collapse of the earth in the form of sinkholes. Sinkholes have become a dangerous phenomenon that is bound to affect further tourist development of the region.

6.1.3 The Jordan Rift Valley and Eastern Slopes

The Jordan Rift Valley is the northern extension of the Syrian/African Rift Valley. The Jordan Valley forms the eastern boundaries of the West Bank. It is a semi-arid region falling between Jordan and Palestine. Like the Dead Sea region, it has unique geological formations, valleys *(wadis)* and gorges. It is also dotted by freshwater springs, especially around Jericho. Jericho is known to be the oldest city in the world, an oasis within this arid region thanks to its plentiful springs. The Jordan River bisects the Jordan Valley and serves as the border between Palestine and Jordan.

The area is renowned for its biodiversity, especially in the lower valley along the banks of the Jordan River. It falls along the route of migratory birds, serving as a stopping point where they rest and feed; over 500 million birds are estimated to pass over the Jordan Valley en route from Africa to Europe and Asia and back. The rich biodiversity includes halophytes, which are tolerant of salt and can actually reduce salinity by absorbing salts from the soil. These plants provide food for wild and domesticated animals. Decades ago, an attempt was made to cultivate them as fodder due to their high nutritional content.

The number of species reported in the area, including those along the banks of the Jordan River and the slopes and marshes bordering the Dead Sea are 1458 vascular plants (including some tropical species), 24 mammals, 40 to 50 aquatic invertebrates, 29 bats, 3 amphibians, 21 reptiles, 3 fish species and 150 birds. These numbers, derived from Israeli sources, clearly illustrate the area's wealth of biodiversity.

Israeli and Palestinian agricultural activities are inflicting damage on the ecology of the region through their heavy use of agrochemicals and irrigation with fresh water. Pesticides' impact on bird species and mammals is well established and

seen in diminished fecundity and fertility. The impact on beneficial insects is also evident through the emergence of secondary pests, which became significant due to their predators' reduced numbers. Added to this is the acquired resistance of major pests to pesticides, necessitating the use of large doses of chemicals and the introduction of newer pesticides. This cycle can only be broken with the introduction of environmental agriculture and IPM practices.

The eastern slopes of the Jordan Valley were formerly used as winter pastures for sheepherders. In early winter, farmers used to drive their flocks to graze on the area's grasses, which emerge earlier due to the moderate climate. Farmers have largely been prevented from doing so since Israel occupied the West Bank in 1967. As has become evident with the attempted annexation of the Jordan Valley, Israel planned all along to restrict Palestinian access to the area. Such a move has had adverse effects on the environment as a whole. Farmers are moving their flocks to graze nearly everywhere, causing an ecological imbalance in the areas where they graze as a result of the damage they cause to seedlings and flora more generally. It is well known that uncontrolled grazing is one of the major factors preventing regeneration of forests. In areas where grazing was not permitted, evidence of the emergence of trees and the beginning of forest regeneration is apparent.

6.2 Conservation of Mountains, Terraces, Wadis and Watershed Areas

The United Nations Environment Programme designated 2002 as the International Year of the Mountains (IYM). The aim of IYM was to safeguard the future of mountain and lowland communities by promoting sustainable development of mountain regions. The CBD is in the process of formulating a new thematic program on mountain ecosystems. The IYM established a number of objectives dealing with mountain communities, cultural heritage and ecosystem preservation.

Palestine is endowed with a chain of mountains running from Jenin in the north to Hebron in the south and sloping towards the west and east. It is generally accepted that these mountains, with their twisting valleys and human-built terraces, are of outstanding beauty and comprise an integral part of the natural and cultural heritage of Palestine. They provide food through agricultural activities, shelter through use of their stones as building material and water from mountain aquifers through their watershed areas.

They are also a source of cultural and eco-tourism, which can be developed further to augment the Palestinian economy. Yet these mountains are facing serious ecological threats, among them urbanization, Israeli settlements, bypass roads, stone and mineral extraction, deforestation and intentional felling of trees by the Israeli army and settlers. The face of major earthworks is changing. The haphazard dumping of solid waste, especially along scenic roads, is aggravating the problem. This disturbance of the ecology is having an impact on biota and

biodiversity. Certain plants take advantage of disturbed areas and colonize them, thus changing the equilibrium in plant communities and species composition, which in turn alters habitats and ecological balance.

With encroaching development, watershed areas are shrinking. Rainwater that falls on watershed catchments areas is not seeping into the intended aquifers but elsewhere as the result of runoff, preventing the aquifers' proper replenishment. Untreated sewage from Israeli settlements and some Palestinian areas could also, over the long term, pollute the mountain aquifers. Many Palestinian communities are planning to install or are in the process of installing sewage treatment plants. Few Israeli settlements have such facilities despite an Israeli law requiring all communities to treat their wastes. Chemical leaching from solid waste likewise threatens to pollute the aquifers. On the Palestinian side, there are active projects and planned future projects to construct sanitary landfills. Israeli settlements are mostly using Palestinian dumps to dispose of their waste. The existing dumps are primitive, without lining or proper management. Waste is often burnt to reduce the volume.

Finding a solution to this situation is not an easy task, as there are many stakeholders with vested interests. But introducing laws for conservation of mountains and their ecology is needed. Many models for doing so are in place worldwide and may provide guidance.

6.3 THE MEDITERRANEAN COAST AND MARINE ENVIRONMENT

In December 2001, MEnA (now EQA) issued the Gaza Coastal and Marine Environmental Protection and Management Plan. The first sentence states: "[T]he Gaza coastal and marine environment is facing large and serious threats." This statement accurately reflects the dire environmental situation of the Gaza coastal and marine environment. These threats are the result of external and internal factors. Among the external factors are the environmental consequences of the building of the Aswan High Dam. The dam held back most of the mineral nutrients that were the basic building blocks in a complex food web. It also held back much of the sand that had replenished the sand in Gaza as well as hundreds of kilometers north. This has resulted in a change in biomass and biodiversity. The effects have been visibly apparent in the loss of sand. Fishermen have also been affected and are pulling in smaller catches.

Exacerbating this problem is the dense population in a small geographical area, putting a strain on all natural resources. Solid waste is building up and raw wastewater is seeping into the sea. Added to this is the environmental impact of building the wharf, over-fishing and the potential offshore extraction of gas. The consequences for natural resources necessitate implementation of an emergency plan to prevent a disaster with health and environmental implications.

This situation, in its entirety, cannot be tackled at once. But laws that, for example, control fishing, should be applied, especially those setting a minimum size for caught fishes and limiting seasonal species catch and total catch per fisherman or fishing boat. The use of untraditional fishing methods (e.g., using poisons or explosives) must be penalized. Sewage treatment projects, whether existing or potential, should be activated so that raw sewage does not seep to the sea. These and many other projects aim to halt environmental degradation and initiate a process of gradual recovery leading to conservation.

Databases on marine organisms are urgently needed. The starting point for collecting such data is fishermen, whose catch must be recorded by knowledgeable marine biologists. According to the CBD, the existing fish landing data or marine trophic index presented in the management plan are not true indicators of fish populations, as they were influenced by Israeli closures, which grounded fishermen or limited the offshore area they were allowed to access. But they can be used as indicators while more representative data is collected. Such new data is invaluable for the management of fisheries and species diversity and fecundity. It should include vertebrates, invertebrates and marine algae, microscopic as well as macroscopic. Changes in the composition and diversity of marine algae will impact species diversity. This has occurred in other parts of the Mediterranean and could occur in Palestine.

Recently, Israel began building a "security" sea wall. This sea wall will inevitably divert sea currents, affecting sand deposition and the movements of nutrients as well as fish migration. From an environmental standpoint, this is a dangerous environmental move that will affect Palestine and Israel alike.

Studies are also needed examining the level of offshore pollution. They should include microbial counts, organic pollutants (including priority organic pollutants), heavy metals, radioactive contaminants and volatile organic hydrocarbons (including petroleum residues). Samples should be taken from seawater, bottom sediments and biota for determining the extent of pollution so as to get a grip on what actions must be planned for conservation purposes.

The creation of protected coastal zones and tourist areas is a positive step towards eventual conservation of the marine and coastal zones. Cleanup operations, environmental recovery and, eventually, conservation require substantial but worthwhile investment.

Sand dunes are ecological habitats that must be properly managed. Although sand is invaluable as a building material, there should be a balance between excavation and natural replenishment. Natural replenishment has obviously been reduced by sand being trapped behind the Aswan High Dam. This necessitates the study of sand replenishment so as to maintain ecological balance on shore and in the sand dunes.

Biodiversity in the Gaza Strip is poorly understood. A comprehensive study is needed covering terrestrial and marine environments. Data derived from Israeli sources is neither adequate nor comprehensive. Existing Palestinian data is also not comprehensive and does not provide a picture of the Gaza environment.

6.4 AQUATIC ECOSYSTEMS

The aquatic ecosystems include wetlands, rivers and springs.

6.4.1 Wetlands

There are a few wetland zones in the West Bank; most have been drained or built over. Some of these are seasonal, meaning they flood in winter and dry up in summer. These flood zones have served as a refuge, providing feeding and resting stations for migratory waterfowl and a home for amphibians. Examples include the two flood *(balou')* areas of Al Bireh and Beitunia and Marj Sanour in the Jenin area. The remaining amphibians living in such flood areas face serious risk of extermination.

Wadi Gaza is the largest of the wetlands and has received special attention and a rehabilitation plan. But much work remains, as there are recurrent infringements on this ecologically prized area through waste dumping and other human activities.

6.4.2 Rivers

The Jordan River remains the largest and only year-round flowing river in Palestine. This river is facing serious ecological disaster: its water is becoming increasingly less as Israel diverts water from Lake Tiberias to its national carrier. Aggravating this problem is the low quality of the river's water, which is saline due to the washing of agricultural land to remove salts and the draining of salty springs into it. The wetlands and marshy areas along the river have been also affected; these were once rich with diverse species. The current status of biodiversity in the river and along its banks is not known, as Israel considers it a security zone and prohibits Palestinians from accessing it.

6.4.3 Springs

Palestinian sources report 527 springs in the West Bank, of which 114 have a minimum discharge rate of 0.1 liters per second. Springs are home to invertebrates (e.g., snails), crustaceans (e.g., crabs) and some fish species. Some of these springs are located within urban boundaries, as towns and villages were built around them. Use of these springs for domestic water supply is extremely limited; use for irrigating crops is more widespread.

Water quality in the springs is variable but generally acceptable, though salinity is on the increase in some—mainly as a result of over-pumping of aquifers. A study of selected springs conducted by the Palestinian Ministry of Health showed the presence of microbial contamination from sewage. This is true for the spring outflow area, where human and animal activity occurs, but may not be true for the spring as a whole. Further investigation is needed.

A study of aquatic species populating springs and their dynamics is also needed as part of environmental protection and conservation strategies. Such a study could include aquatic and other plants and fauna, depending on the particular spring.

7. CONSERVATION STRATEGIES FOR SPECIES OF FLORA

7.1 DATABASE OF PALESTINE'S FLORA

A database for Palestine's flora is urgently needed. The scattered data from Palestinian institutions on flora, including the red list, are a good starting point to build on. The database should be centralized and managed by an institution. Data from relevant sources can be fed into it. The methodologies used will have to include searching the existing databases of Israeli sources, such as ROTEM, but the data therein should be sorted to determine which is exclusive to Palestine. The methods should also include field surveys to test the validity of available data and determine any necessary revisions.

7.2 RED LIST OF PLANTS

In 2002, BERC published the *Red List of Threatened Species*. As mentioned previously, this is a positive step but needs further development and field-testing. There is no mention in this publication of the scientific methods employed for gathering and testing data. Any red list should be coupled with geographical information system (GIS) data so as to facilitate management of threatened species.

7.3 CONTROL OF ALIEN SPECIES

A study of alien species, either intentionally introduced or invasive, is missing from Palestinian biodiversity information. This gap must be filled through the proposed database and field surveys. A strategy to control alien species, especially those that are aggressive, is dependant on knowledge of the species itself, geographic distribution and breeding characteristics.

7.4 WILDFLOWER PROTECTION CAMPAIGN

Palestine is among the richest countries in wildflowers as a result of its varied geophysical characteristics and the different ecosystems within a small geographic area. In spring, when abundant wildflowers emerge, tourists are dazzled by an array of colors within a small area. Some of these plants, the rare ones in particular, are on the verge of extinction due to grazing and handpicking. A campaign for wildflower protection and conservation is urgently needed. This should be coupled with enforcing laws to deal with persons who pick wildflowers or graze animals in protected areas.

Some Palestinian institutions have attempted to raise environmental awareness at the school, public and government level. Unfortunately, their impact has been limited and has not been studied. NGOs and universities could execute a

wildflower protection campaign, but, to succeed, it must part of government policies.

Neither the Palestinian Environmental Law of 1999 nor the Agricultural Law of 2003 refers to wildflowers specifically in the clauses on plant protection. This is a real weakness in the legislation, as wildflowers in Palestine are a special feature meriting special protection.

7.5 MEDICINAL PLANTS

Palestine is rich in wild medicinal plants, which, as part of indigenous knowledge, are used in folk medicine. Recently, there has been renewed interest in such plants, mainly for domestic use in herb spicing. A few researchers at Palestinian universities have carried out scientific work on extracts from such plants. Unfortunately, such research has not received the funding it warrants and has thus been limited to individual (though valuable) efforts.

Given adequate support and funding, potential exists for discovering important medications derived from local medicinal plants that are not commercially exploited or cultivated on a large scale. Palestine's environment is conducive to the propagation of plants with medicinal characteristics. Medicinal folklore must be translated into scientific research to investigate its applicability in producing effective drugs.

8. CONSERVATION STRATEGIES FOR SPECIES OF FAUNA

The first step towards a conservation strategy for fauna is creating a database, which would include a red list of threatened species. The existing data are mainly derived from Israeli sources and were not field-tested. Most available field data is on birds, including migratory birds.

8.1 REINTRODUCTION OF FAUNA: LIMITATIONS AND POSSIBILITIES

Reintroduction of fauna is an attractive option in areas where they have become rare or are on the verge of extinction. This option is only possible if an entity for the protection of natural heritage is formed (or at least a well-staffed entity for national parks and reserves). Examples of successful reintroduction of fauna abound in neighboring countries and worldwide. These include the introduction of herbivores and carnivores. One important carnivore to consider reintroducing is the wolf, with an aim towards controlling the population of herbivores such gazelles and wild boars.

Successful reintroduction of fauna must be coupled by special programs for their protection, including campaigns for raising awareness of the benefits of such measures. It also should be paralleled by political progress, since management of reintroduced species, especially in natural reserves, will be difficult to accomplish with Israeli restrictions in place.

8.2 ACTION PLAN FOR RAPTORS: LIMITATIONS AND POSSIBILITIES

Various sources and observations indicate a serious reduction in raptor biodiversity. There is a multitude of contributing factors, including:

- Shrinking and loss of habitat.
- Reduced food sources.
- Contamination of raptor food by pesticides, resulting in reduced fecundity.
- Illegal hunting.
- Illegal trade in raptor offspring.

Raptors are ecologically important for keeping the environment in a state of balance. Although laws prohibit hunting or trapping them, public awareness of their importance is extremely limited. Thus, viable, worthwhile options include conducting awareness campaigns and exploring possibilities for breeding raptors in captivity and then reintroducing them in the wild.

8.3 CONSERVATION POLICY FOR INVERTEBRATES: LIMITATIONS AND POSSIBILITIES

There is no adequate assessment of invertebrates in Palestine. Israeli sources estimate their number at 30,000, but they too lack a comprehensive list. The use of agrochemicals, along with habitat destruction and environmental pollution, is affecting population dynamics and causing an imbalance in prey-predator relationships. This is clearly evident in agriculture. Large populations are emerging among what, years ago, were inferior pests kept under control by predators. In addition, alien species are appearing and spreading in the absence of their native predators.

A database needs to be created of existing invertebrates. As part of this process, insects and other invertebrates in private collections should be entered into a database. Existing data from neighboring countries should be sorted and tested in the field to determine its validity in Palestine. Pursuing a profession in entomology should be encouraged. Existing experts in taxonomic entomology should be encouraged to seek funding from biodiversity-related funding resources.

A management plan for the conservation of invertebrates should be included in any biodiversity conservation plan. Invertebrates are part and parcel of the food web, thus benefiting all biological species.

8.4 Action Plan for Conserving Insectivorous Bats

Insectivorous bats are beneficial mammals worthy of protection and conservation. The number and species diversity of bats in Palestine has not been documented, but they are clearly becoming rare in many localities.

As with flora and other fauna, studies are needed to create a database on bats in general and with an emphasis on insectivorous bats. Existing data should be incorporated in this new database. A red list of threatened bat species should be included.

Conservation strategies for bats must include monitoring their preferred food, feeding grounds, roosting places and, when necessary, breeding programs in captivity.

8.5 Conservation of Amphibians

Israeli sources report six existing amphibian species, with the seventh species believed extinct. Palestinian sources, possibly derived from Israeli sources and those of neighboring countries, refer to the same number. Amphibians in Palestine and, indeed, worldwide are experiencing a serious threat to their existence due to accelerated habitat loss, as the seasonal wetlands where they breed are disappearing. The drying up of many springs is aggravating this trend, causing further destruction to wet pools, their breeding grounds.

A survey of amphibian species and their habitats and breeding characteristics is an important part of biodiversity conservation due to the major role that amphibians play in controlling insects and some vermin. No such programs currently exist. Such programs should be seriously considered and implemented as part of biodiversity activities.

9. CONSERVATION STRATEGY FOR GENETIC RESOURCES

9.1 THE PALESTINE GENE BANK

The establishment of a gene bank for Palestinian flora, with a particular emphasis on agricultural crops, is already part of EQA and the Ministry of Agriculture's biodiversity strategies. MEnA (now EQA) proposed a $1.3 million program (NBSAPP, April 1999) for establishing a gene bank in Palestine with a host of Palestinian institutions as partners. There was likewise an attempt to start a gene bank at ARIJ years ago; the fate of this project is not clear, but there are field activities involving planting some collected landraces for seed conservation, propagation and morphological selection. This is due to the lack of facilities with temperature control. Currently, a gene bank is being formed at BERC. This is a positive step but requires long-term funding to ensure sustainability.

The formation of a modern gene bank should entail collaborative efforts by the government and NGOs, although one institution may assume responsibility for management. The scattered valuable efforts must be coordinated within a clear, well-designed plan with practical objectives. The government's role should be more policy-oriented than operational; creating a gene bank requires various specialties and adequate facilities, needs bound to overburden government resources.

9.2 *IN SITU* CONSERVATION: LANDRACES AND OLD CULTIVARS

Many researchers believe that key crops, especially grains and some fruit trees, originated in Palestine but are rapidly disappearing due to loss of habitat and uncontrolled grazing. Although the creation of a gene bank is of utmost importance, *in situ* conservation is needed. A few institutions, prominent among them ARIJ and BERC, are propagating landraces (commonly known as *baladi*). This entails collecting seeds, planting them and selecting certain morphological features for further investigation.

In situ preservation through habitat conservation of wild cultivars is not being practiced. It necessitates creating nature reserves and natural heritage areas, which the Palestinians find difficult under Israeli occupation. However, the loss of wild relatives of existing cultivars is a loss for all of humanity, as they provide genes that may help improve the genetic makeup of domesticated cultivars.

9.3 BIOTECHNOLOGY AND SUSTAINABLE USE OF GENETIC RESOURCES

Biotechnology is an important tool for helping improve domesticated cultivars and produce certain biochemical products for commercial use. Unfortunately,

biotechnology infrastructure in Palestine is extremely limited and in need of substantial resources. A biotechnology unit was active at Bethlehem University and one is being prepared in Hebron. This is a constructive start, but ensuring sustainability through continued funding is crucial to success, as is having well-trained staff. Again, higher education institutions, with the encouragement of the Ministry of Education and Higher Education, need to set down a long-term plan to support applied research in biotechnology areas.

10. MONITORING AND EVALUATION

10.1 GEOGRAPHICAL INFORMATION SYSTEMS AND REMOTE SENSING

There are two important GIS databases in the country. The first, mainly concerned with mapping, is located at the Ministry of Planning, and the second, concerned with Israeli settlement activities and the annexation and expansion wall, is located at ARIJ.

Existing biodiversity data related to various geophysical characteristics (e.g., climate, soil type, water resources and archeological sites) must be integrated into a comprehensive GIS database. This is an ambitious but necessary project, as it would provide researchers with information necessary for biodiversity planning and management and the aforementioned biodiversity indicators. Such a database should be dynamic, growing continuously with the addition of new data. The institution housing this GIS database is irrelevant so long as it has adequate resources and is well funded. To assist in sustainability, the host institution could raise funds through membership and provide services for a fee.

Currently, ARIJ is best equipped to deal with GIS data and extract information through remote sensing. Such data is necessary for establishing biomass, land use and land cover. Yet the facilities at ARIJ need further development and funding to attain desired national goals. Unfortunately, resolution of aerial photographs depends on whether they are taken in area A, B or C. Resolution in area A is acceptable but limited in area B, while in area C Palestinians are not eligible to request aerial photographs. Resolution and thus accuracy is limited to 2.5 meters.

GIS and remote sensing are tools that can be employed in biodiversity-related activities, which can be planned after establishing biodiversity indicators. Such activities include monitoring and evaluating environmental impact and possible damage to natural heritage, biodiversity and its assorted components. They further include monitoring and evaluating land cover conditions, changes in land use patterns and ecosystem viability. Likewise, the effect of climate change and its impact on biodiversity must not be ignored. The indicators utilized to assess changes in biodiversity should be measurable so as to show alterations in the environment that affect biodiversity. Together, these activities will support the acquisition of knowledge about changes in the status of and trends in biodiversity resources.

Evaluations of progress in biodiversity-related activities can be performed by tracking positive changes in policies and the legal framework for protecting natural heritage and biodiversity, as well as by monitoring implementation of biodiversity-related projects. Changes in the use of biodiversity resources and their sustainability could likewise be measured and evaluated.

11. ACTION PLAN AND NEEDS

11.1 UNIT FOR THE PROTECTION OF NATURAL HERITAGE

Throughout this report, there was mention of the need to establish an entity or unit for the protection of natural heritage. Such a unit is needed to set policies for biodiversity conservation. Previous work on this issue led to a proposal for creating an "authority for the protection of cultural and natural heritage." The natural heritage component was removed as a result of inter-ministerial objections relating to jurisdiction. The proposed NHPU is crucial to successful implementation of biodiversity conservation policies. Biodiversity is a component of natural heritage and cannot be separated from it; protection of natural heritage is the protection of biodiversity and much more.

The setup for this required unit can be discussed among relevant Palestinian ministries, but its membership should include universities, research institutions and NGOs. A proposed setup was put forth in the course of work by Birzeit University and could be used as grounds for further development. This proposed setup also included laws for protecting natural heritage, which could be incorporated as bylaws within the Environment Law. The unit could be semi-autonomous and headed by a minister. At this stage, situating it within EQA would be the most logical arrangement. This will mean major organizational changes within EQA, as NHPU activities would be extensive.

11.2 DATABASES

Databases relating to fauna and flora do exist but need further investigation into their validity, as much of their data derives from Israeli sources. This is acceptable so long as selective surveys are conducted in the field. The creation of a valid Palestinian fauna and flora red list is strongly needed.

11.3 NATURE RESERVES AND PARKS

Palestinians must officially declare their own nature reserves and parks. It is not enough merely to go along with Israel's selections. These could be valid but need further investigation. The declaration of nature reserves and parks should follow the aforementioned, standard international procedures as regards ranking areas and determining the level of protection for each.

11.4 BIODIVERSITY PROTECTION CAMPAIGNS

Regular national campaigns are needed to raise awareness among the public and policymakers as to the importance of biodiversity for the wellbeing of Palestinians. While such campaigns have occurred, their impact was not adequately researched. Daily practices among the bulk of the Palestinian population show a decline in care for biodiversity, principally as a result of the

difficulties of daily survival, which make environmental issues secondary priorities.

Palestinian curricula have begun introducing environmental issues, but the majority of specialists believe that much more could be done. The subject of environmental protection and biodiversity could be expanded and supplemented with fieldtrips. This implies that educators need to expand their knowledge of biodiversity-related subjects.

11.5 GENE BANK

In order to preserve wild cultivars of domesticated plants and landraces, a national gene bank should be established. This could be an extension of BERC's gene bank or as otherwise determined.

11.6 BOTANICAL GARDENS

Botanical gardens are beginning to appear in urban and rural areas. Cultivation of botanical gardens featuring native plants as a means of conserving them has been limited, however, as propagating and maintaining wild plants is difficult and requires specialists.

11.7 REFORESTATION

A reforestation campaign is part of Palestinian policies but is impeded by Israeli military orders restricting Palestinian tree planting in many areas, including in areas B and C. The proper combination of trees and shrubs must be carefully studied to recreate a forest.

ANNEX I

IMPORTANT BIODIVERSITY AREAS IN PALESTINE

Sources:
Wildlife Society (1999). *Important Bird Areas in Palestine.*
MOPIC (April 2000). *Ecologically Significant Areas in West Bank*

Some areas in Palestine have special environmental significance: they are home to various important species of plants and animals not commonly found elsewhere and also have significant geophysical features. These areas should receive much care and protection. Moreover, the Palestinian population should have the chance to enjoy them. They include the following:

Um Al Rihan Forest
District: Jenin
Area: 11,000 dunums
Elevation: +400 – 475 meters
Coordinates: 32 32`N 35 09`E

Description
Um Al Rihan forest is a reserve that contains more than 3000 dunums of dense natural woodlands. It is located west of the city of Jenin, near the Green Line separating the Palestinian lands occupied in 1948 and those occupied in 1967. Many villages in the Jenin district fall within this region, among them Alkhulgan, Anin, Ein Alsahleh, Tourat Alnazaleh, Um Alrihan, Yabad and Zuba.

Um Al Rihan, rich in genetic diversity and wildlife, is considered a natural reserve area and should be classified as a national park. Most of the forests in Um Al Rihan are natural, although reforestation has been practiced in the area.

Um Al Rihan is a protected region with an ecosystem resembling that of Mediterranean forests. It is also part of the semi-coastal zone. Considered to be among Palestine's natural and cultural heritage areas, it contains Roman and

Palestinian historical sites in addition to rich biodiversity. During the British mandate over Palestine in the twentieth century, the peculiarity of these forests attracted the attention of the British delegation, leading to appointment of a person from Turat Al Nazaleh village to guard and develop the site.

A path 1300 meters in length was opened to allow visitors to enter deep into the forest. The marine influences in this region do not affect the forest, since mountains or hills block the sea winds. Various kinds and types of plants and trees inhabit the region, among them pines (Pinus spp.), cypresses, carob trees (Ceratonia celequa), oak trees (Quercus spp.), thorny burnets, Atlantic pistachios (Pistacia atlantica) and Christ thorn. Annual rainfall ranges between 400 to 450 millimeters; annual average temperature ranges between 4.2 to 36.9 degrees Celsius; and relative humidity is around 65 percent. Terra rosa soil predominates, with 25 percent of the area being rocky.

Birds and Animals

The most important characteristic of this region is its semi-coastal location and its position along the route of migratory and other birds moving from the coast to the mountainous regions and the Jordan Valley. The most important birds passing through the area include the white stork, with 2000 birds registered in the spring of 1999. The lesser kestrel may also be present, as it was sighted in the past; the honey buzzard is among the region's migratory birds; and the Egyptian vulture is a resident bird that also breeds in the region. Mammals, such as gazelles, wild boars, foxes, striped hyenas and the Palestine jungle cat, also inhabit the area.

Wadi Gaza Region

District: Gaza
Area: 1250 dunums
Elevation: +0 – 6 meters
Coordinates: 31 35`N 34 27`E

Description

This is a wetland region following the coastal system of the Mediterranean Sea. The source of Wadi Gaza is located near Al Samou village, south of Hebron. From there, Wadi Gaza crosses the Naqab desert and finally opens out into the Mediterranean Sea, south of Gaza City. The last nine kilometers of its course fall within the Gaza Strip itself, making Wadi Gaza the largest valley in Gaza.

The valley is considered an ecologically significant natural

heritage area. It is one of the few remaining undeveloped natural areas in the Gaza Strip and serves as a natural habitat for migratory and endemic birds. Some bird species ranked as rare or endangered by IUCN still find the valley an ideal place for feeding during migration. Threats to Wadi Gaza's environment stem mainly from wastewater and solid waste pollution, disposal of construction debris in the valley bed, encroaching urban development, depletion of resources from overgrazing, tree cutting, hunting and the construction of a bridge (which restricts biotic exchange with the sea).

Plants
Regional plants include a variety of freshwater and brackish water plants.

Birds
Water birds and migrant birds, some of which are threatened globally, are found in Wadi Gaza.

Bird species that pass through the region in large numbers include the glaucous gull, greater flamingo (observed in January 1998), night heron, shoveler, great cormorant (which spends winters in the region) and crane (observed in the past, though its current status is unknown).

The white pelican passes over the region during its migration and is registered as a crossing bird. The common tern can be found in large numbers, reaching as many as 2000 birds, some resident and others migratory. The great black-headed gull still lives on the Dier Al Balah shore.

Wadi Al Quilt Region

District: Jerusalem
Area: 1500 dunums
Elevation: -100 – +350 meters
Coordinates: 31 50`N 35 24`E

Description
This area, part of the Jerusalem wilderness desert, is classified as a natural protectorate, with outstanding natural and historical characteristics. It is considered among Palestine's rich natural and cultural heritage areas. Its environmental system represents the desert and the Jordan Rift Valley. It has unique geological features, with towering hills and steep valleys, and is also rich in springs. Water flows from barren rocks and forms small and large waterfalls toward the Jordan Valley and the Jericho district. Indeed, the region is considered one of the most striking in Palestine in terms of natural beauty and is one of the

popular hiking areas for Palestinians and foreign visitors alike.

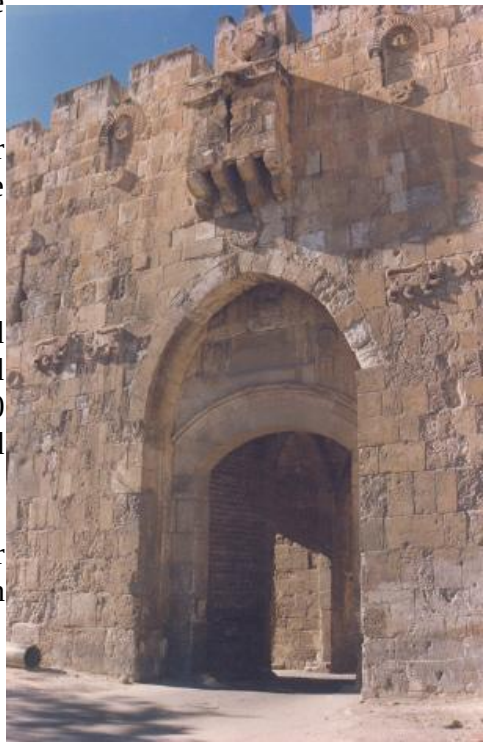
Animals
Animals found in this region include the rocky hyrax, gazelle and wolf.

Plants
The area is rich in seasonal plants and grasses that bloom in spring, among them the rare Jericho rose. Plants dry up in late spring as precipitation is low and the temperature rises quickly during this season. Grazing animals are found from late winter until mid-spring.

Birds
There are many endemic birds species, including the house sparrow, Spanish sparrow, blackbird, fan-tailed raven, common swallow, collared dove, white-breasted kingfish, European bee-eater, cattle egret, eagles, owls, bonellis eagle, Tristram's grackle and Palestine sunbird.

Walls of Jerusalem
District:Jerusalem
Distance:5 kilometers
Height:+750 meters
Coordinates:31 52 `N35 13 `E

Description
UNESCO declared this site a cultural heritage area. Population density in the area is high, and, environmentally, the walls of Jerusalem follow the basin of the Mediterranean Sea region.



Importance of the Site
The walls of Jerusalem and the high buildings provide shelter to certain birds, especially the lesser kestrel, which Birdlife International (Middle East Division) classifies as threatened.

Birds
The lesser kestrel is one of the internationally threatened birds found in this area. It nests in the walls of Jerusalem and the old buildings within the walls every spring. About 80 nestlings were registered during the past few years. This bird eats mice, insects and reptiles.

White storks and many other migratory birds also pass over the east side of the city of Jerusalem during their migration (especially over the Mount of Olives, east of the Old City).

Jerusalem Wilderness Region

District: Bethlehem/Hebron
Area: 150 square kilometers
Elevation: +250 – 600 meters
Coordinates: 31 42`N 35 19`E

Description

This area extends from southeast of Bethlehem to the south of Hebron, where it extends to the mount surrounding the Dead Sea. Many striking valleys are found within this semi-desert area. One valley considered among the more beautiful areas is Ra'as Al Hemar, located within Wadi Khretoon, southeast of Bethlehem. It is rich in cultural heritage and has some Christian monasteries dating back to the Roman and Byzantine eras. Mosaics from these eras can still be found there. The area slopes east to the Dead Sea and southeast to Ein Gedi.

Animals

The most important animals of this region are the capra ibex, gazelle, rocky hyrax, fox, hyenas, wolves and rare spotted leopard.

Birds

Large raptors are found here, especially the Egyptian vulture, a prominent resident living and breeding in the area. The griffon vulture is also found at the western site of Al Fashkha and the Dead Sea.

Mar Saba – Wadi Qidron

District: Bethlehem
Area: 2000 dunums
Site: East of Bethlehem
Coordinates: 31 43`N 35 21`E

Description

This is an agricultural and grazing region located in the center of the Jerusalem wilderness area in the southern portion of the Bethlehem district. It is rich in cultural and natural heritage. The historic Mar Saba Christian Orthodox monastery, built around 300A.D., is located near Wadi Qidron. The valley extends from the city of Jerusalem to the Dead Sea.

Wadi Qidron has a lasting stream starting in Jerusalem, but it is heavily contaminated by untreated sewage from Jerusalem, the Bethlehem district and Israeli settlements. This region contains Christian religious and historical sites and archeological ruins dating from the fifth century and earlier. At present, animals and birds use these areas as shelters during winter and breeding times.

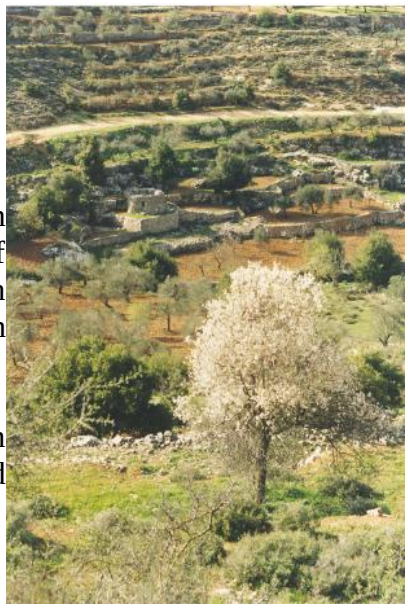
Plants
The region contains an extensive variety of endemic plants, most of which flower during spring.

Animals
Animals of the region include the gazelle, rocky hyrax, fox and hyena.

Birds
Resident birds in the monastery region include the lesser kestrel (with a population of ten couples recently nesting in the walls of the Mar Saba monastery), sand partridge, Tristram's grackle, Egyptian vulture and Palestine sunbird.

Wadi Al Makhrour

District: Bethlehem
Area: 3000 dunums
Elevation: +913 meters
Coordinates: 31 40`N 35 09`E



Description
This natural and agricultural region is located in the western part of the city of Bethlehem and on the lands of the town of Beit Jala, Battir village and the Cremisan Christian monastery. The region contains some springs and fresh water, along with thick forests.

This area is also rich in cultural heritage, with old Roman tombs and wells scattered everywhere, along with old Palestinian watchtowers *(qaser* or *mintar).*

Birds
Scores of birds pass through the region when migrating from Africa to Europe and Asia during spring and autumn. Registered birds include the honey buzzard, black-eared wheatear, Palestine sunbird and sand partridge. The golden eagle used to be resident in this area as well.

Al Fashkha Region

District: Jericho
Area: 25 kilometers
Elevation: -390 meters
Coordinates: 31 42`N 35 28`E

This is a protected wetland area on the shores of the Dead Sea near the city of Jericho. It contains large quantities of fresh water and brackish springs.

Along the Dead Sea's northern borders from the west side there are three springs: Al Gazal, Tanour and Al Fashkha. Average drainage from these springs is about three million cubic meters per year. The oasis of Al Fashkha is about 1.4 kilometers wide and 5 kilometers long. This region is one of the few areas in Palestine containing a wide variety of wetland plants in and around the springs. The springs are fed from the aquifers of the eastern slopes, which are in turn replenished by rainfall in the West Bank.

The oasis contains artificial pools, some created prior to 1976. In addition, there are natural pools and springs containing fresh water, providing the habitat for a wide variety of fish species.

Plants

The plants in this region belong to the semi-tropical climate and include dates, palms and plants of African origin. Cane covers the wetland areas. Halophytes are abundant; many wild herbivores, such as the ibex, graze upon them.

Animals

This region is famous for the ibex, gazelle, rocky hyrax and wolf. Several species of fishes and crustaceans are also found in the springs.

Birds

The oasis of Al Fashkha springs is an important wetland area for migratory and endemic birds. The area is the habitat for threatened species, such as the Dead Sea sparrow and lesser kestrel. Other birds include the night heron, griffon vulture and white stork, large numbers of which pass through the area.

Jericho Region

District: Jericho
Area: 35 square kilometers
Elevation: -360 meters
Coordinates: 31 51`N 35 27`E

Description

The city of Jericho is one of the oldest documented cities in history. Human presence and activities in the area date back tens of thousands years. The area is rich in natural and cultural heritage sites.

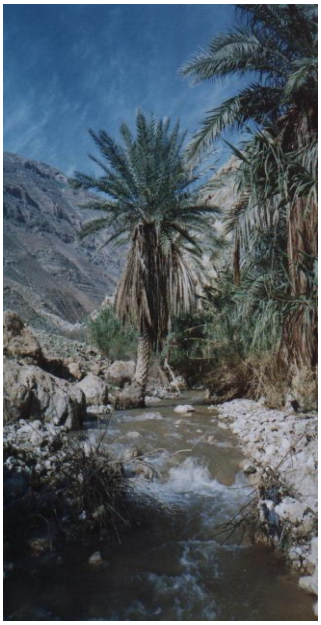
The high mountains to the west of Jericho are considered a good habitat for raptors, such as the lesser kestrel during its migratory journey. Moreover, the area is rich in biodiversity, especially along the banks of Jordan River, one to two kilometers east of Jericho. The Israeli occupation forces control the area and prohibit Palestinians from entering or accessing it. A wide variety of endemic and migratory bird species with global importance inhabits the area.

Animals

The caracal, lynx, mongoose, wolf and hystrix are found in this region.

Birds
Abundant bird species nest on the mountains west and north of the city. These include the lesser kestrel, honey buzzard, white stork and black stork, the latter of which appear in a large numbers during their bi-yearly migration. A subspecies of the sand partridge also lives and breeds in this area. The tawny owl is a resident bird in the center of the city of Jericho, and the lapwing and Barbary falcon also reside in Jericho.

Al Oja Spring Region
District: Jericho
Area: 8500 dunums
Elevation: -100 – +100 meters
Coordinates: 31 57`N 45 26`E



Al Oja spring is located about 20 kilometers northwest of the city of Jericho in the Jordan Valley, extending east to the Jordan River. The area is a protected wetland but also the site of intensive agriculture. It is a natural heritage area, and Palestinians often use it for picnicking. The Israelis excavated wells at the mouth of the spring and the slopes to the west, drastically reducing spring output (to the extent that it completely dried up a few years ago).

Plants
A total of 77 species belonging to 28 families have been recorded, and 200 species are estimated to exist along the Jordan River's banks.

Animals
The area is famous for the rocky hyrax, gazelle, hystrix, fox, hyena and wolf. Fish species, snails and crustaceans, such as crabs, also live in the spring.

Birds
The eagle, lesser kestrel and night heron are found in the area (the latter of which is becoming a resident bird and is breeding in the region). The griffon vulture passes through during migration. The Egyptian vulture is a resident bird and breeds in small numbers in the mountainous areas. The chukar is a registered bird that lives in the Al Oja region, though the population of this bird is currently unknown. The falcon is another resident bird breeding in this area. In addition, scores of migratory species pass through the Al Oja spring region.

Wadi Al Quff Region
District: Hebron

Location: Wadi Al Quff/Beit Kahel
Area: 24500 dunums
Elevation: +600 – 700 meters
Coordinates: 31 33`N 35 07`E

Description

This is a large region located west of Hebron and planted with wooded trees. The area is rich in biodiversity because of its trees and plentiful water. There are also springs, among them Al Sukar, Al Haska and Al Majnounha.

Animals

Animals in this region include the hyena, hystrix, wolf, common badger, rabbits, hares, gazelles, wild boars and other mountain-region animals.

Birds

Birds in this region include the white stork (which passes through in the spring), lesser kestrel, lesser spotted eagle, roller, rock dove, finch, sand partridge, hudhud, white wagtail, European bee-eater and yellow-vented bulblul.

Um Al Safa Region

District: Ramallah
Area: 1500 dunums
Elevation: +600 meters
Coordinates: 32 01`N 35 09`E

Description

This is a protected area located northwest of the city of Ramallah and consisting primarily of natural forest. The area's topography consists of mountains, valleys and hills. Some springs are located downhill, north of the forest, and others are found nearby. Agricultural activities are largely limited to producing olive oil from the native olive trees.

Birds

The white stork passes through the region during its spring migration; the lesser spotted eagle and the Palestine sunbird are also registered species of the region.

Qenya Springs Region

District: Ramallah
Area: 3500 dunums
Elevation: +500 – 600 meters
Coordinates: 31 55`N 35 08`E

Description

Ein Qenya is an agricultural area, part of the environmental system of the western Jerusalem heights. Qenya springs comprise a protected area located northwest of the city of Ramallah and about nine kilometers north of Qenya village.

Agriculture in the area is dependant upon irrigation sourced from the spring. Typical plants include vegetables and some citrus plants.

There are many springs in the area, among them the well-known Al Balad spring. Other springs include Wadi Al Dalb spring, located in the north of the village and consisting of several lasting springs—Al Harashah spring, Kafrieah spring and Al Janaien spring—which flow year round in the valley, eventually reaching the Mediterranean Sea through Wadi Al Mallaki.

Qenya springs are characterized by ancient ruins, such as the Romanian cave on top of the mountains and old olive trees from the Roman era.

Animals

Animals living in this area include the gazelle, hystrix, wild boar, common badger and fox.

Birds

Because of its richness in natural resources, such as water and trees, this area is considered a preferred area for endemic and migrant bird species, among them the white stork, yellow-vented bulbul, eagle (a resident bird that also breeds in the region), great tit, roller, common dove and collard dove, linnet, chukar, hudhud, white wag-tail and European bee-eater.

ANNEX II

PALESTINIAN BIODIVERSITY RESEARCH AND STUDY

Creation of the Red List of Threatened Plants for the West Bank and Gaza Strip

The study has attempt to identify threatened plant species in the West Bank and Gaza based on available information on these species, including their taxonomy, species range, population trends, main habitats, major threats and conservation status.

The list has been compiled from previous surveys and studies and from local surveys performed by BERC. The list contains, for each species, the following information: Latin name, common name, geographical region, growth form, abundance, endemism, attractivity, habitat vulnerability, dynamics and blooming time.

Species listed in the Red List of Threatened Plants have been classified and ranked according to their abundance, endemism, attractivity, habitat vulnerability, dynamics and blooming time.

Abundance: CC = Very common; C = Common; RP = Potentially rare; R = Rare; RR = Very rare; X = Extinct.

Habitat Vulnerability: V = Vulnerable to destruction; VV = Very vulnerable

Dynamics: D = Number of sites has declined by at least 30 percent for the last 35 years; ND = Number of sites has not declined for the last 35 years; Epi = Episodic, occurs in very few sites (one to five), in which very few specimens have been found and the occurrences are not stable.

Attractivity: 1= Attractive; 2 = Very attractive.

Endemism: P = Historic Palestine; PSS = Palestine and costal Sinai or southern coastal Lebanon; PS = Palestine and Sinai; PST = Palestine and southern Turkey; PLWS = Palestine, Lebanon and Western Syria; PJ = Palestine and Jordan; PSL = Palestine, Syria and Lebanon; PL = Palestine and Lebanon; PDM = Palestine, Jebel El Arab.

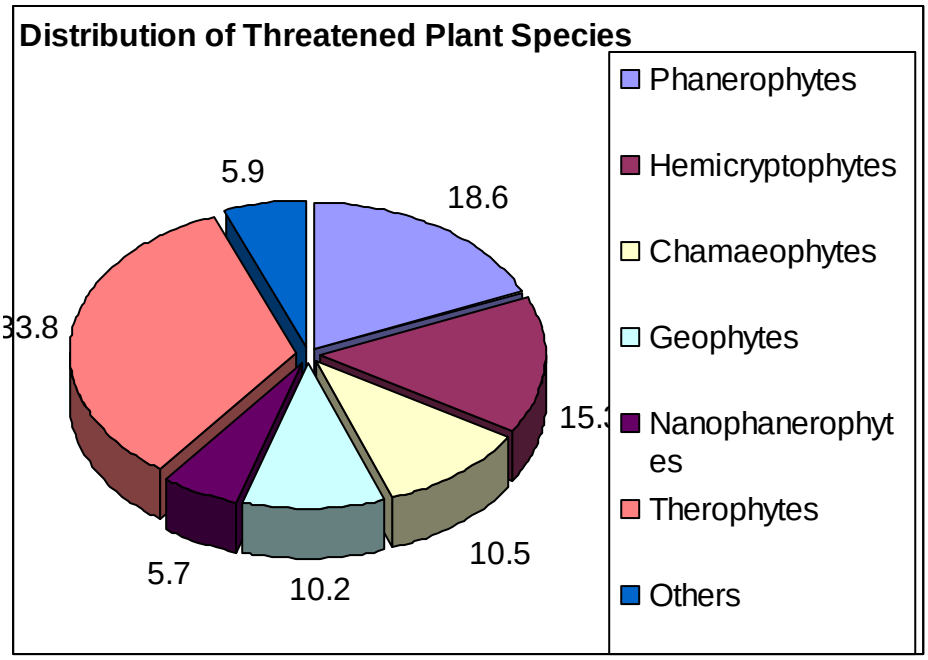
The IUCN 1994 Red List categories could not be adopted since there is insufficient information available for the targeted species.

The red list contains 334 threatened species belonging to 222 genera and 81 families; the total number of species in historical Palestine was 2953 species belonging to 908 genera. The large percentage of threatened plants relative to the number of species in historical Palestine is a significant indicator of the size of the

threat facing floral biodiversity. It likewise points to the necessity of prompt action aimed at floral biodiversity preservation.

The majority of threatened plant species belong to:

- Therophytes (annuals), comprising 33.8 percent (113 species) of the threatened species.
- Phanerophytes (trees), comprising 18.6 percent (62 species).
- Hemicryptophytes (herbaceous perennials), comprising 15.3 percent (51 species).
- Chamaeophytes (subshrubs), comprising 10.5 percent (35 species).
- Geophytes, comprising 10.2 percent (34 species).
- Nanophanerophytes (shrubs), comprising 5.7 percent (19 species).

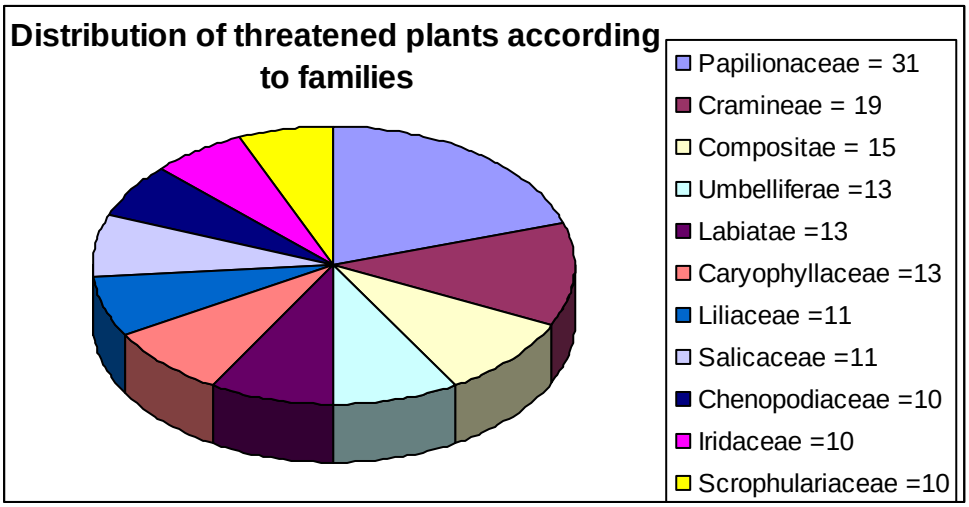


Moreover, the majority of the threatened plants (67.6 percent, 226 species) were ranked as very rare, while 26.3 percent (88 species) were ranked as potentially rare, and 3.3 percent (11 species) were rare.

The majority of threatened plants (46.7 percent, 156 species) belong to 11 families:

1. Papilionaceae 9.3% = 31
2. Cramineae 5.7% = 19
3. Compositae 4.5 % = 15
4. Caryophyllaceae 3.9% = 13
5. Labiatae 3.9% = 13
6. Umbelliferae 3.9% = 13
7. Liliaceae 3.3% = 11

8. Salicaceae 3.3% = 11
9. Chenopodiaceae 3.0% = 10
10. Iridaceae 3.0% = 10
11. Scrophulariaceae 3.0% = 10



Further, there are 47 endemic plant species considered threatened (14.1 percent of total threatened species). These species belong to 35 genera of 19 families. The majority of these (57.4 percent, 27 species) are considered very rare while the rest are potentially rare. In addition, around 51.4 percent (24 species) of these belong to five families:

1. Iridaceae 14.9% = 7
2. Liliaceae 10.6% = 5
3. Compositae 8.50% = 4
4. Labiatae 8.50% = 4
5. Salicaceae 8.50% = 4

Birds of Palestine

This publication (Awad, 2005) deals with the resident and migrant birds of Palestine. The book opens with a general overview of the geographical and topographical characteristics of Palestine. It presents a brief description of the geographical location, topographical zones, climate and environmental factors affecting bird distribution and the relationship between birds and humans. It also covers human daily activities and their impact on birds and their habitat, as well as the role of birds in ecosystem balance, the food chain and pest control.

Although the book's primary focus is birds, the author also provides summary information on other biodiversity components, such as Palestine's flora and

(other) fauna, as well as the important role of location and topography in enhancing Palestine's biodiversity. Information presented includes the following:

- Flora of Palestine: There are around 2953 flowering plant species, 53 of which are endemic (51 in the West Bank, including 12 considered rare). Most of these plant species belong to the compositae family. There are 543 threatened plant species, 334 of which are in the West Bank and Gaza. Around 70 tree species are found in Palestine.

- Fauna of Palestine:
    - Birds: There are around 500 bird species, which are ranked and classified as:
        - Resident or endemic.
        - Migrants.
        - Summer visitors.
        - Winter visitors.
        - Vagrants
    - Mammals: There are 116 mammal species, among them herbivores, carnivores, insectivores and so forth.
    - Fish: There are around 32 endemic and 14 to 16 introduced fish species in Palestine's water bodies (excluding species found in the Mediterranean Sea).
    - Amphibians: There are 110 amphibian species, classified as follows: 7 amphibian species, 6 marine turtle species and 97 reptile species living in fresh water or on land.
    - Invertebrates: There are around 30,000 invertebrate species.

Bird Orders in Palestine

According to Voous's ranking system, birds in Palestine can be classified as belonging to 23 orders:

Order 1: Struthioniformes – One family: Struchionidate (Ostrich)
This order is extinct in Palestine.

Order 2: Gaviformes – One family: Gaviidae (Divers)
This order contains one family of vagrant species.

Order 3: Podicipediformes – One family: Podicipedidae (Grebes)
This order contains one family of diving water birds.

Order 4: Procellariformes – Three families: Diomedeidae, Hydrobatidae, Procellariidae
This order contains three families of vagrant species.

Order 5: Pelecaniformes – Five families: Anhingidae, Pelecanidae, Phaethontidae, Phalacrocoracidae, Sulidae
This order contains five families of vagrant and winter visitor species. The Anhigidae family has become very rare in Palestine.

Order 6: Ciconiiformes – Three families: Ardeidae, Ciconiidae, Threskiornithidae

Order 7: Pheonicopteriformes – One family: Pheonicopteridae

Order 8: Anseriformes – One family: Anatidae
This order contains one family with three genera: Anatini, Anser, Cygnus

Order 9: Accipitriformes – Two families: Accipitridae, Pandionindae

Order 10: Falconiformes – One family: Falconidae
This order contains one family with eleven species of falcons.

Order 11: Galliformes – One family: Phasianidae

Order 12: Gruiformes – Three families: Gruidae, Otididae, Rallidae

Order 13: Charadriformes – Twelve families: Burhinidae, Charadriidae, Dromadidae, Glareolidae, Haematopodidae, Laridae, Recurvirostridae, Rostratulidae, Rychopidae, Scolopacidae, Stercorariidae, Sterindae

Order 14: Pterroclidiformes – One family: Pteroclididae

Order 15: Columbiformes – One family: Columbidae

Order 16: Psittaciformes – One family: Psittacidae
This order contains one family of introduced species.

Order 17: Cuculiformes – One family: Cuculidae
This order contains one family with four species, two of which are vagrant birds.

Order 18: Strigiformes – Two families: Strigidae, Tytonidae
This order contains two families with many species, one of which is extinct in Palestine (Ketupa Zeylonensis).

Order 19: Caprimulgiformes – One family: Caprimulgidae

Order 20: Apodiformes – One family: Apodidae

Order 21: Coraciiformes – Four families: Alcedinidae, Coraciidae, Meropidae, Upupidae

Order 22: Piciformes – One family: Picidae

Order 23: Passeriformes – Twenty-four families: Alaudidae, Bombycillidae (vagrant birds), Corvidae, Emberizidae, Estrildidae, Fringillidae, Hirundinidae, Laniidae, Motacillidae, Muscicapidae, Nectariniidae, Oriolidae, Paridae, Passeridae, Prunellidae, Pycnonotidae, Remizidae, Sittidae, Sturnidae, Sylviidae (majority are migrant birds), Tichodromadidae, Timaliidae, Troglodytidae, Turdidae

The book contains detailed information about the following bird species (including name, Latin name, order and family as well as a general description of shape, height, size, color and so forth and information concerning habitat, food and breeding):

Endemic or resident birds: These comprise around 20 percent of total bird species in Palestine; 23 species are described.

Winter visitors (August – January): There is insufficient data on their numbers due to the difficulty of recognizing them when they are found in the same area as resident and endemic species belonging to the same families; seven species are described.

Summer visitors (February – September): Seven species are described.

Migrants (pass through in autumn or spring): Fourteen species are described.

Vagrants (appear irregularly): These comprise around 25 percent of total bird species in Palestine; 2 species are describe.

According to IUCN, the following are found in the Middle East region:

1. 24 globally threatened bird species.
2. 22 bird species that are endangered and/or facing a decrease in their numbers, their habitat or part of their habitat.
3. 15 bird species considered globally rare but common in the Middle East region.

BERC – Til Botanical Gardens

In 2003, BERC established the Til Botanical Gardens in response to biodiversity deterioration in Palestine. The gardens, covering 15,000 square meters, primarily feature natural and threatened endemic plants with local significance. The intention was to display these plants and establish genetic stores of them. In

addition, the gardens will play an important role in the Palestinian community, providing a site for recreation, education and biodiversity conservation.

At BERC's Til Botanical Gardens, there are currently 131 medicinal plants, 418 herbarium species, 43 trees and shrubs.

BERC – Til Botanical Gardens Newsletter

In August 2003, BERC issued a one-time newsletter introducing the Til Botanical Gardens and their contents and sharing progress and developments. In addition, the newsletter presented brief information about the importance of botanical gardens and their role in conserving biodiversity.

Community-Based Seed Bank – Nablus District

The overall goal in establishing the Community-Based Seed Bank (CSB) is to achieve genetic resource conservation at the community level and to maintain and improve local crop accessions, thereby ensuring lasting food productivity and availability. Moreover, CSB plays an important role in enhancing the diversity of traditional food crop varieties.

The project is being implemented in Nablus in six rural clusters. Targeted plants are mainly food crops, including cereals, legumes and vegetables. The landraces, maintained at CSB until 20 December 2005, included 95 seed types.

Conservation of Medicinal Plants and Related Traditional Knowledge in the West Bank and Gaza Strip

The aim of this project is to conserve Palestinian medicinal plants and traditional knowledge associated with their use. For this purpose, BERC has established an ethno-botanical conservation site within the Til Botanical Gardens; the site currently has around 130 plants.

Guide to Trees and Shrubs from Palestine

This book was prepared as a working guide for readers in general, as well as for nature lovers, conservation educators, technicians and practitioners. The guide is intended to support implementation of the CBD objectives, namely, the conservation of biodiversity, the sustainable use of its components and the fair and equitable sharing of benefits arising from access to genetic resources.

The book contains three chapters. Chapter 1 contains information about the topography, soil, climate, plant geographical zones and distribution of plant

communities in the West Bank and Gaza. Chapter 2 addresses conservation of natural plants, explaining the methods and mechanisms for increasing the number of natural and rare plant species and describing how to conserve plant species outside of their natural habitats. Chapter 3 includes plant descriptions and discusses plants' use and value. It contains detailed information about 51 tree and shrub species, covering shape and appearance, habitats, geographical distribution, usage and nutritional, medical and industrial value.

Biodiversity: Value and Conservation

This study briefly presents some general information about biodiversity; its importance and related ecological, economic and social value; and the major concerns and threats facing global biodiversity. The study also summarizes the current state of biodiversity in Palestine (for fauna, flora, aquatic species and natural areas), covering its importance, threats and conservation strategies, stages of development and sustainable use.

Conservation and Sustainable Use of Dry-Land Agro-Biodiversity Project Fourth Interim Report

The PNA's Conservation and Sustainable Use of Dry-Land Agro-Biodiversity project aims at promoting the conservation and preservation of important agricultural landraces and wild relatives.

The project has targeted agricultural landraces crops and wild relatives in parts of the northern and southern West Bank, mainly in Jenin (Der Abu Deif village and Tayasir village) and the Hebron area (Sair and Daheria). Project sites were selected based on the presence of targeted species; sites may thus cover an entire village or community.

During the course of the project, data has been collected and results analyzed in narrative and graphic format. GIS mapping tools have allowed for spatial presentations on targeted crops and analysis of land use practices that contribute to the maintenance or loss of agro-biodiversity in the selected areas.

This report is the fourth annual report; the three previous reports (issued in 2000, 2001 and 2002) presented data collected through field surveys of fruit trees and herbaceous species. Data collection occurred over three phases: in the first phase, the characteristics of land cover/land use were described; in the second phase, a soil classification system was created using GIS tools; and, in the third phase, the hydro-geological modeling approach used was described and the results of hydrologic modeling reported.

The study targeted 30 herbaceous species belonging to 7 genera, along with 20 tree species. Survey analysis focused on features such as species name (genus and species), frequency (number of quadrates containing the specific species), relative frequency (frequency/total number of quadrates) and mean density, height and perimeter for fruit trees.

In addition, the project addressed identification of areas climatically suited for species of interest using data on current distribution and the range of environmental parameters.

Using GIS Tools and Remote Sensing to Delineate Agro-Ecological Zones for the West Bank

Agro-ecological zoning (AEZ) is an important tool for land-use planning, economic development and natural resources management, as well as an indicator of social factors. AEZ analysis involves using GIS tools and remote sensing to identify smaller units with similar potential and constraints within areas of land.

Important Bird Areas in Palestine

This study deals with important bird areas in Palestine; it adopts the IUCN standards for selection and identification of these areas.

The study presents information about natural Palestine, including location, topography, natural water resources, soil, climate, temperature, humidity, rainfall, winds and evaporation. It also discusses international strategies for the conservation of bird species, including international conventions and treaties for the protection of biodiversity.

The following information was obtained from the study:

- In Palestine, there are 490 bird species belonging to 206 genera in 65 families grouped in 21 orders. Of the 65 families, 45 are nesting.

- The most common families in Palestine are Turdidae (chats, thrushes and wheatear) and Sylviidae (warblers).

- The orders with the largest number of species are Passeriformes (290 species), Charadriformes (85 species) and Anseriformes (30 species).

- There are 170 nesting bird species, including 150 residents and 50 summer visitors.

- There are 24 bird species that are threatened worldwide but common in the Middle East region.

- There are 36 bird species that are endangered in their habitats or part of their habitats in the Middle East.

- There are 61 bird species that are rare worldwide but common in the Middle East region.

The study identified 13 sites as important bird areas. Selection was based on the results of technical field studies and surveys, wherein each site was studied for its location, topography, natural resources, number of birds, animals and plants, nearby human activities and other factors.

ANNEX III

SELECTED BIBLIOGRAPHY

Ali-Shtayeh, Moh'd, & Jamous, Rana (April 2002). *Biodiversity: Values and Conservation.*

Ibid (August 2005). *Establishing a Community Seed Bank for Semi-Arid Agriculture in Palestine: Structure, Management and Functions.*

Ibid (August 2002). *Red List of Threatened Plants of West Bank and Gaza Strip and the Role of Botanical Gardens in their Conservation.*

Ali-Shtayeh, Moh'd; Jamous, Rana; & Hamad, Ali Khalil (2003). *Guide to Trees and Shrubs from Palestine.*

ARIJ (2003). *Conservation and Sustainable Use of Dry-Land Agro-Biodiversity Project – Interim Report.*

Al-Atrash, Imad, Wildlife Society (1999). *Important Bird Areas in Palestine.*

Ibid (2003). *Wildlife Field Guide of Wadi Gaza.*

Awad, Simon (2005). *Birds of Palestine.*

EQA & UNDP (June 2003). *Assessment of Capacity Building Needs and Palestinian Priorities in Biodiversity.*

European Academic Science Advisory Council (2005). *A User's Guide to Biodiversity Indicators.*

General Corporation for Environmental Protection (December 2001). *First National Report of the HKJ: Conservation and Sustainable Use of Biological Diversity in Jordan.*

Issac, Jad, & Gasteyer, Stephen. *The Issue of Biodiversity in Palestine.*

PCBS (May 2000). *Biodiversity in the Palestinian Territories.*

PIALES (October 1996). *Combating Desertification in the Palestinian Jordan Valley: An Approach towards Sustainable Development.*

Ibid (November 1996). *A Preliminary Investigation of Biodiversity in Palestine, Problems and Prospects.*

PNA (October 2003). Palestinian Agricultural Law No. 2, for the year 2003.

Ibid (February 2000). Palestinian Environmental Law No. 7, for the year 1999.

PNA, MEnA (December 2002). *Gaza Coastal and Marine Environment Protection and Management Plan.*

Ibid (December 2001). *Palestinian Environmental Strategy.*

PNA, Ministry of Agriculture (April 2005). *The National Policy and Legislation for Promoting the Conservation of Agro-Biodiversity in the Palestinian Authority.*

Ibid (May 2005). *Synthesis of the National Policy and Legislation for Promoting the Conservation of Agro-Biodiversity in the Palestinian Authority.*

PNA, Ministry of Tourism and Antiquities (June 2005). *Inventory of Cultural and Natural Heritage Sites of Potential Outstanding Value in Palestine.*

PNA, MOPIC (April 2000). *Ecologically Significant Areas in West Bank.*

Ibid (February 1999). *Landscape Assessment of the West Bank Governorates.*

PNA, Palestinian Environmental Authority (April 1999). *National Biodiversity Strategy and Action Plan for Palestine.*

Sansur, Ramzi (April 1995). *Environment and Development Prospects in the West Bank and Gaza Strip* (UNCTAD/ECDC/SEU/8).

Shtayeh, M., & Hamad, Ali (1995). *Protection of the? Palestinian Environment.*

State of Israel, Ministry of Environment (December 1997). *Conservation and Sustainable Use of Biological Diversity in Israel.*

Wildlife Society (2004). *Enhancing Ecotourism in Palestine.*

Ibid. *Together for Birds and People in the Jordan Valley.*

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تم تمويل وطباعة هذا التقرير من مرفق البيئة العالمية (جيف)من خلال برنامج الأمم المتحدة الإنمائي / برنامج مساعدة الشعب الفلسطيني UNDP/PAPP.

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