

Science and Community Based Conservation for Al-Arqoub Area, Palestine

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The Palestine Institute for Biodiversity and
Sustainability
2026



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Citation: Mazin B. Qumsiyeh and the Palestine Institute for Biodiversity and Sustainability. 2026. Science and community based conservation for Al-Arqoub area, Palestine. Palestine Institute for Biodiversity and Sustainability, Bethlehem University, Bethlehem, Palestine.

ISBN 978-9950-8617-1-8

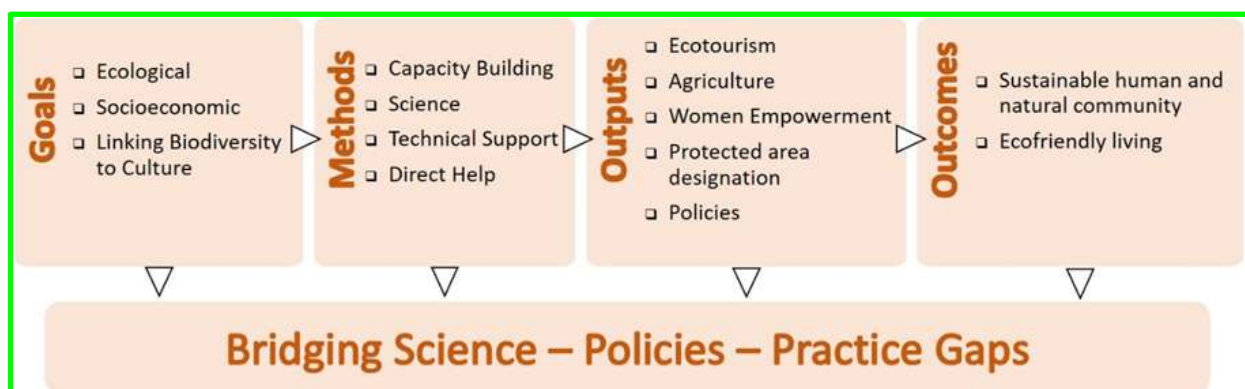
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Executive Summary

Since its founding in 2014, the Palestine Institute for Biodiversity and Sustainability has developed a special interest in the land and people of the area south of Jerusalem and west of Bethlehem called Al-Arqoub. Five projects to help people and nature in the area were completed by the Institute, funded by National Geographic Society (two projects), Darwin Initiative, the EU, and the British Council. Over 60 publications on this area have been produced by our team. Largely as a result of our work the area was designated a protected area following our collaboration with IUCN and the Environment Quality Authority (EQA) to create the new protected area network (IUCN 2025; Qumsiyeh et al. 2023b). This is a unique area of cultural and natural heritage, part of which is also designated as a UNESCO World Heritage Site (MOTA 2015). The projects we carried out in the area, including the latest, were participatory and involved over 250 key stakeholders. Initial work focused on the Al-Makhrouk valley and the two hills around it. It was later expanded to include the Cremisan and Husan valleys and finally a fourth valley was added (Wadi Fukin). The eight Palestinian communities we worked with over the past few years are Al-Walaja, Battir, Husan, Nahhalin, Al-Khader, Artas, Beit Jala, and Wadi Fukin. This book synthesizes decades of scholarly work, institutional reports, field research and conservation efforts to assess how wildlife management and biodiversity conservation in the study area are addressed within the context of one of the most politically constrained and environmentally disrupted settings on earth. Analyzing strengths, weaknesses, opportunities, and threats (SWOT analysis), we also look to the future and outline recommendations and action plans for sustainable conservation under both existing realities and potential peace scenarios.

The overall OUTCOME is participatory and includes a set of action plans for ecofriendly living and sustainable human and natural communities.



This publication summarizes findings from the past 12 years working in the area and especially following the designation of the target area as a protected area in 2023. The area was found to be very rich in biodiversity (e.g. 384 vascular plant species and 111 bird species) and to have an exceptional cultural and economic heritage that will serve as a benefit to all people of Palestine. The Institute worked with local, regional, and international stakeholders adopting the traditional arabic concept of Hima as a model of protection. Hima is a 1400 year-old set of practices which focus on protected land management, where a community or authority sets aside an area to conserve grazing, trees, and other resources for long-term public benefit. Its key principles include: community ownership and decision-making, integration of cultural values and ecological sustainability, and long-term stewardship over short-term exploitation. Accordingly, the Institute's management plan that was developed, including proposed actions, responds to the objectives of Palestine's National Biodiversity Strategy and Action Plan (NBSAP), and accords with the guidelines of CBD/COP/14/7, 14/8, 14/12, 14/13, and 14/14 provided by the CBD (Convention on Biological Diversity) and related international conservation frameworks such as the Strategic Plan for Biodiversity 2011-2020.

The process of gathering data and developing the action plans that are summarized here was participatory, and supported local education and capacity-building goals. The results not only advance science but help bridge the science-policy-practice gaps. Going forward, we expect this to continue as plans are revised and adapted. The creation of this first Hima area in Palestine will serve as a model replicable for the other protected areas.

Acknowledgements

We are grateful to over 250 supporters and stakeholders who hail from municipalities, village councils, relevant government ministries (education, local government, agriculture, environment quality authority), NGOs, CSOs, and local cooperatives. We are especially grateful to all staff members and contractors associated with the Palestine Institute for Biodiversity and Sustainability who helped collect data for this report and/or engaged in focus group meetings and workshops to achieve the needed results. Our PIBS team who contributed to this work include Amal Handal, Zuhair Amr, Banan Al-sheikh, Elias Handal, Johann Gedeon, Mohammad Najajrah, Roubina Ghattas, Issa Albaradeia, Isra Al Qadi, Zena Musleh, Sara Khair, Manal Ghattas, Mones Dadou, Saed Shomaly, Anton Khalilieh, Maëlle Bousquié, Con Lynch, Sam Van Nes, Fatima Asad, Yafa Manasra, Shahd Banat, and Maysa Ayoub. We acknowledge the experiences and feedback shared with us from the Society for Protection of Nature in Lebanon (SPNL) and the Royal Society for Conservation of Nature (RSCN). Earlier funding for the work in the area was received from Darwin Initiative, National Geographic Society, the EU, and the British Council. The production of the management plan and the publication of this book were funded by the National Geographic Society. Content of course is the responsibility of the Palestine Institute for Biodiversity and Sustainability (Bethlehem University) and does not necessarily reflect the views of funders.



Abbreviations

ACs	Current Agricultural Cooperatives in the WHP
APA	Al-Arqoub Protected Area
ARIJ	Applied Research Institute-Jerusalem
ARU	Animal Rehabilitation Unit
BR	Biosphere Reserve
CBD	Convention on Biological Diversity
CCC	Convention on Climate Change
CCHP	Center for Cultural Heritage Preservation
CEPF	Critical Ecosystem Partnership Fund
CHM	Clearing House Mechanism
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on Conservation of Migratory Species of Wild Animals
COP	Conference of the Parties
CSO	Civil Society Organization
EIA	Environmental Impact Assessment
EQA	Environmental Quality Authority
GBF	Global Biodiversity Framework
IAS	Invasive Alien Species
IBA	Important Bird Area
IPA	Important Plant Area
IUCN	International Union for Conservation of Nature
IHL	International Humanitarian Law
JSC	Joint Services Council
JSCTDB	Joint Service Council for Tourism Development of Bethlehem Governorate
KBA	Key Biodiversity Area
MDLF	Municipal Development and Lending Fund
MoA	Ministry of Agriculture
MoC	Ministry of Culture
MoE	Ministry of Education
MoLG	Ministry of Local Government
MoTA	Ministry of Tourism and Antiquities
NBSAP	National Biodiversity Strategy and Action Plan
NGOs	Non-governmental organizations
OECM	Other Effective Area-Based Conservation Measure
PA	Protected Area
PAN	Protected Area Network
PCBS	Palestinian Central Bureau of Statistics
PENGON	The Palestinian Environmental NGOs Network
PIBS	Palestine Institute for Biodiversity and Sustainability
RSCN	Royal Society for Conservation of Nature-Jordan
SPNL	Society for Protection of Nature in Lebanon
SWOT	Strengths, Weaknesses, Opportunities, and Threats or SWOT analysis
UNFCCC	United Nations Framework Convention on Climate Change
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHS	World Heritage Site

1. Introduction

In the late 20th century the conservation of biological diversity became recognized as an urgent issue for humanity. This is largely due to the scientific observation of significant decline in biodiversity accompanying the wide spread of industrialization in the 19th and 20th centuries. Two key texts emerged from a number of preparatory meetings that rang the danger bell at the global level: Publication of the Global Biodiversity Strategy and the Convention on Biological Diversity (CBD) signed at the Earth Summit in Rio de Janeiro (both in 1992). After the Aichi targets, set by the CBD Conference of Parties (COP), ended in 2020, new targets were set in the Kunming-Montreal COP meetings representing an ambitious Global Biodiversity Framework. However, developing countries had critical reservations about the issue of unjust demands compared with capabilities, especially in light of global threats like climate change and related climate injustice.

Compared to countries of the same latitude, Palestine has an exceptionally rich biodiversity stemming from both geologic and geographic factors (Qumsiyeh and Abusarhan 2021; Qumsiyeh et al. 2025). No less than five biogeographic zones occur within an area of 27,000 square kilometers: Mediterranean, Irano-Turanian, Saharo-Arabian, Coastal, and Ethiopian/Sudanese (Soto-Berelov et al. 2015). As a land bridge between Eurasia and Africa, it is one of the world's most important bird migration flyways, with hundreds of millions of birds making annual migrations through this area (Alon 2010). Palestine hosts over 51,000 species of flora and fauna constituting about 3% of global biodiversity (Hassoun et al. 2025), with nearly one third of wild plant species considered rare or vulnerable (EQA 2011). Palestine connects Africa with Eurasia and is in the western part of the Fertile Crescent where the first humans migrated out of Africa and also where they first transitioned from being hunter-gatherers to developing an agricultural and nomadic shepherd life (McCorriston and Hole 1991; Eshed et al. 2004; Zeder 2008). The geologic activities over the past 100 million years, and especially the formation of the Great Rift Valley, ensured a rich varied topography which resulted in a burst of speciation producing many endemic species of plants and animals. This is a result of diverse habitats covering five ecozones (Central Highlands, Semi-Coastal Region, Eastern Slopes, Jordan Rift Valley, and Coastal Regions) and four biogeographical regions (Mediterranean, Irano-Turanian, Saharo-Arabian, and Sudanese/Ethiopian) (Whyte 1950; Zohary 1947; Por 1975; Qumsiyeh 1985).

Climate is varied from cold winters with semi-permanent frost in mountains 1,000 meters above sea level (Mount Hermon) to the semi-tropical climate of the lowest point on earth in the Dead Sea region at 430 meters below sea level. Rainfall is between <50 mm in arid regions to >1000 mm in the highest mountains. Given its small geographic area, it is not surprising that the country exhibits exceptionally high levels of biodiversity, surpassing those of some countries that are ten times larger in size (Qumsiyeh 1996). The mild climate, fertile soils, and rich diversity of plants and animals in the Fertile Crescent—a region extending from Palestine to Iraq—created favorable conditions for the development of early human societies. The abundance of wild ancestors of crop plants and domesticated animals enabled the transition from hunting and gathering to agriculture and animal husbandry. As a result, the Fertile Crescent became one of the world's earliest centers of domestication, giving rise to key crops such as wheat, barley, and lentils, as well as the domestication of animals for agriculture and trade including goats and donkeys. These developments laid the foundation for the emergence of the first human civilizations.

The region has experienced profound anthropogenic environmental change driven by a combination of factors, including population movements, industrialization, climate change, land-use transformation, and colonial expansion. The extent of vegetation loss in Palestine over recent decades underscores the urgency of effective conservation interventions. Wooded areas in the occupied Palestinian territory previously covered approximately 314,700 dunums in 1974, representing 5.2% of the total land area however by 2007, this figure had declined by nearly

29%. By 2020 forest cover had been reduced to approximately 111 km² in the West Bank and only 3 km² in the Gaza Strip, compared with 320 km² and 42 km², respectively, in 1970 (PIBS/CEBioS 2021 and ¹). This dramatic reduction reflects the combined pressures of population growth, urbanization, Israeli colonial settlement expansion, and the destruction of vegetation cover associated with infrastructure construction and military activity. The Al-Arqoub area, as one of the last remaining green corridors in the Bethlehem district, must be viewed within the broader context of ongoing habitat degradation and landscape fragmentation occurring throughout Palestine. This has had a huge impact on biodiversity, yet to date few studies have addressed this. In this chapter, we review what is known about biodiversity in Palestine (a small but critical part of the Fertile Crescent) including highlighting threats and opportunities for conservation and sustainable living for both people, and fauna and flora.

In response to these challenges, a range of mitigation and adaptation initiatives have been undertaken. These include the development of a new Protected Area Network (PAN) (Qumsiyeh et al. 2023a), the designation and active protection of several priority sites (e.g., Qumsiyeh et al. 2022b; Qumsiyeh et al. 2023b), the preparation of a new National Biodiversity Strategy and Action Plan (EQA 2022), climate change-related efforts (Qumsiyeh et al. 2022a), and ex situ conservation measures for endangered plant species (Qumsiyeh et al. 2024). The new PAN identified 27 areas in urgent need of protection, including the focal site of this project, which was subsequently surveyed and published (Qumsiyeh et al. 2023b). This work was largely supported by funding from the National Geographic Society and the Darwin Initiative². In that publication, it was further recommended that this and other priority areas in Palestine be urgently considered for biosphere reserve development. Notable achievements that built on earlier work and laid the groundwork for this project include: the National Biodiversity Conservation Action Plan (last one 1999), the 6th National Convention on Biological Diversity report, and the new Protected Areas Network. PIBS played a leading role in all three initiatives, working closely with the Environment Quality Authority (EQA) and a range of national and international partners.

The four biogeographical zones identified in Palestine (Mediterranean, Irano-Turanian, Saharo-Arabian, Ethiopian-Sudanese) were mapped based on plant distribution by Zohary (1947) and have been used with little modification since. Soto-Berelov et al. (2015) refined and added to these the coastal zone and noted changes both recent and in historic and prehistoric times. The Mediterranean Zone has special and rich biodiversity that is threatened and considered a key hot-spot for biodiversity conservation (Myers et al. 2000). This Mediterranean Zone in Palestine stretches from the Haifa and Galilee region across the hills and slopes (especially those facing west to the Mediterranean zone all the way down to Hebron).

This report is the culmination of more than 12 years of systematic research and monitoring in the Al-Arqoub area. Research efforts intensified following the designation of the site as a protected area in 2023 (Qumsiyeh et al. 2023b). The preparation of this report was further strengthened through extensive community engagement activities conducted during 2025–2026, that helped identify key knowledge gaps and conservation priorities. Additional field surveys were undertaken to address deficiencies in both faunal and floral datasets, with particular emphasis on Wadi Fukin, an area not adequately covered in previous studies. Gap-filling efforts also targeted other priority sites and ecological components necessary for conducting a comprehensive threat assessment and developing a scientifically robust management plan for the protected area.

The ultimate goals envisioned for this project long term are:

1. Conserving, for present and future uses, the cultural and biological diversity and integrity of biotic and abiotic communities within natural and semi-natural ecosystems,

¹ <https://ps.bl2.chm-cbd.net/en/basic-pages/forests>

² <https://www.palestinenature.org/conservation/NGS-Initial-study.pdf>

and to safeguard the genetic diversity of species on which their continuing evolution depends.

2. Providing an example for land management and approaches to sustainable development.
3. Providing facilities for scientific research, environmental monitoring, communities education, and training with the possibility of comparative studies in collaboration with the international network.
4. Enhancing and sustaining the natural and cultural values of the area through scientifically rigorous, culturally appropriate, and operationally sustainable management practices.

2. Protected areas

Both the 6th National Report to CBD (EQA 2021) and the National Biodiversity Strategy and Action Plans (NBSAP) for the state of Palestine (2023) recognized the primacy and importance of better planning and management of protected areas in line with the post-Aichi targets of CBD. PIBS led in writing both reports. The NBSAP was actually the first to comply with the Kunming-Montreal Global Biodiversity Framework (GBF; CBD 2022). The Protected Areas Network (PAN) for the state of Palestine evolved after the Palestinian National Authority (PNA) was established in 1994. The evolution of the protected area network in Palestine followed several distinct phases. Initially, 22 protected areas were handed over to the Palestinian Authority following the Oslo agreements (Garstecki et al. 2010; Qumsiyeh and Amr 2016; HSF 2017). In 1999, the Palestinian ministerial committee approved an expanded list of 50 protected areas. By 2010, the Environmental Quality Authority had reassessed these and added further sites. They stated a total to 22 areas under various levels of Palestinian management (the rest under Israeli control), of which only 13 fell within Area B and were subject to partial Palestinian administrative control (Garstecki et al. 2010; Qumsiyeh and Amr 2016). In the Garstecki et al. (2010) preliminary assessment it was stated that much work remains to be done especially in using IUCN criteria to reassess these supposed “nature reserves”.

In 2021/2022 IUCN-ROWA was funded by CEPF for a new PAN in Palestine in collaboration with the Environment Quality Authority³, the team at the Palestine Institute for Biodiversity and Sustainability, together with IUCN and the relevant government authorities (EQA, Ministries like Agriculture, Tourism, Local Government). Collective work generated 13 criteria that were scored objectively. As a result 22 areas were excluded and several other areas were coalesced to produce a new, more representative and coherent PAN of 28 areas that covers 11% of the land of the occupied Palestinian territories (Qumsiyeh et al. 2023a; IUCN 2025; Fig. 1). If managed well, the new PAN would help fulfill Palestine’s obligations under the CBD contributing to global biodiversity conservation and will ensure the protection of the most vulnerable Palestinian fauna and flora while also contributing to the local population via ecosystem services.

As noted in the Clearing-House Mechanism (CHM) report for the State of Palestine⁴, the reassessment was undertaken because the previous protected area network, designated during the Israeli occupation, lacked a clear scientific rationale and included areas selected for reasons unrelated to biodiversity conservation. The updated Protected Area Network was designed to represent all major vegetation types and phytogeographical regions of Palestine, thereby improving the protection of key ecosystems within the Mediterranean Biodiversity Hotspot and providing a more scientifically robust framework for long-term conservation planning. Supplementary material published with the report and cited by Qumsiyeh et al. (2023a) included the available scoring criteria⁵. As noted above, the process of developing the revised Protected Area Network was transparent, participatory, and scientifically grounded. It involved broad

³ <https://iucn.org/fr/node/33175>

⁴ <https://ps.chm-cbd.net/protected-areas-0>

⁵ <https://www.palestinature.org/conservation/f3e7553fb6.pdf>

stakeholder engagement and has received support and recognition from governmental institutions, civil society, local communities, and international conservation organizations. Significant opportunities exist for collaborative conservation efforts involving governmental agencies, NGOs, academic institutions, and local communities to strengthen Key Biodiversity Areas (KBAs), Protected Area Networks (PANs), and other conservation initiatives in Palestine. The work was undertaken through a highly participatory and collaborative process involving a broad range of stakeholders, including civil society organizations (CSOs), non-governmental organizations (NGOs), academic institutions, local and international environmental organizations, community representatives, and local and national governmental authorities. Strategies were also refined⁶. The revised Protected Area Network (PAN)⁷ received formal endorsement from the highest levels of the Environment Quality Authority (EQA), the International Union for Conservation of Nature (IUCN), relevant governmental ministries, and the supporting funding agencies. It was then adopted at the highest levels of government and entered the National Spatial Plans approved by the Ministerial Group. This represents one of the most significant recent achievements in biodiversity conservation and environmental planning in Palestine.

In partnership with the Environment Quality Authority (EQA) and other stakeholders, and with support from the National Geographic Society, PIBS continues to support the improvement of protected area management. However, major challenges remain. As most protected areas in the West Bank are located in Area C under Israeli control, only 13 reserves (11.3% of the total protected area) fall within Area B and in a non-conflict situation, and are thus subject to Palestinian control and management.⁸ The project also incorporated a proposed assessment of the conservation status of species and ecosystems and red-listing per IUCN as needed.⁹

There were five management plans developed after some study for five areas: Al Marj (Um AlTut), Beitillo, Wadi Al-Quff, Wadi Al-Zarqa AlUlwi, and South Jerusalem hills (SJH). PIBS studied the latter area (important plant and bird area and part of the East Mediterranean biodiversity hotspot) and produced a website¹⁰ and a management plan¹¹ focused on the WHS (two valleys). Subsequently a management plan was produced for a third connected valley—Cremisan¹². The main aims are to integrate the Al-Arqoub landscape with adjacent areas and previously generated datasets from the World Heritage Site (WHS) in order to collectively valorize the new protected area.

⁶ <https://ps.chm-cbd.net/sites/ps/files/2022-09/MRV%20Final%20Report.pdf>

⁷ <https://www.cepf.net/sites/default/files/final-report-111713.pdf>

⁸ <https://www.protectedplanet.net/country/PSE>

⁹ <https://www.palestinenature.org/conservation/IUCN-report-Annex.pdf>

¹⁰ <https://almakhrouir.palestinenature.org/>

¹¹ <https://www.palestinenature.org/conservation/Final-Biodiversity-Conservation-Plan-for-WHP-23-December-2019--by-Roubina-Ghattas.pdf>

¹² <https://www.palestinenature.org/conservation/Cremisan-Valley.pdf>

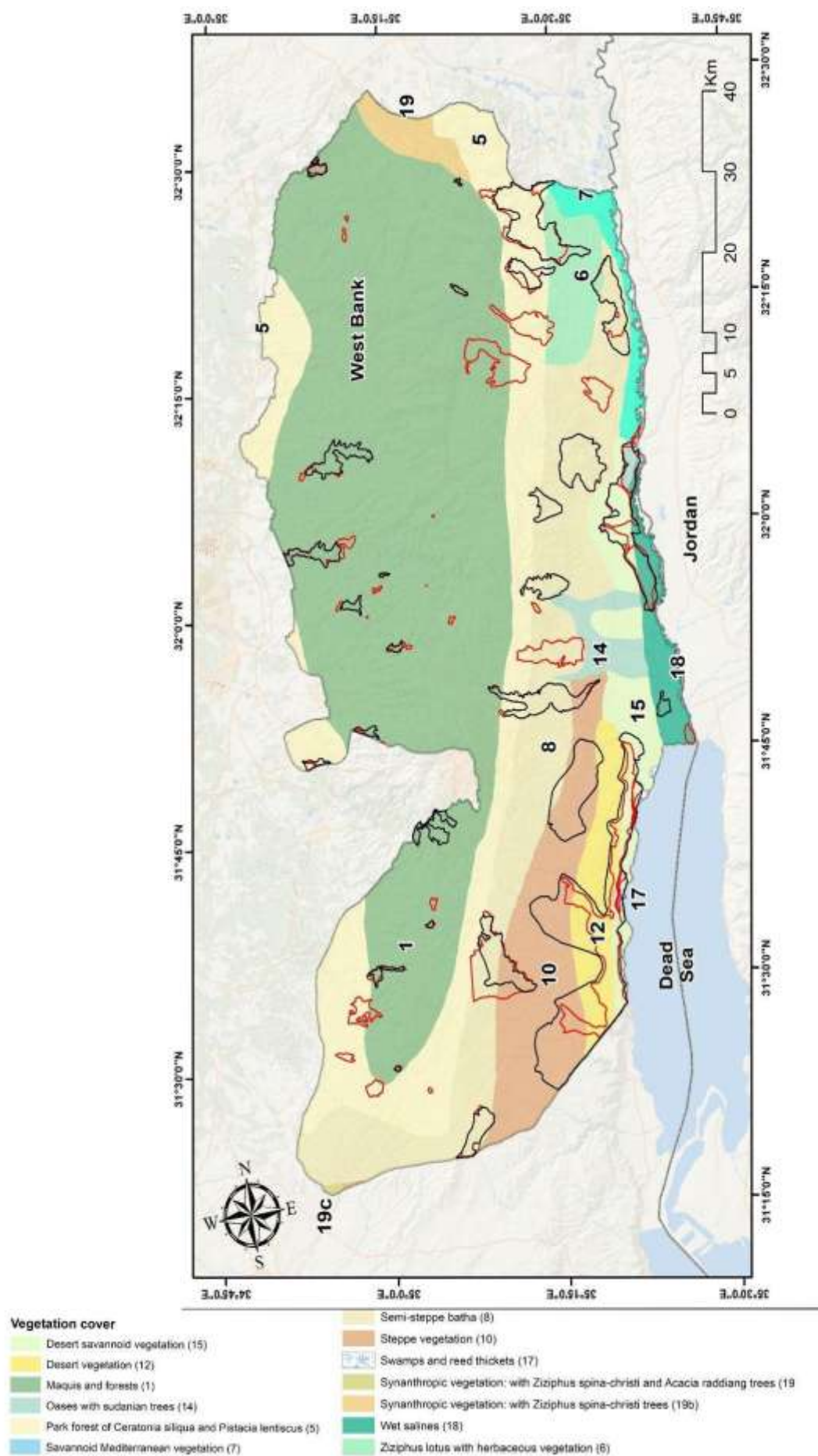


Fig. 1. Protected areas in Palestine and vegetation cover

3. Study Area and methods

3.1 Study Area

The new nationally approved protected areas network for the State of Palestine contained 28 areas; five of which had been the subject of previous ecological assessments (IUCN 2025). From these, three areas were selected for more detailed study as pilot sites for the implementation of community-based conservation initiatives: Wadi Al-Zarqa Al-Ulwi, Wadi Al-Quff, and the newly designated Al-Arqoub area. The latter is the subject of this work that aims to bridge science-policy-practice gaps (i.e. transition from protected area designation to the implementation of effective conservation management and on-the-ground actions).

Wadi Al-Zarqa Al Ulwi protected area: Our institute provided a comprehensive assessment of the importance of ecological, biological, and socio-economic benefits of the area (PMNH 2018). Communities in the area were engaged to help protect the rich valley: including Deir Ballut, Al Lubban al Gharbi, Kafr ad Dik, Bruqin, Bani Zeid (Deir Ghassana - Beit Rima), and Qarawat Bani Zeid. The results show rich floral and faunal biodiversity. The floral analysis compared to a nearby protected area (Wadi Qana) showed unique features of both areas worthy of protection (Qumsiyeh & Al-Sheikh 2023). Main environmental threats that affect the area were also identified by the study. In addition, the report represents the significance of environmental education and awareness programs in the promotion of conservation efforts targeting more than 200 people of the region's communities. Moreover, we have discussed opportunities for the development of sustainable economics in the area through tourism and permaculture initiatives. Wadi Natuf, just 6 km to the South-West of WZ, had evidence of the earliest human agriculture, now commonly called the Natufian period (Stein et al. 2025).

Wadi Al-Quff protected area: This area has been well studied by the Palestine Institute for Biodiversity and Sustainability. Published research shows the rich but highly threatened biodiversity in the Palestinian regions. Wadi Al-Quff has Mediterranean forests, valleys, wetlands, and varied ecosystems which support the area to be a habitat for a large number of plants and animal species. This habitat is characterized by Mediterranean *Quercus calliprinos* woodland on limestone bedrock mixed with cultivated *Pinus halepensis* trees that contribute to the area's vegetation structure. It has very interesting fauna and flora that is well studied. Many field trips to the Wadi concluded with the documentation of 89 species of birds, 21 reptiles, 19 mammals, 3 amphibians, more than 250 invertebrates and over 230 plant species. The Protected Area is mainly threatened by urban expansion from Tarqumiya, Bayt Kahel and Halhul areas. Moreover, major environmental threats were discussed through the study and many conservation methods were suggested including both urgent and long-term ones. Simple interventions can help save the habitats for plants like orchids, *Allium carmeli*, *Salvia indica*, *Clematis cirrhosa*, for birds like *Circaetus gallicus* and mammals like bats, porcupines, *Vormela peregusna*, and reptiles like *Ophisops elegans*. There are detailed reports on the very rich flora and fauna of the area as well as one published paper on the threats and potential management plan for the same, published in a series of papers in a special issue of the Jordan Journal of Natural History¹³. The study ends by concluding that Wadi Al-Quff represents a valuable and threatened natural area which needs immediate conservation action, scientific controlling, and community involvement to conserve its biodiversity for the future.

Al-Arqoub (South Jerusalem Hills) Protected Area (henceforth APA) was designated in the new protected area network of 2023 for very cogent technical reasons in accordance with IUCN

¹³ <https://www.palestinature.org/conservation/JJNH3-edit-final-pages.pdf>

criteria including the significant threats to the area (Qumsiyeh et al. 2023b; IUCN 2025). The focus on this area for this work was driven by the following considerations:

- 1) The area includes a UNESCO World Heritage Site¹⁴. This engaged one of the best locally involved communities who participated in mapping and designating this WHS (Desclaux-Salachas 2020).
- 2) The area is listed as an Important Plant Area (IPA) (Al-Sheikh, 2021), an Important Bird Area (IBA) (Birdlife International 2018a), and a Key Biodiversity Area KBA¹⁵, and one of WWF's Global 200 Priority Biomes for Conservation (Olson and Dinerstein 2002). The area is also recognized as a Global Biodiversity Hotspot (CEPF 2017) and a Global Center of Plant Diversity (WWF and IUCN 1994).
- 3) The first project funded by the National Geographic Society's earlier grant for exploration of the World Heritage Site (WHS) area and the Darwin Initiative funded PIBS to do community work relating to agriculture ecotourism and other ecosystem services also in the WHS area which provided much baseline data for this work. A draft management plan for two of the four valleys studied here was also carried out in 2019. For this area, a management conservation plan is already complete¹⁶ and has been adopted by the relevant authorities¹⁷. The two projects forced us to think of the relationships of the two valleys to other nearby valleys as a connected ecosystem. For example, just to the northeast of the WHS, there is a valley called Cremisan and proceeded to study it separately from the two projects above¹⁸ (see report on Cremisan Valley¹⁹) and data presented herein on a fourth valley (Wadi Fukin). Furthermore PIBS undertook a project in partnership with the IUCN and the EQA to map and redesign protected areas in this site so we decided to designate the enlarged valley system as a protected area (see Qumsiyeh et al. 2023a).
- 4) These two projects and other projects in the area showed the potential of the area as pilot case for other areas: the data on this area was cited a number of times in the 6th Convention on Biological Diversity (CBD) National Report by the state of Palestine to COP, the NBSAP, and on the Clearing House Mechanism for the state.
- 5) Finally, because the area is close to PIBS-Bethlehem University and we have many good relationships with the local eight communities around the protected area. PIBS researchers are very familiar with and are knowledgeable regarding threats to the area. For example, attempts by settlers supported by the Israeli army that encroached on the buffer Zone of this world heritage site were recorded. team working on this project has challenged these activities (see footnote²⁰ for our intervention via UNESCO. Palestinian farmers and inhabitants of the valley complained about the demolishing of farmhouses, burning of structures, and confiscation of lands. Limitations on movement and work are evident. Thus, a biosphere plan would emerge that is much stronger than for other, more distant areas.

Let us now proceed to describe this area and the work we did to map it. Before 1948, the Al-Arqoub cluster of villages were located to the south and west of Jerusalem, Bethlehem, and Beit Jala and connected to those by roads (See Figure 2). More than 20 of those communities were ethnically cleansed between 1948–1950 during the creation of the state of Israel (Pappe 2006). The remaining communities like those in the study area came under Jordanian rule 1949–1967. One of those villages, Al-Walaja, was destroyed in 1948 but had land left on the eastern side of the Green Line and was rebuilt as the new Al-Walaja (Qumsiyeh et al. 2026a). Another, Battir,

¹⁴ <https://whc.unesco.org/en/list/1492/>

¹⁵ <https://www.keybiodiversityareas.org/map>

¹⁶ <https://www.palestinature.org/conservation/Final-Biodiversity-Conservation-Plan-for-WHP-23-December-2019--by-Roubina-Ghattas.pdf>

¹⁷ See plan adoption letter <https://bit.ly/3B7WCK9>

¹⁸ See this report on Cremisan Valley: <https://bit.ly/2V4B1C9>

¹⁹ <https://bit.ly/2V4B1C9>

²⁰ See <https://www.palestinature.org/conservation/Letter-from-UNESCO.pdf>

had the unique feature of having lands retained north of the railroad track (the Green Line) which the villagers were allowed to still access after 1948. However, threats to the areas surrounding those two villages caused the State of Palestine to submit a plan for designation as a UNESCO world Heritage site (MOTA 2015; Fig. 3). The newly designated protected area (IUCN) contained three valleys interconnected by small strips of land (Fig. 4). This study added a fourth valley (Wadi Fukin; Fig. 5 and Fig. 6).

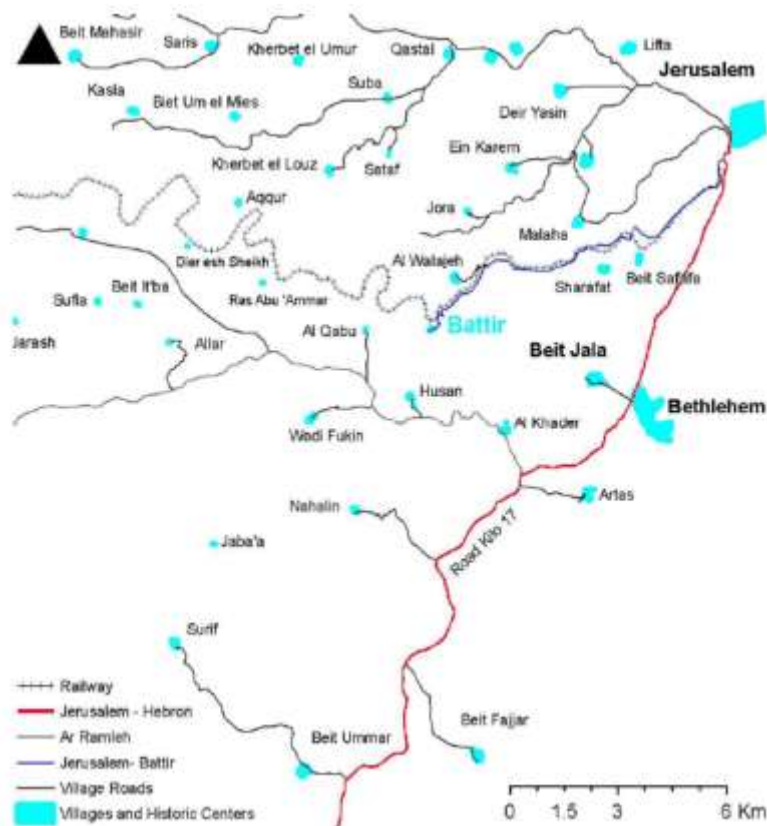


Fig. 2. Al-Arqoub cluster of villages (after Gola et al. 2010).

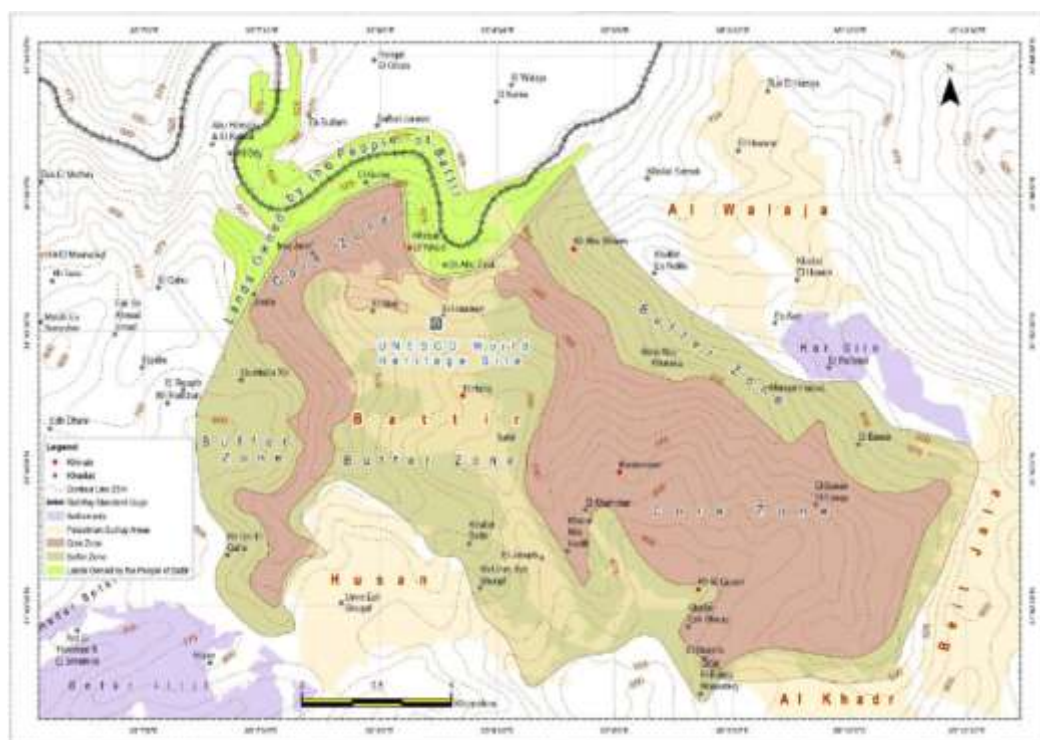


Fig. 3. Map of core and buffer zones in the WHS as well as location of ancient human habitations (ruins) which could be rehabilitated and used as tourism attraction site and/or in redesigning ecotour paths (MOTA 2015).

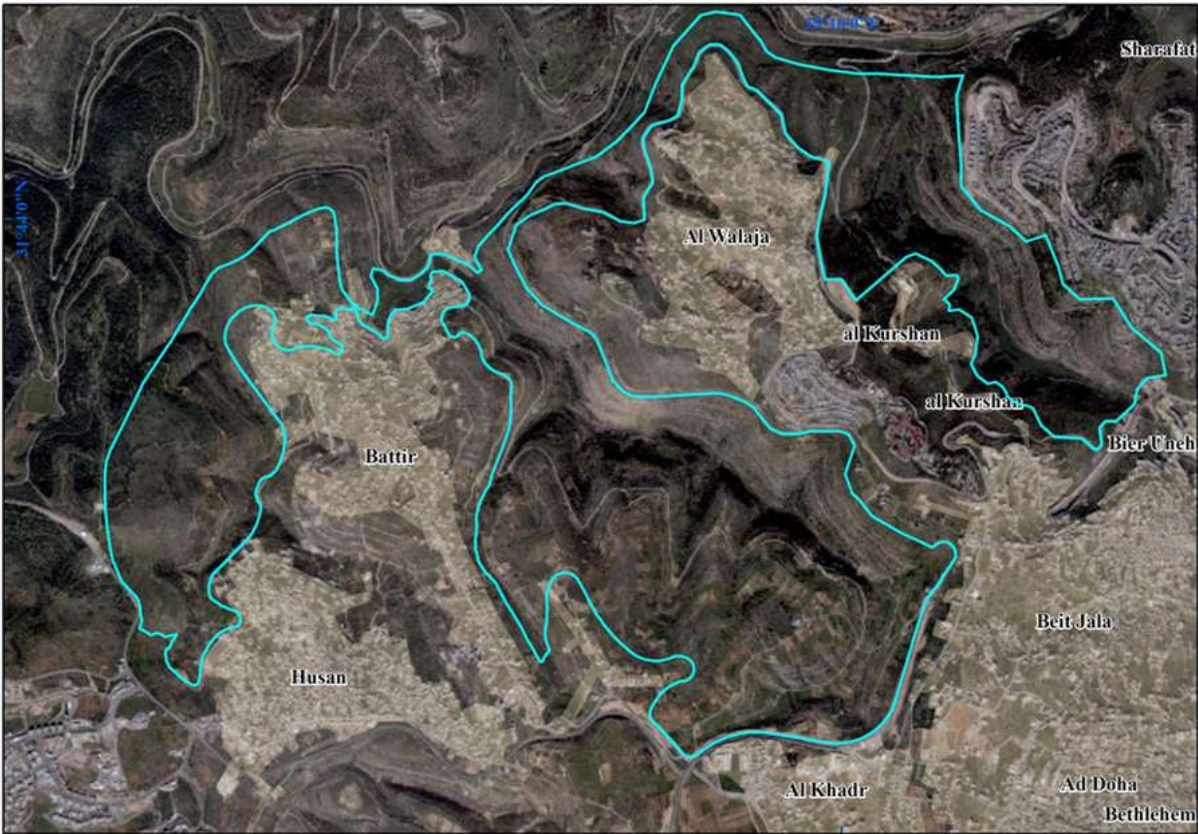


Fig. 4. The newly designated protected area of Al-Arqoub (Qumsiyeh et al. 2023b; IUCN 2025).

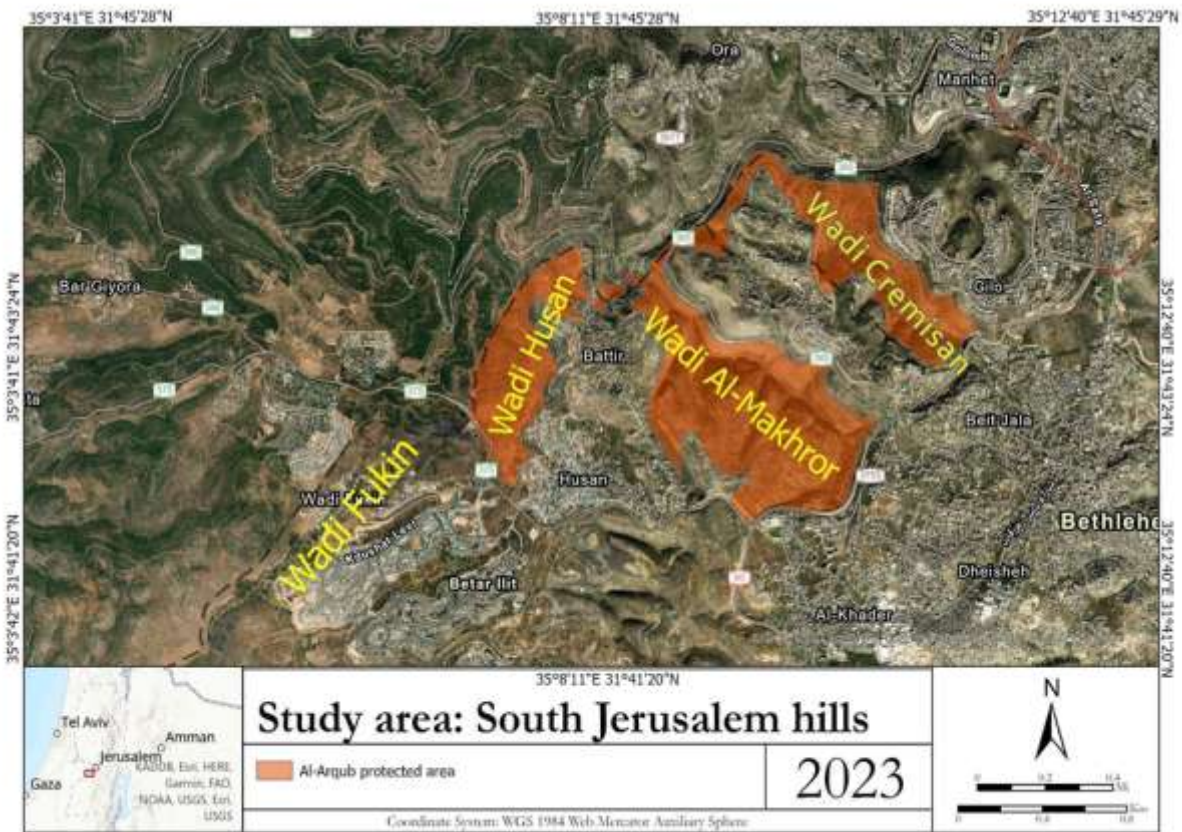


Fig. 5. The four valleys of the Arqoub study area

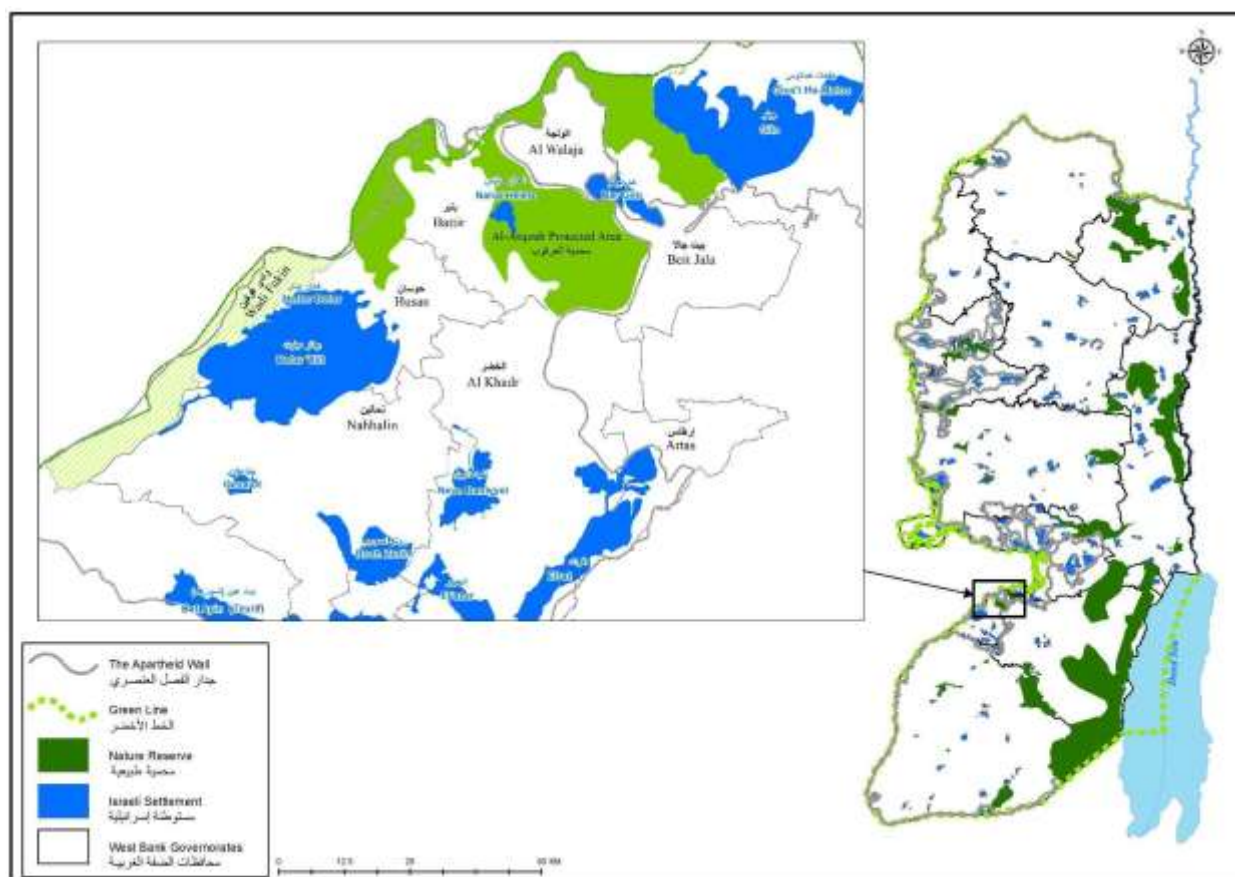


Fig. 6. The Al-Arqoub protected area plus Wadi Fukin (included in the study area) and surrounding Palestinian communities and Israeli colonies.

3.2 Methods

A systematic desktop review was conducted to compile all available relevant scientific policy and grey literature pertaining to the Al-Arqoub area and to the methods of Hima and biosphere reserve establishment. Sources consulted included peer-reviewed journals, national reports (EQA, NBSAP, ARIJ, etc.), UNESCO documentation, IUCN guidelines, and previous PIBS project reports covering the study area as well as those covering other protected areas like Wadi Al-Zarqa Al-Ulwi and Wadi Al-Quff. Relevant international frameworks, the Convention on Biological Diversity, the Kunming-Montreal Global Biodiversity Framework, UNESCO's Seville Strategy for Biosphere Reserves, and the MAB Technical Guidelines, were also systematically reviewed.

A stakeholder database was compiled from national and local networks building on the more than 200 stakeholders engaged during prior PIBS projects in the area. Stakeholders were mapped across six categories: (1) vulnerable community members including farmers, women's cooperatives, and youth; (2) local authorities including village and municipal councils; (3) national government including the EQA and Ministries of Agriculture, Tourism, Local Government, and Culture; (4) civil society organizations and NGOs; (5) tour guides and operators; and (6) academic and research institutions. In addition to local work, we also engaged practitioners and experts both regionally (Lebanon facilitated by SPNL and Jordan facilitated by RSCN) and globally (experts in management, systematics etc. from seven countries).

The study area was surveyed for geological, paleontologic, geographic and botanic attributes focusing on biodiversity surveys by traditional survey methods (e.g. Hill 2005). Plant species occurrence and biodiversity monitoring was carried out mostly in spring 2017 using techniques such as those explained in Ansari (2017). Data collected include the number of species occurring

along these transects, coverage interception per species, and maximum height, which was then analyzed using appropriate keys and descriptions. Collections were made and stored at the herbarium of The Palestine Institute for Biodiversity and Sustainability. Some more delicate or endangered species were photographed and left in the field.

Field observations and sampling of both plants and animals were designed to cover the different habitats noted in the area (see section 4). Sites were examined carefully for the presence of active animals, animal signs and tracts, active burrows, remains or any other vital signs that indicate the activity of animals. Bat echolocation was recorded to determine species richness. Sherman traps were used to trap small mammals and camera traps for large mammals. Transects of over 100 m long were used to look for plants and reptiles. Observed species were recorded and photographed when possible. Field work for birds covered the breeding season and the spring and winter migration seasons. Three different methods were used to study the birds of the site; for the bird baseline and breeding bird survey we used point counts and line transects (Bibby et al. 2000), and for the survey and monitoring of soaring birds a vantage point count was used. During the survey, researchers were equipped with binoculars, telescope, digital camera with telephoto lens, mp3 player and speakers, bird calls, bird field guide, GPS, notebook, and data sheet. The researcher recorded the common name of the species, its location, the bird's status, and when possible, a picture of the recorded birds. Additionally, any observation of roosting birds (soaring birds) with their location during this survey was recorded. All birds heard (singing or calling) and/or seen, were recorded. Line transects were created between these point counts and the researcher moved from one-point count to the other using these lines, whenever possible. In addition, any casual or opportunistic observation of birds obtained while walking/driving to the point counts, during walks carried out within the protected area and its vicinity, were recorded and added. The breeding bird survey was combined with the baseline survey during the spring season and extended to the third week of May. The field activities for all vertebrates were followed by data verification, normalization, and analysis to establish proper description of the ecological character of the study area.

Butterflies and other flying insects were captured with a butterfly net. To collect moths, a fluorescent light was placed at night in promising locations near wooded areas and with a white cloth under it. This attracts moths, which were then placed directly into containers or transferred to containers via aspirator. Other arthropods were simply picked up from substrates or plants they feed on. Insects were euthanised for collection in killing jars or by freezing and all other preparations done by standard zoological methods (Millar et al. 2000). Scorpions were collected via turning over rocks and other objects they use to hide under during daytime or by sweeping the area using a UV light at nighttime (usually 10 PM to midnight). Spiders were collected from under rocks or among plants. Snails were simply picked up where they occur (usually under rocks, in crevices, or around trees or shrubs). In winter, slugs and active snails were noted and photographed. A hand held lens was used for smaller snails. Other methodologies for mollusks (collecting, cleaning, preservation, storage) followed standard protocols (Millar et al. 2000; Sturm et al. 2006; Geiger et al. 2007).

Field data obtained through our work were compared to records available in published scientific papers. Species were identified using standard keys and works (e.g. Vachon 1966, 1974; Levy 1985, 1988; Levy and Amitai 1980; Amr and Abu Baker 2004; Heller 2009; Sama et al. 2010). For many specimens, processing was done at Palestine Museum of Natural History (PMNH), including our nascent Palestine Biodiversity Research Center (PBRC) and the Bethlehem University laboratories for genetic studies. Global species conservation status was assigned according to the IUCN Red List²¹ and consulting data of Dolev & Perevolotsky (2004). Some voucher specimens were kept or photographed and stored for future work/publication at PMNH. For more on other field and laboratory methodologies see RSCN (2005).

²¹ <https://www.iucnredlist.org/>

4. Geology, Geography, and habitats

Palestinian geologic studies proliferated with the increased interests of Europeans in Palestine in the second half of the 19th century (see Benzinger 1895; Blanckenhorn 1896, 1925; Lartet 1873; Lynch 1852; Russell 1888). Recent literature showed that the tectonic movements resulted in multiple openings and closing of the sea basins and uplifts that produced the rich fossil fauna of the Eastern Mediterranean region (Ben-Avraham et al. 2002). Of the various geologic eras studied in our region, the Mid Cretaceous (particularly Cenomanian 93-100 MYA) provided an interesting assemblage of geological and paleontological material (Braun and Hirsch 1994; Philip 1978; Fig. 7).

Most of the rock outcroppings in the Bethlehem area were formed under shallow, warm marine conditions during the late Cretaceous period (Fig. 7), spanning from the Late Cenomanian approximately 95 million years ago to the Late Santonian approximately 82 million years ago. This roughly 13-million-year period of marine sedimentation produced the limestone and dolomite formations that today define the characteristic rugged topography of the region. The rock column starts with medium-thick fractured hard dolomitic limestone with thin marl interbeds that grades upward to be of thick marls and chalks which dominate the whole geologic column with occasional occurrence of medium-hard, thin limestone beds. A major fault directing NE-SW led to the sinking of the eastern part of the area relative to its western part. The outcropping of these soft and thick rock successions made them more susceptible to erosion factors leading to the formation of steep hillsides around the city of Bethlehem, especially in the eastern and northern side (Fig. 8). Moreover these thick limy strata were also suitable sites for karst phenomena and the formation of many caverns and underground caves making the area good shelter for the first people and their domesticated animals.



Fig. 7. Examples of Cenomanian fossils: *Pholadomya*, *Cardium*, *Hemiaster syriacus*, *Fasciolaria saffensis*.

The varied habitats seen in the study area were classified from our earlier study as follows:

1. Natural Oak forest (Fig: 9, 10, 11): Sclerophyllous Broad Leaved Oak Forest and Maquis. This habitat is dominated by the *Quercus calliprinos* Oak tree that supports the growth of diverse and dense batha/garrigue plant associations of mainly *Sarcopoterium spinosum*, *Cistus creticus*, *Cistus salviifolius*, *Calicotome villosa*, and *Coridothymus capitatus*. This habitat supports the growth of diverse, wild Mediterranean trees (Fig. 12) such as *Rhamnus lycioides*, *Crataegus aronia*, *Pistacia palaestina*, and the reseedling of *Pinus halepensis*, and *Pinus pinea*, in addition to diverse shrub and herbaceous species such as *Teucrium divaricatum*, *Teucrium capitatum*, *Fumana arabica*, *Andropogon distachyos*, and many others.
2. Mixed natural oak and olive groves: This habitat is dominated by both oak and olive trees. The habitat support the growth of number of trees such as *Arbutus andrachne*, *Pistacia palaestina*,

- Styrax officinalis*, and number of shrubs and herbaceous species such as *Pistacia lentiscus*, *Phlomis viscosa*, *Calicotome villosa*, *Cyclamen persicum*, *Smilax aspera*, and many others.
3. Man-made planted coniferous woodland: This habitat is dominant with *Pinus halepensis* cultivated tree and its reseeding plants. This habitat does not support diverse plants but mainly scattered herbaceous species especially at the sides of the habitat where new habitats start to emerge.
 4. Batha and Garrigue habitat: This habitat supports the growth of shrub/subshrubs and herbaceous species. Of the main species are *Phlomis viscoa*, *Cistus spp.*, *Sarcopoterium spinosum*, *Coridothymus capitatus*, *Calicotome villosa*, *Bellis sylvestris*, *Teucrium creticum*, and many others.
 5. Fallow lands and olive groves: This habitat is mainly located at the flat lowland valley, where there are widespread olive groves either cultivated or still taken care of by its owners as those groves are plowed lands or groves that are cultivated and left alone for one or two seasons only, or groves that were cultivated but neglected and only visited for harvesting and here the fallow land appear under or on the sides of the olive grove land. The plant associations in this habitat are *Asparagus aphyllus*, *Andropogon distachyos*, *Calicotome villosa*, *Carlina spp.*, *Arum Palaestinum*, and *Malva parviflora*.
 6. Mixed oak and Pine forest supporting Batha association: Supports diverse types of plants such as *Pistacia palaestina*, *Rhamnus lycoides*, *Crataegus aronia*, *Teucrium capitatum*, *Thymus spicata*, *Thymbra spicata*, *Leontodon tuberosus*, and others (Fig. 15).
 7. The trench of the lowland valleys (the deepest point in the valleys): Main plants are *Pistacia palaestina*, *Quercus calliprinos*, *Sarcopoterium spinosum*, *Calicotome villosa*, *Cistus spp.*, *Salvia indica*, *Daucus carota*, *Phagnalon rupestre*, *Dittrichia viscosa*, and many others.
 8. Micro-environments that support the growth of specific plant species within the different habitats. This is mainly obvious on terraces (natural and man- made) (Fig. 13 and 14), near paths, near water collections, and on heaps of small rocks. For example, there are lithophyte species that grow abundantly in the valley are *Cyclamen persicum*, *Umbilicus intermedius*, *Arisarum vulgare*, *Chiliadenus iphionoides* (*Varthemia*), *Ajuga chamaepitys*, and others which are mainly geophytes. Near the paths and water collection sites there were diverse plants growing such as *Sinapis arvensis*, *Malva parviflora*, *Foeniculum vulgare*, *Nasturtium officinale*, *Verbascum sinuatum*, *Ferula communis*, and many others. And there are a number of climbing plant species including *Smilax aspera*, *Clematis cirrhosa*, *Lonicera etrusca*.



Figure 8. Example of cliff sides and caverns that provided shelter for humans, domesticated animals, and wildlife in the area.



Figure 9. View of Cremisan/Wadi Ahmed Valley.



Figure 10. Typical valley structure in the study area showing contrasting habitats on the northern and southern sides near Nahhalin. This reflects local geologic and climate conditions (sun and heat).



Fig. 11 Habitats of mixed original oak and planted pine trees.



Fig. 12: Mixed agricultural and maquis habitats near Battir (Al-Makhrouir valley).



Fig. 13: Terraced agricultural fields below Battir.



Figure 14: View from Al Malhrour Valley.



Fig. 15: Wadi Alghwait between Husan and Nahhalin.

Interest in geography of Palestine before the modern era started with Greek philosophers like Herodotus who mentioned the Dead Sea in a “province of Syria” and was followed by studies by travelers like Ibn Batuta and work in the late Middle ages (see Avi-Yonah 1962; Hütteroth and Abdulfattah 1977). In the 19th century there was renewed interest using more scientific principles in the geography of the area (Ritter 1866; Hull and Fund 1888; Albright, 1921). The geography of the area and especially the human impact on the landscape was most prominently studied in the case of Battir which is part of the area under study here (Abu Hammad 2016). Al-Makhroun is in the Mediterranean climatic zone; local elevations ranging from 710–920 meters above sea level with annual rainfall around 550 mm (Fig 16).

As the 21st century unfolds, climate change will have a dramatic impact on biodiversity and human health and sustainability (Portnov and Paz 2008). This requires the integration of educational, evolutionary, and ecological responses into models and potential remedies (Settele et al. 2005, Lavergne et al. 2010). Since ecosystems play a significant role in human well-being, human beings must rise to the many challenges, especially the one that threatens life on earth as we know it—climate change (UNDP 2010). The world is now fully aware of the potentially devastating impact of human induced activities on climate change. While it is common sense that climate change impacts biodiversity mostly via habitat alterations, there is a challenge of how to perform these studies (Rinawati et al. 2013). Some benefiting industries and countries that emit large quantities of carbon into the air have attempted to limit emissions to stop the deterioration and at least moderate the human impact on our atmosphere. International meetings have been held and all scientists warned of the impending global challenge (e.g., United Nations Framework Convention on Climate Change²²). The effect of climate change on biodiversity in our region is still poorly understood (Sternberg et al 2015). We do know however that the protected areas in this study will likely be impacted in numerous ways by climate change. The diversity of vegetation classes and habitat types across this relatively small geographic area is at risk from these unpredictable climatic changes. Conservation plans such as outlined here are an important tool in building cultural and ecological resilience in the face of these challenges.

Returning to the primary study area, this territory is part of a valley system that starts from Beit Jala (the Cremisan Monastery or Wadi Ahmad area) around Al-Walaja then progresses through the villages of Al Khader, Battir, Husan, in a south direction, continuing to collect runoff along the way to reach its point of major discharge in the Mediterranean via Wadi Es-Sant, while also filling the Western water aquifer. Battir alone has more than ten water springs and the village of Husan contains more than twelve. An extensive man-made system of terraces planted mainly with olive trees and grapes in the Cremisan valley represent an essential component in the historical development of the cultural landscape of this area with multiple functions and meanings at the environmental, agricultural, socio-cultural, and symbolic levels. This system dates back to the Chalcolithic period (4500 to 3000 BC); marking the beginning of traditional village patterns in Palestine (Ghattas et al. 2019). Cultural protection of this landscape is critical (Tengberg et al. 2012). The study area is an important part of this hydrological system that replenishes the western aquifer. The mean annual temperature in this area is 16°C. The annual precipitation is between 601 mm–688 mm, with the highest elevation that reaches up to 804 meters above sea level.

The four valleys of the area covered by this study:

- 1) Wadi Cremisan (aka Wadi Abu Ahmed): Located to the northeast of the study area, connecting Beit Jala to Al-Walaja, is home to the historic Cremisan Monastery and features an extensive system of terraces planted mainly with olive trees and grapes, dating back to the Chalcolithic period (4500–3000 BC). The valley supports contrasting habitats on its northern and southern slopes reflecting local geologic and climatic conditions. A

²² <http://unfccc.int>

full description of the valley's biodiversity and cultural heritage is available in the dedicated Cremisan Valley report.²³

- 2) Wadi Al-Makhrou (Fig. 17): is a valley located about 7 km south of the old city of Jerusalem and about 6 km northeast of the old city of Bethlehem. It is connected to other valley systems and stretches from the Walaja and Cremisan valleys to the South of Jerusalem and takes in the water of the Makhrou itself (between Beit Jala, Al-Khader, and Al-Walaja) to drain into the Battir and then Husan and Nahhalin valleys (Fig. 16). Al-Makhrou is an important part of the system that refills the water aquifer of the Bethlehem District area and the fresh water springs pass from the center of old trees planted there. The area is the last remaining biodiversity-rich area south of Jerusalem and in the Bethlehem and Jerusalem districts (Fig. 18). The valley is mentioned early in travel books (e.g. Robinson 1856). Excavations in the valley show humans used the bounty of the valley from the Middle Bronze Age (Rapoport 2006) going through use in the Iron Age, Persian, Hellenistic, and early Islamic Periods until today (Dagan 2010).
- 3) Wadi Al-Oyun (aka Wadi Husan): Located 6.5 km west of Bethlehem, this valley is bordered by Al Khader to the east, Battir to the north, and Nahhalin to the south. The valley is fed by more than twelve water springs and covers a total area of 7,361 dunums of which 1,026 dunums are cultivated land. Its Mediterranean habitats support a rich diversity of fauna and flora documented in our surveys (see section 7. *Fauna and Flora*). The valley and its community face severe pressure from the neighbouring Israeli settlements of Betar Illit to the south and the Green Line to the west.



Figure 16. A map shows the location of Wadi Al-Makhrou in Bethlehem district.

²³ <https://www.palestinenature.org/conservation/Cremisan-Valley.pdf>



Fig. 17: The reason the valley is called Al-Makhrour: water dripping along limestone cliffs.



Figure 18. Wadi Al-Makhrour photo taken from the southern hill towards the north showing the Israeli colony of Har Gilo and to the left the edge of the Palestinian village of Al-Walajah.

- 4) Wadi Fukin: Historically known as the Valley of Thorns, it is located at an elevation of 600–650 meters above sea level and is surrounded by steep rocky hills. The valley is fed by eleven perennial springs originating from a shallow aquifer covering approximately 6 square kilometers of watershed. These springs support a traditional irrigation network that has sustained rich Mediterranean agriculture for centuries, including olives, grapes, figs, and vegetables. Recent botanical surveys have identified numerous rare and endangered

plant species in the hills surrounding the valley. Wadi Fukin faces severe ecological pressure from the expansion of neighbouring Israeli settlements, particularly Beitar Illit, which has been built on confiscated village lands and whose expansion threatens the spring recharge area.

The World Heritage Site stretches from Al-Makhroul Valley to Battir village to Al-Oyon Valley in Hussan includes traditional footpaths (which connected various human settlements that developed around the many springs that dot the slopes of the mountains) which have contributed to the creation of a unique cultural landscape composed of agricultural terraces that are supported by dry-stone walls, agricultural watchtowers (manatir or qusoor), olive oil presses, ancient irrigation pools to collect the water flowing from the springs, ancient irrigation canals, and the remains of human settlements (khirab), all conserved by the local villagers (Battir, Hussan, and Beit Jala) for centuries (Fig. 19). As a part of its commitment, the Ministry of Tourism and Antiquities prepared a draft management and conservation plan for the WHS and buffer areas. The final management plan aims to expand on the existing MOTA (2015) draft management plan for this UNESCO site but also to improve self-sustainability in order to conserve the Outstanding Universal Value (OUV) for this area. The management includes a SWOT analysis for the area and detailed recommendations including an action plan. It also includes community capacity-building activities.

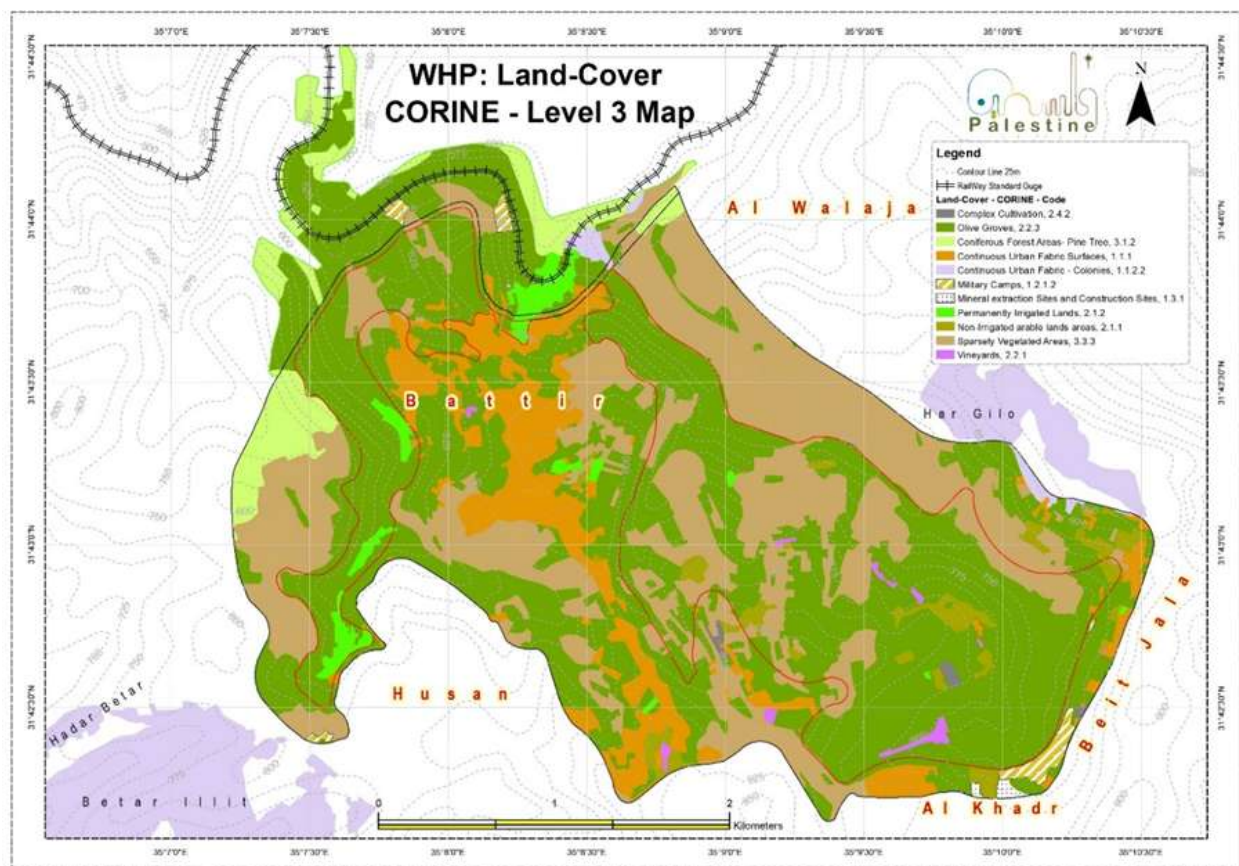


Fig. 19. Land use in the WHS.

5. Flora and Mushrooms

In terms of the scope of literature available on flora in Palestine, there are records on this topic dating back to the late 19th century, when Guerin (1852) and Tristram (1892) wrote the Natural History of Palestine, which drew on the work done by the Palestine Exploration Fund to produce *Flora of Palestine* in the late 1880s. Palestine has a rich flora in spite of its small area due to its geographical position as a meeting point between Asia and Africa, where three phytogeographical regions intersect: Mediterranean, Irano-Turanian, and Saharo-Arabian. There have been some

studies of the flora of our region but they mostly focused on areas of Palestine inside the Green line (Post 1933; Zohary 1966, 1972, 1973; Feinbrun-Dothan 1986; Zohary and Feinbrun-Dothan 1986; Tchernov & Yom-Tov 1988; Danin 1992; Danin and Feinbrun-Dothan 1991; Danin 2004; Al-Sheikh et al. 2000) though not focusing on the area under study discussed here. Historic Palestine is estimated to have over 3,000 vascular plant species, approximately 1 percent of the global biodiversity. Palestine contains not only rich biodiversity for its latitude but a large number of endemic and rare species (Al-Sheikh and Qumsiyeh 2021). Forested areas, while compiling a small percentage of the total area, harbor much of this floral diversity (Ghattas et al. 2005).

A study by ARIJ (2006) noted 2,076 plant species inhabit the West Bank and Gaza Strip, and 1,290 species in 105 families grow in the Gaza Strip, of which 117 species grow only in the Gaza Strip. More thorough study (Al-Sheikh 2019) noted the occupied West Bank had 1,612 plant species but over 30 additional species have been recorded since (to 2025 e.g. Al-Sheikh & Qumsiyeh 2021b; Al-Sheikh et al. 2024; Gedeon & Qumsiyeh 2023; Gedeon et al. 2025) and more remain to be discovered. Much more work needs to be done in this field, such as the studies that were done in some of the protected areas: Wadi Al Quff (Al-Sheikh & Mahassneh 2016), Wadi Al Zarqa Al Ulwi and Wadi Qana (Qumsiyeh & Al-Sheikh 2023), and Wadi Janata (Ghattas et al. 2018). Plants will be key to understanding habitat changes and to the monitoring and evaluation of ecosystems in these protected areas (Boyko 1947).

Local flora includes the common Mediterranean type of flora as the valley and the surrounding villages are located in the central highlands of Palestine that enjoys the Mediterranean ecosystem and the Mediterranean Plant Geo-Element (Fig. 20). This ecosystem is the richest ecosystem in Palestine. It is woodland and semi-shrub undergrowth with high canopy cover (further research is needed to specify and monitor the canopy percentage) and contains a diverse assemblage of trees, shrubs/sub-shrubs, and herbaceous associations. A major feature is a natural forest which comprises a *maquis*, *garrigue* and *batha* associations in different stretches along the valley. The natural forested area is one of the few green areas remaining in Bethlehem Governorate; it is famous for the abundance of oaks, carobs, terebinths, Palestinian lentisks, Palestine buckthorns, spiny hawthorns, prickly burnets, soft-hairy rockroses, headed thymes, wild marjoram, and many other plants. Further studies are needed to better identify the available vegetation cover, its distribution and its status at Al- Makhroul valley (Fig. 21).

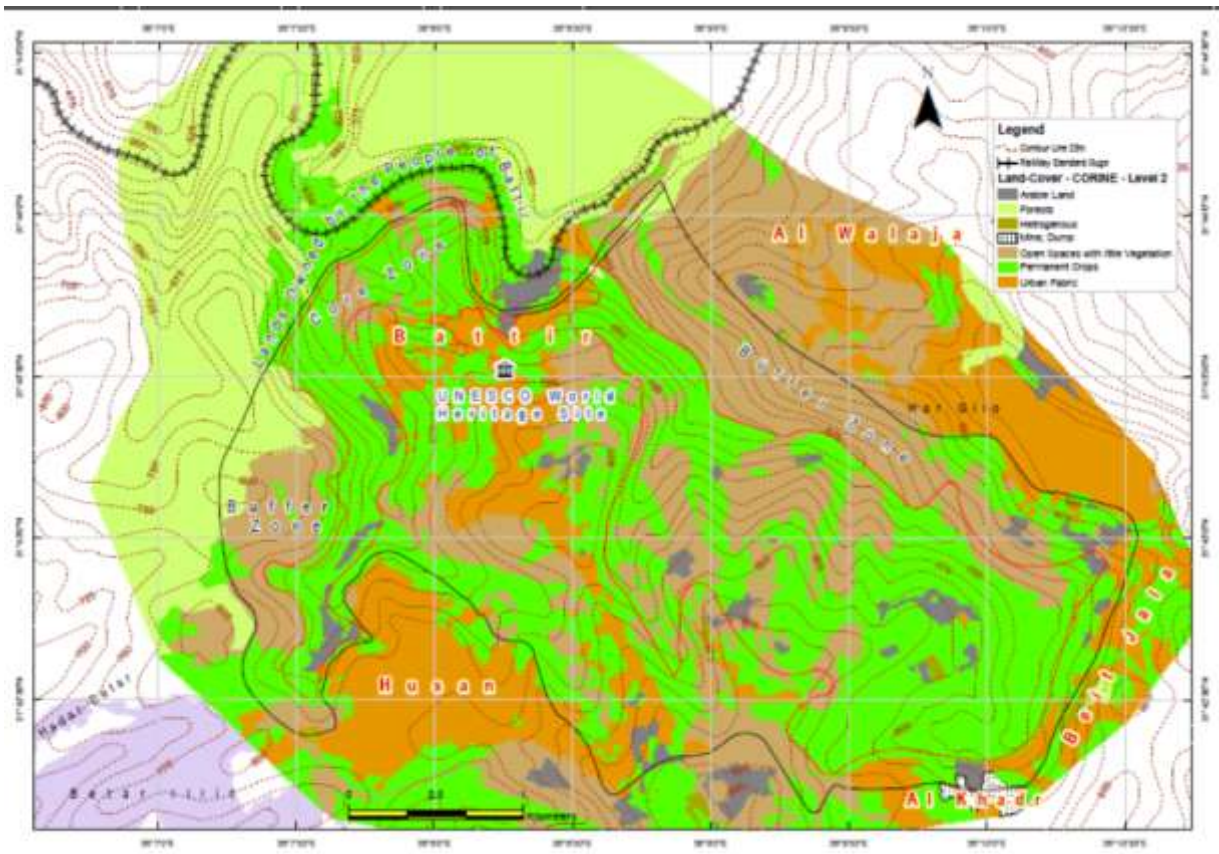


Fig. 20. CORINE Classification of Land Cover including “forested” areas in the valley (MOTA 2015).



Fig 21. Red poppies in the study area.

In the study area, there are 384 vascular species belonging to 73 families. The seven richest families are Papilionaceae (Fabaceae) 48 species, Compositae (Asteraceae) 47 species, Labiatae

(Lamiaceae) 29 species, Gramineae (Poaceae) 28 species, Scrophulariaceae 13 species, Boraginaceae 12 species, and Cruciferae (Brassicaceae) 12 species (Fig. 22).

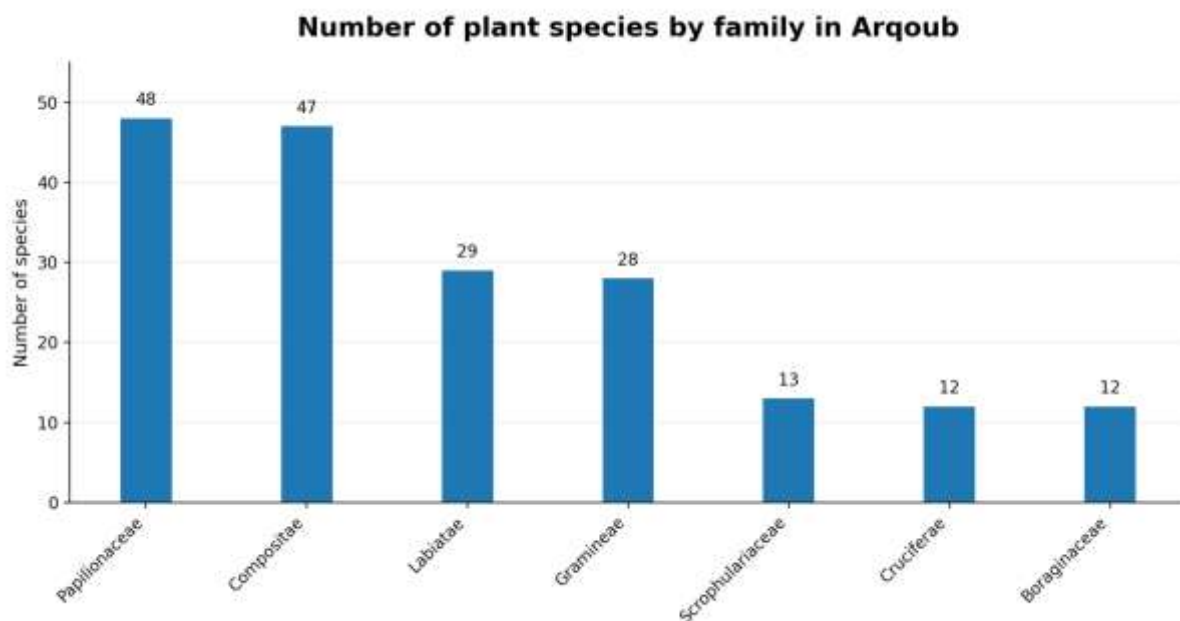


Fig. 22. The most common plant families in terms of number of species

Notable plants include *Fumana thymifolia*, *Adonis annua* (very rare), *Amygdalus communis*, *Tulipa agenensis*, *Anchusa aegyptiaca*, *Arabis verna* (RR), *Buglossoides tenuiflora* (RR), *Coronilla cretica* (R), *Crepis reuteriana* (R), *Lolium rigidum*, *Putoria calabrica* (RR), *Salvia indica* (RR), *Stellaria pallida* (R), *Theligonum cyanocrambe*, *Veronica anagallis aquatica*, *Briza minor*, *Juncus bufonius*, *Rhamnus alaternus* (R), *Carduus argentatus*, *Colichium hierosolymitanum*, *Nonea philistaea*, *Reseda alopecuroides*, *Verbena supina*, *Polygonum argyrocoleon*, *Portulaca oleracea*, *Lactuca undulata*, and *Turgenia latifolia* (Qumsiyeh et al. 2024) The area has an interesting variety of mushroom species; such as *Amanita ovoidea*, *Arrhenia rickenii*, *Coprinopsis friesii*, *Coprinus comatus*, *Cryptomarasmius corbariensis*, *Lentinus arcularius*, *Lepista sordida*, *Lycoperdon perlatum*, *Psathyrella bipellis*, *Suillus collinitus*, *Volvopluteus gloiocephalus*, *Xerocomellus redeuilhii*. These species were reported in 2021 (many are locally threatened): *Anacamptis papilionacea* subsp. *palaestina*, *Anacamptis pyramidalis*, *Neotinea tridentata*, *Ophrys iricolor*, *Ophrys lutea*, *Orchis anatolica*, *Orchis galilaea*, and *Limodorum abortivum* (Pahl and Qumsiyeh 2021). *Iris vartanii*, *Ophrys iricolor*, *Ophrys sphegodes*, and *Salvia indica* are important as ornamental plants, especially *Salvia indica* (Fig. 24) which is large with appealing purple flowers. Cremisan also has two young trees of *Quercus ithaburensis* which is rare in the West Bank.

An example of a surveyed area is shown in Figure 23, including selected sampling quadrants, which are described in greater detail in subsequent sections. The study benefited from consultations with local experts, including Banan Alsheikh and Johann Gedeon, as well as international specialists such as Ruediger Prasse. Gap-filling data were collected through targeted surveys in selected areas, particularly in and around the eight communities included within the study area. Data on flora comparing 2018 with 2020 can be found here: <http://bit.ly/2plr7wc> (plants beginning), 2021 here <https://bit.ly/3gJz9pu> & the most recent update for all the study area of four valleys here <https://www.palestinenature.org/conservation/Full-flora-in-Arqoub.pdf> documenting 384 species of vascular plants in the study area. Examples of flora in the area are shown in Fig 24.



Fig. 23. Important areas for flora in Wadi Al-Makhrou (top), and in Battir itself and Husan valley (bottom).



Fig. 24. *Salvia indica*, *Orchis galilaea*, *Tulipa agenensis*, *Limodorum abortivum*.

Notable species of mushrooms/fungi identified²⁴: *Amanita ovoidea*, *Arrhenia rickenii*, *Coprinellus micaceus*, *Coprinopsis friesii*, *Coprinus comatus*, *Cryptomarasmius corbariensis*, *Geopora arenosa*, *Helvella lacunose*, *Lentinus arcularius*, *Lepista sordida*, *Lycoperdon perlatum*, *Omphalotus olearius*, *Psathyrella bipellis*, *Sarcomyxa serotina*, *Suillus collinitus*, *Tapinella panuoides*, *Trametes hirsute*, *Volvopluteus gloiocephalus*, and *Xerocomellus redeuilhii*.

6. Fauna

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

²⁴ There were over 15 other species that could only be identified to genera or family. Further study is needed (see Thaler et al. (2020).

published by Palestinian scientists. Among native Palestinian zoologists Dr. Sana Atallah (died 1970) focused on mammals (Atallah 1977, 1978). Additional significant studies of mammals followed (Qumsiyeh 1985, 1996, Harrison and Bates 1991; Whitaker Jr et al. 1994; Qumsiyeh 1996; Mendelssohn and Yom-Tov 1999; Amr et al. 2006; Benda et al. 2010) reptiles and amphibians (Damhoureyeh et al. 2009; Disi and Amr 2010; Salman et al. 2014; Bar and Haimovitch 2011; Werner 2016), arachnids (Levy 1985, 1998; Levy and Amitai 1980; Qumsiyeh et al. 2013), mollusks (Heller and Arad 2009; Amr et al. 2018 and references cited therein), and insects (Halperin and Sauter 1991; Katbeh-Bader and Amr 1998). The data below on fauna incorporates our recent studies starting in 2019 (beginning of our work in the area via a limited National Geographic grant) and includes data collected as gap filling data in 2025.

6.1 Invertebrates

Snails: The following 16 land snail species were collected from the study area: *Granopupa granum*, *Buliminus labrosus*, *Paramastus episomus*, *Pene bulimoides*, *Euchondrus septemdentatus*, *Euchondrus chondriformis*, *Eopolita protensa jebusitica*, *Sphincterochila fimbriata*, *Monacha obstructa*, *Monacha syriaca*, *Monaca crispulata*, *Metafruticicola fourousi*, *Xeropicta krynickii*, *Levantina caesareana*, *Levantina lithophaga*, and *Helix (Pelasga) engaddensis*. The species *Monacha crispulata* is a species found in Al Makhrou and it needs a specific habitat with dense oak trees, and the only known distribution of this species is throughout Palestine, Lebanon, and Jordan. A total of 14 species of freshwater snails are recorded from the Palestinian Territories (West Bank). They belong to seven families (Cochliopidae, Melanopsidae, Neritidae, Lymnaeidae, Physidae, Planorbidae, and Thiariidae) in eleven genera (*Bulinus*, *Eupaludestrina*, *Heleobia*, *Galba*, *Melanoides*, *Melanopsis*, *Mieniplotia*, *Physella*, *Planorbella*, *Radix*, and *Theodoxus*) (Handal et al. 2015, 2023). We found one species of freshwater snails in the Al Arqoub Protected area, *Melanopsis buccinoidea*, a species found in Wadi Fukin.

Insecta is the largest assemblage of animal species, containing around 7 million species - the biggest biomass of living animals on earth. Our estimation is that Palestine could have more than 35,000 species of the class Insecta. Few studies were conducted in the Palestinian territories and these are discussed below. For example, there are over over 20 species of butterflies and many other species of moths (a difficult group taxonomically that is actively being studied with some new species being discovered), and according to a recent study by Gedeon et al. (2025) a total of 44 species of Butterflies were recorded from the Al Arqoub Protected area. As for moths, 11 families were found and over 21 species (many yet to be identified including the families Erebiidae, and Noctuidae), we did not focus on them due to lack of identification keys. Orthoptera is an order studied well in Historic Palestine in the years between 1893-1939 by Uvarov, Swinton and Giglio-Tos (see Abusarhan et al. 2017). The most comprehensive recent study on the Orthoptera of Palestine was published by Fishelson (1985) but still did not show the distribution of species within the Palestinian territories. According to Abusarhan et al. (2017), 10 species of grasshoppers were recorded from the studied area as the following: *Truxalis grandis*, *Acrotylus insubricus*, *Oedipoda aurea*, *Oedipoda miniata*, *Oedipoda caerulescens*, *Tmethis pulchripennis asiaticus*, *Prionosthenus galericulatus*, *Calliptamus coelesyriensis*, *Eremotmethis carinatus*, *Sphingonotus (Sphingonotus) rubescens*. **Dragonflies:** Odonata is an order of insects divided into three suborders: Anisoptera (true dragonflies), Zygoptera (damselflies), and Anisozygoptera (a very small suborder considered intermediate between damselflies and dragonflies). A study shows some of the Anisoptera that exist in Wadi Al Makhrou and the surrounding area (Al Walaja and Hussan), and it shows the existence of three species: *Trithemis arteriosa*, *Trithemis annulata*, and *Orthetrum chrysostigma* (Adawi et al. 2017).



Fig. 25 A: *Bombylius* sp., B: *Oxythyrea noemi*, C: *Carcharodus alceae*, D: Crap spider (*Thomisus* sp.) feeding on a fly.

Praying mantids or Mantodea is a vast order of insects. Handal et al. (2018) reviews the praying mantis in the west Bank and shows existence of 16 species out of 30 species from the Historic Palestine, four species recorded from Al Makhroun and Battir (*Blepharopsis mendica*, *Empusa fasciata*, *Rivetina byblica*, and *Iris oratoria*).

Coleoptera (beetles) is a huge order rich with species and reaches 1.5 million worldwide. Many studies on beetles have been done in Historic Palestine but none of them show the species that exist specifically in the Palestinian territories—the West Bank. One study done by the Palestine Museum of Natural History on subfamily Cetoniinae shows that 2 species exist - *Tropinota suturalis* and *Oxythyrea noemi* (Handal and Amr 2018). More studies need to be carried out in this field to develop a list of species that exist in the area. A subsequent study of Coccinellidae in the Southern parts of the West Bank and the Jordan valley covers species richness (Najajrah et al. 2019).

Butterflies (Lepidoptera) are poorly studied in the West Bank – Palestine and most studies done around the Palestinian territories in Historic Palestine indicate about 150 species (Benyamini

1997). Few studies address the diversity of butterflies throughout the Palestinian territories and only focus on the southern West Bank with 54 species and two protected areas, Wadi Zarqa Al-Ulwi with 30 species and Wadi Quff with 23 species (Abusarhan *et al.* 2016; PMNH 2018; Qumsiyeh 2016). Abusarhan *et al.* (2016) shows 12 species of butterflies collected from the Wadi Al Makhrou area belonging to four families and without including the family Papilionidae which two species observed by the PMNH team before but not published (*Papilio machaon* and *Achon apollinus*). Species recorded from WM: Pieridae: *Aporia crataegi augustior*, *Pieris brassicae*, *Pieris rapae leucosoma*, *Pontia daplidice*, *Colias croceus*; Nymphalidae: *Limenitis reducta schiffmuelleri*, *Melitaea telona*, *Polygonia egea*; Lycaenidae: *Lycaena thersamon*, *Polyommatus Icarus*; Hesperidae: *Spialia orbifer hilaris*, *Syrictus tessellum nomas*.

A recent study targeted the Arqoub Protected area to assess eco-corridors of the PA between the valleys (Al Makhrou, Cremisan, Wadi Fukin, and Wadi Husan), documented a total of 44 species of butterflies species, belonging to five families Papilionidae, Pieridae, Lycaenidae, Hesperidae, and Nymphalidae (Gedeon *et al.* 2025).

Heteroptera: no taxonomic studies related to true bugs have been published for species in the West Bank. We identified many species including the existence of the invasive Western conifer seed bug *Leptoglossus occidentalis* (Hemiptera, Coreidae) in the study area (Handal and Qumsiyeh 2019).

Arachnids: There are at least 150 species of spiders. The difficult group was the regular spiders (Order Araneae). There were two species of camel spiders, and some pseudoscorpions: *Chithonius jonicus*, *Cardiophum stupidum*, and *Ephippiochthonius sp.* The dominant scorpion species that we found include: *Hottentotta judaicus*, *Scorpio maurus*, and *Nebo hierichonticus* (see also Qumsiyeh *et al.* 2013).



Fig. 26 *Androctonus* scorpion.

Other Invertebrates: Recently Bdir and Adwan (2011, 2012) investigated the presence of larval stages of **trematodes** among freshwater snails collected from the Palestinian Territories.

6.2 Fish, Reptiles, and Amphibians

Only one species of fish was noted in the study area, *Garra nana*, from Wadi Fukin and in Artas area (Suleiman's pools), plus the invasive species of Gold fish are known to have been introduced to some ponds. Salman *et al.* (2014) studied amphibians (frogs and toads) from the West Bank –

Palestine, results showing two species of frogs (*Pelophylax bedriagae* and *Hyla sp.*) that exist around our study area in Hussan, Wadi Fukin, and Artas. Our recent study (2025/2026) showed toads, water frogs and tree frogs are represented each by a single species (*Bufo sitibundus*, *Pelophylax bedriagae* and *Hyla savignyi* respectively) in Al-Arqoub (Fig 27).



Fig 27. *Bufo sitibundus*, *Pelophylax bedriagae*, and *Hyla savignyi*.

Reptile studies in Palestine started in the 19th century (Festa 1894; Boettger 1878; Tristram 1884). There is a rich biodiversity of reptiles, both endemic and non-endemic, from various biogeographic zones: Ethiopian, Mediterranean, Saharo-Arabian, and Irano-Turanean (Werner 1988). While significant studies on the reptiles in the areas occupied by Israel since 1948 were conducted, there are few studies by local scientists on the herpetology of the State of Palestine. Recently, the Palestine Natural History Museum reported on a collection of reptiles from several localities within the Palestinian Territories. Distributional data for 36 species belonging to 13 families are given (Handal et al. 2016). Reptiles are diversified and include 17 families (Tortoises: Bataguridae and Testudinidae; Lizards: Agamidae, Anguidae, Chamaeleonidae, Gekkonidae, Phyllodactylidae, Lacertidae, Scincidae, and Varanidae; Snakes: Leptotyphlopidae, Typhlopidae, Boidea, Colubridae, Atractaspididae, Viperidae, and Elapidae) with a total of 93 species and subspecies. A total of 21 species of reptiles were reported from the four valleys as the following (Wadi Fukin: 12 species, Wadi Husan: 11 species, Wadi Al Makhror: 20 species, Wadi Cremisan: 13 species) (Fig. 28) see Table 1.

Table. 1. List of Reptiles from each Valley

Family	Species	Common Name	Wadi Al Makhror	Wadi Cremisan	Wadi Husan	Wadi Fukin
Lacertidae	<i>Phphenicolacerta laevis</i>	Common Lebanon	X	X	X	X
	<i>Ophisops elegans</i>	Elegant lizard	X	X		
Chamaeleonidae	<i>Chamaeleo chamaeleon</i>	Chameleon	X	X	X	X
Agamidae	<i>Laudakia vulgaris</i>	Rock Agama	X	X	X	X
Testudinidae	<i>Testudo graeca</i>	Mediterranean tortoise	X	X	X	X
Gekkonidae	<i>Hemidactylus turcicus</i>	House Gecko	X	X	X	X

Phyllodactyli dae	<i>Ptyodactylus guttatus</i>	Fan Fingered Gecko	X	X	X	X
Scincidae	<i>Ablepharus rueppellii</i>	Snake eyed Skink	X	X		
	<i>Chalcides ocellatus</i>	Cylindrical Skink	X	X	X	X
	<i>Heremites vittata</i>	Bridled mabuya	X		X	X
	<i>Chalcides guentheri</i>	Günther's cylindrical skink				X
	<i>Xerotyphlops syriacus</i>	Eurasian blindsnake	X	X		
	<i>Dolichophis jugularis</i>	Black whipsnake	X	X	X	X
	<i>Eirenis coronella</i>	Crowned dwarf racer	X			
	<i>Eirenis decemlineatus</i>	Narrow-striped dwarf racer	X	X		
	<i>Eirenis rothii</i>	Roth's dwarf racer	X			
	<i>Hemorrhois nummifer</i>	Coin-marked snake	X	X	X	X
	<i>Platyceps collaris</i>	Red whip snake	X			X
	<i>Micrelaps muelleri</i>	Müller's black- headed snake	X			
	<i>Malpolon insignitus</i>	Eastern Montpellier snake	X		X	X
	<i>Daboia palaestinae</i>	Palestine viper	X			

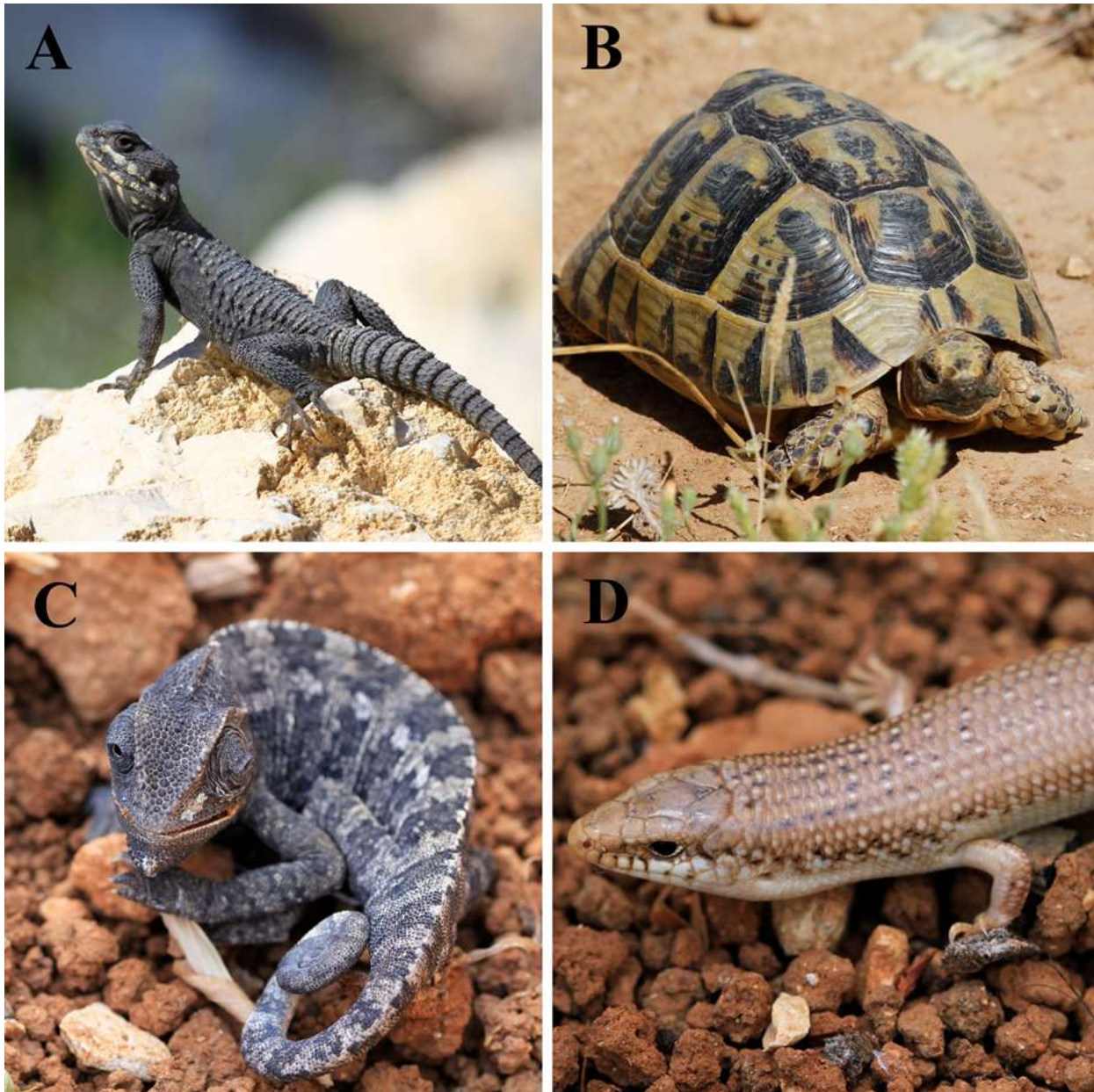


Fig 28. A: *Laudakia vulgaris*, B: *Testudo graeca*, C: *Chamaeleo chamaeleon*, D: *Chalcides ocellatus*.

6.3 Birds

Birds are the most visible of the Palestinian fauna and much earlier scientific work was done on them. But unlike the studies of other groups, there were also “layperson” books and booklets that appeared for this visual group (e.g. Awad 2009). In 2024, Al Shomali published a field guide book on the Birds of Palestine (West Bank) with around 300 bird species. Brett (1988) reported on the birds of prey in Palestine. Birds have been studied intensively in Historic Palestine by Israeli ornithologists in the past 50 years, but still the Palestinian territories (West Bank and Gaza) are poorly known and need more attention (Shirihai *et al.* 1996; Amr *et al.* 2016; Awad *et al.* 2017; Backleh and Atrash 2007; Saeed & Qumsiyeh 2020). There is a need for further study of protected areas such as: Wadi Quff and Wadi Zarqa Al-Ulwi (Khalilieh 2016; PMNH 2018).

Ornithologist Dr. Anton Khalilieh, studied the birds in two of the four valleys (Al-Makhrou and Husan), With 105 bird species from the area, 37 breeding birds were documented, 29 of them are resident bird species, and one of the breeding species is categorized as an invasive alien bird species, the Common Myna (Handal & Qumsiyeh 2021). Nine species of the recorded birds are classified as threatened species at the national level, which include Long-billed pipit, Black-eared

Wheatear, Long-legged Buzzard, Cretzschmar's Bunting and Little Swift, Lanner falcon, Tawny pipit, and Turtle dove. Two recorded bird species, the Meadow pipit and the Turtle dove, are listed as *near threatened* and *vulnerable*, respectively, at the IUCN Red list. This area and eastern areas of Jerusalem are considered as Important Bird Areas (IBA) as per international criteria.²⁵

The initial survey in 2018 was followed by another survey in the 2020/2021 winter season. Ornithologist Saed Shomally, studied a third valley (Cremisan/Wadi Ahmad), and documented 68 species of birds as a result, 23 species of which are resident, 17 winter visitor, 27 spring visitor, and 2 invasive species. The Environmental Education Center (EEC), a ringing station for birds located at Taleta Qumi, shows data of more than 70 species of passerine that have been ringed at the ringing station (Awad *et al.* 2017). Our most updated list includes 111 species (Fig 29) with their local and international conservation status noted²⁶.

PIBS published one paper on the diet of the Eagle owl in Wadi Al-Makhroul (Amr et al. 2016) which is located near WM, indicating this data could give predictions for the Avifauna that could be found in the valley.

²⁵ See Important bird areas <http://datazone.birdlife.org/site/results?cty=240&fam=0&gen=0> and <http://datazone.birdlife.org/country/palestinian-authority-territories>

²⁶ <https://www.palestinature.org/conservation/Birds-Al-Arqoub-PA.pdf>



Fig 29. A: Wren (*Troglodytes troglodytes*), B: Jay (*Garrulus glandarius*), C: Common Redstart (*Phoenicurus phoenicurus*), D: Little Owl (*Athene noctua*). Photos by Saed Al Shomali.

6.4 Mammals

Our knowledge of mammals in our area incorporates literature from the 19th to the late 20th century but few studies focused on the West Bank (Tristram 1866, 1884; Bodenheimer 1935; Atallah 1977; Harrison & Bates 1991; Qumsiyeh 1985, 1996). In a study on two protected areas: Wadi Zarqa Al-Ulwi and Wadi Quff, mammal data starts to appear in regard to the West Bank (PMNH 2018; Qumsiyeh 2016). So far, a total of 92 species and subspecies of mammals are known to live in the State of Palestine. These species belong to eight orders (Artiodactyla, Carnivora, Chiroptera, Soricomorpha, Erinaceomorpha, Hyracoidea, Lagomorpha and Rodentia).

Two studies have been undertaken in the Bethlehem area related to Wadi Al Makhroul in respect of mammals. In Qumsiyeh et al., (2014b) researchers highlight the diversity of mammals that exist in the Bethlehem district with 31 records of species from 16 families, which includes data from Al Makhroul. Another study on the Eagle owl diet from Al Makhroul shows five species of mammals (*Erinaceus concolor*, *Rattus rattus*, *Meriones tristrami*, *Microtus guentheri*, and *Rousettus aegyptiacus*) and a domesticated cat (Amr et al. 2016). A more narrowly focused publication related to the status of Striped Hyena in the West Bank has been published and

discusses its status and population threats, and its records from the study area are documented in the study (Handal et al. 2019). Other observations in the past three years from the PMNH team recorded several species of mammals including (*Vulpes vulpes*, *Canis aureus*, *Hyaena hyaena*, and *Gazella gazelle* (Fig. 30), *Procavia capensis* [in Taleta Qumi], and *Sus scrofa* [in Battir]). According to Dolev et al. (2004) *Hyaena hyaena* is an endangered species in our region and near-threatened globally, and the mountain gazelle is a near-threatened species globally which is in need of re-assessment for our area. The situation regarding hyenas was monitored and reported on separately in a research paper (see Handal et al. 2019). Golden Jackals were observed with a population of 5 individuals in a pack in Al-Makhrour Valley.

Our trapping-based surveys in the area of Makhrour valley in 2018–2020 showed average 28% success rates for small rodent traps (usually 20–40 traps per night) with *Apodemus* being the most common, especially in oak wooded areas. We also recorded *Acomys*, *Mus musculus*, and *Dipodillus dasyurus*, and even once caught a shrew *Crocidura*. Our trappings in 2025 and 2026 showed only 18% success rate and most nights, only *Apodemus* was caught. This decline, with *Apodemus*, now the near-exclusive species caught, may reflect increasing habitat pressure consistent with the intensifying threats documented over the same period. This warrants further systematic investigation to document and monitor this worrying trend.

Table 2. Mammals of the Al-Makhrour valley. Note: bats were identified strictly by echolocation data.

Family	Scientific Name	Common Name	2018	2020	2025
Erinacidae	<i>Erinaceus europaeus</i>	European hedgehog	X	X	X
Soricidae	<i>Crocidura leucodon</i>	Bicolored White-toothed Shrew	X	X	
Pteropodidae	<i>Rousettus aegyptiacus</i>	Egyptian fruit bat	X	X	X
Rhinopomatidae	<i>Rhinopoma hardwicki</i>	Lesser Mouse-tailed Bat	X	X	X
	<i>Rhinopoma microphyllum</i>	Greater Mouse-tailed Bat	X	X	X
Vespertilionidae	<i>Pipistrellus kuhli</i>	Kuhl's Pipistrelle	X	X	X
	<i>Pipistrellus (Hypsugo) savi</i>	Savi's Pipistrelle	X	X	X
	<i>Pipistrellus pipistrellus</i>	Common Pipistrelle	X	X	X
	<i>Otonycteris hemprichi</i>	Hemprich's long eared bat	X		X
	<i>Plecotus christiei</i>	Long-eared plecotine bat	X	X	X
	<i>Eptesicus bottae</i>	Bottae's serotine	X	X	X
Rhinolophidae	<i>Rhinolophus ferrumequinum</i>	Greater Horseshoe Bat	X	X	X
	<i>Rhinolophus hipposideros</i>	Lesser Horseshoe Bat	X	X	X
Molossidae	<i>Tadarida teniotis</i>	European Free-tailed Bat	X	X?	
Emballonuridae	<i>Taphozous sp</i>	Egyptian Tomb Bat	X	X	X

Muridae	<i>Apodemus mystacinus</i>	Eastern broad-field toothed mouse	X	X	X
	<i>Acomys cahirinus</i>	Spine Mouse	X	X	X
	<i>Rattus rattus</i>	Black Rat	X	X	X
Gerbillidae	<i>Dipodillus dasyurus</i>	Wagner's gerbil		X	
Hyaenidae	<i>Hyaena hyaena</i>	Striped Hyena	X		X
Bovidae	<i>Gazella gazella</i>	Mountain Gazelle	X	X	X
Canidae	<i>Vulpes vulpes</i>	Red Fox	X	X	X
	<i>Canis aureus</i>	Golden Jackal	X	X	X
Felidae	<i>Felis sp.</i>	Wild Cat	X	X	X



Fig. 30. Mountain Gazelle (*Gazella gazella*) Photo by Maher Sakarna (PIBS).

7. The Eight Communities of Al-Arqoub

The rich biodiversity documented above does not exist in isolation; it is deeply intertwined with the lives, livelihoods and cultural heritage of the eight communities that surround and inhabit the Al-Arqoub area. Understanding these communities is therefore essential to any meaningful conservation plan. The study area enjoys a strategic location with the availability of springs which attracted people to settle in the area, adapting its steep landscape into arable land through the development of a complex irrigation system for the water supply that has led to the creation of dry wall terraces, agricultural watchtowers (manatir) (locally known as palaces (qusoor)), and olive presses. All formed the basis for the strong presence of the agriculture of olives, vegetables, and others. The traditional system of irrigated terraces is an outstanding example of technological expertise which constitutes an integral part of the cultural landscape. The existing landscape reflects one of the oldest farming methods known to humankind and is an important source of livelihood for local communities (MoTA 2013). There are eight human communities in the prospective ABR: Battir, Husan, Al-Walaja, Al-Khader, Nahhalin, Wadi Fukin, Artas and Beit

Jala who were involved in this work. All these communities are part of the Bethlehem Governorate and they are bordering each other with the 1949 Armistice Line (the Green Line).

According to Oslo Interim Agreement signed in 1995 between the PLO and the Israeli government, Palestinian land was classified into three different areas with different management by the Palestinian and Israeli authority; area A under complete Palestinian sovereignty, area B under Palestinian public authority and Israeli security authority, and area C under full control of the Israeli authority. The lands of the communities are classified as follow:

- Battir; 23.% (1610 dunum) area B and 76.3% (5185 dunum) area C
- Husan; 12.6% (928 dunum) area B and 87.4% (6433 dunum) area C
- Al Walaja; 2.6% (113 dunum) area B and 97.4% (4215 dunum) area C
- Al Khader; 9% (745 dunum) area A, 5,5% (457 dunum) area B, 85.5% (7,078 dunum) area C
- Beit Jala; 34.6% (3175 dunum) area A and 65.4% (6000 dunum) area C

The majority of people reside in area A and B which represent the minority land area and the population numbers are shown in Table 3.

Table 3. Demographics and areas of the eight communities studied.

Village	Population Number (2017)	Area (dunum)	Cultivated Area (dunum)	% of cultivated land of total area
Battir	4696	6,795	3352	49.3%
Husan	7048	7,361	1026	13.9%
Al Walaja	2671	4,328	1942	44.9%
Beit Jala	13484	9,749	5289	54.3%
Al-Khader	12,301	20,095	10,143	50.5%
Wadi Fukin	1,300	2,744	85	43.2%
Artas	5,745	4,304	1,538	35.7%
Nahhalin	8,740	12,126	10,130	83.5%
Total	57,000	67,502	34,605	51.26%

Battir: Battir is bordered by Beit Jala town and Al Walaja village to the east, Husan village to the west, Husan and Al Khader to the south, and the 1949 Armistice Line to the north. Battir portrays a major Palestinian cultural landscape and is now a world heritage UNESCO site. This was established mainly to protect the traditional terraces and other agricultural systems (Fig 31 and 32) supported by a unique ancient egalitarian water distribution system and irrigation channels as Battir continues to fight the occupation peacefully through its cultural and natural heritage. Battir has always been considered the vegetable garden of Jerusalem due to the abundance of springs in the area. The traditional system of irrigated terraces within the nominated property is an outstanding example of technological expertise that constitutes an integral part of the cultural landscape. The farmers who worked and still work the land attest to the sustainability of this system and to its continuation for the past 4,000 years (MoTA 2015). The farmers at this village use this system until today as it delivers water to the terraced agricultural land based on a simple mathematical calculation and a clear time-managed rotation scheme. The Battir geo-cultural landscape encompasses ancient terraces, archaeological sites, rock-cut tombs, agricultural towers, traditional footpaths, olive oil presses, and most importantly

an intact water system represented by a collection pool, channels, and more. The integrity of this traditional water system is guaranteed by the families of Battir, who depend on it.

The vegetables of Battir have always been well appreciated in the nearby towns and villages. The eggplants of Battir (*Beitinjan battiri*) are considered to be the best and the most famous landrace in the area. Vegetables are grown in the terraces all year around, and were once mainly sold in Jerusalem, although this situation changed when Battir was completely cut off from Jerusalem after the 1967 war. Still, even today, Battir is considered one of the major sources for vegetables for the Bethlehem district. The total area of Battir is about 6,795 dunums, of which 3,352 dunums are cultivated land (3,187 dunums of fruit trees, 137 dunums of open field of vegetables, 4 dunums of vegetables planted under plastic houses, and 24 dunums of field crops and forages). Agriculture activities in Battir depend mostly on rainwater. As for irrigated fields, they depend on water springs and domestic harvesting cisterns. For livestock production in Battir there are over 600 sheep and goats, 2 farms of broiler chickens, and many bees' hives. Four water springs are present in the Battir territory, which are the Ein El Balad, Ein Jame', Ein Al Baseen, and Ein 'Amdan springs.

Battir's unique heritage is shaped by thousands of years of human-nature interaction. The village is known for its intricate system of stone terraces and a Roman-era irrigation system that distributes spring water to eight agricultural families on a rotational basis (MOTA 2015). These terraces not only maintain soil stability and water efficiency but also serve as biodiversity hotspots supporting native flora and fauna (Qumsiyeh et al. 2021). Culturally, Battir is embedded in Palestinian history and identity. Oral traditions, community festivals, and agricultural customs continue to play a central role in the lives of residents. The landscape embodies a symbiosis between human activity and natural resources that is rare and worth preserving. Despite its World Heritage status, Battir faces multiple conservation challenges and threats discussed in Chapter 8.



Fig. 31. Battir Terraces and agriculture



Figure 32. Ancient Canaanitic stone terracing and typical stone home in AlMakhroul valley in Battir.

Husan: Husan is located 6.5 km (horizontal distance) west of Bethlehem City. Husan is bordered by Al Khader town to the east, Battir village to the north, Nahhalin Village to the south, and the 1949 Armistice Line and Wadi Fukin village to the west. The total area of Husan is about 7,361 dunums of which 1,026 dunums are cultivated land (767 dunums of fruit trees, 216 dunums of open field of vegetables, 2 dunums of vegetables are planted under plastic houses, and 41 dunums of field crops and forages). Agriculture activities in Husan depend mostly on rainwater. As for irrigated fields they depend on water springs and domestic harvesting cisterns. For livestock production in Husan there are 558 head of sheep and goats, 13 farms of broiler chickens, and 72 beehives. The segregation wall isolates Husan from the large urban centers in Bethlehem governorate (Bethlehem, Beit Jala, and Beit Sahour) and confiscates 97% of the open areas of the village, the majority of which is agricultural land and forest. Husan is bordered by Israeli settlements; Betar 'Illit, from the south, and the Green Line (1949 Armistice Line) from the west. In addition to this complicated scenario Husan, like many other Palestinian villages and towns, had a very substantial area of land appropriated, around 3,140 dunums (42.6 percent of the total area of the village), for the construction of Betar 'Illit in 1985 and also 50 dunums, for the construction of the neighbouring Hadar Betar settlement. The village is also subjected to two permanent military checkpoints and iron barriers adjacent to the village.

Al Walaja: This village is actually the new village of Al-Walaja. The old village is on the Israeli side of the Green line and was ethnically cleansed in 1948 (Fig 33). Only 10% of the population with land on what became the West Bank under Jordanian rule in 1948 were able to rebuild within the new Al-Walaja. Most of the original residents live as refugees in other areas. The total area of the new Al-Walaja is about 4,328 dunums with a population of some 1,200 (Saleh 2012; PCBS 2017) (Fig 34). Water springs within the new Al-Walaja include Ain Haniya, Al Hadfa, and Al Juwayza. Our analysis of land use in the new Al-Walaja can be summarized as such:

- 1) Agricultural land 34% of the total area.

- 2) Bare and open land 26% of the total area.
- 3) Forest and natural vegetation 22% of the total area.
- 4) Urban Area (Palestinian Built-up) 9% of the total area.
- 5) Israel Settlements with 9% of the total area.

The village has a long history not only of injustice but also of resistance (Barnard & Muamer 2016; Holmes and Gutiérrez 2018; Qumsiyeh 2017, 2025; Qumsiyeh et al. 2026a).

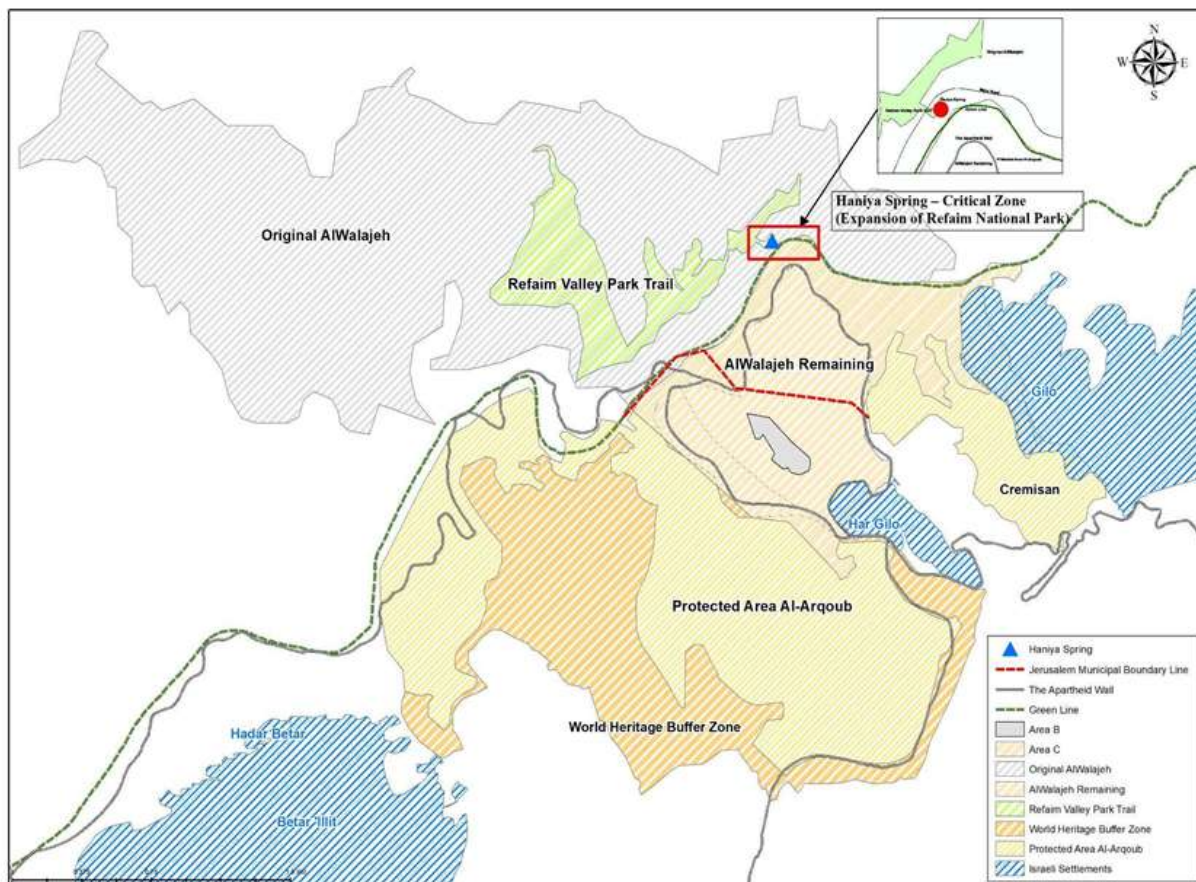


Fig. 33. Area of original Al-Walaja in 1948, the remaining ‘new’ Al-Walaja (being surrounded by segregation walls) and protected area and world heritage site designated by local people (Qumsiyeh et al. 2026a)

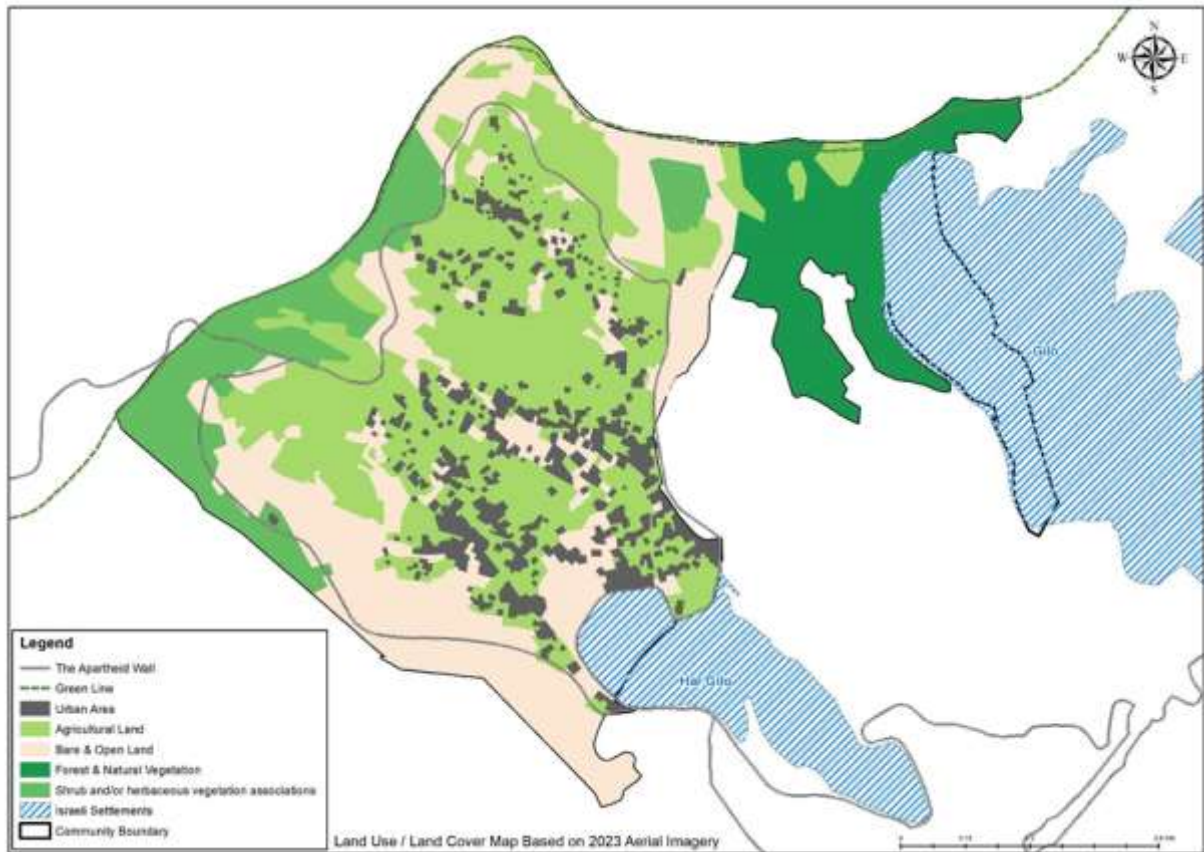


Fig. 34. Land Use Map of the Remaining area of Al-Walaja Village (Qumsiyeh et al. 2026a).

Al Khader: Al Khader is a town situated at approximately 800 meters above sea level, with settlement records dating back to at least 1700 AD. Its residents are historically connected to Al Walaja village, from which many of the town's founding families originate. Currently home to approximately 12,000 residents (Palestinian Central Bureau of Statistics 2017), Al Khader's economy relies heavily on agriculture, particularly grape cultivation, which covers around 4,200 dunums of the town's land, alongside stone and marble quarrying, and employment in the Israeli labor market. The town has been significantly affected by Israeli land confiscation, with the segregation wall isolating approximately 68% of its total land area, amounting to 5,620 dunums of predominantly agricultural land and forest being taken.

Wadi Fukin: The village had a population of around 1,449 residents in 2021 (PIBS 2021). Historically, the village is known as the "Valley of Thorns." After the village's inhabitants were displaced in 1948 and again in 1956 by Israeli forces, many of its residents returned in the 1970's and rebuilt their homes. The current population of Wadi Fukin is approximately 1,200 people. The village is located at an altitude of between 600 and 650 meters above sea level and is surrounded by steep, rocky hills. Thanks to its geographical location and the abundance of springs that feed the valley, Wadi Fukin is one of the greenest agricultural areas in the region. The village is surrounded by three Israeli settlements, which have been built on parts of its confiscated land. Wadi Fukin originally encompassed an area of about 12,000 dunums, of which approximately 8,500 dunums have been seized. Historically, the village was home to around eleven natural springs, six of which remain active today. The local population engages in a variety of economic activities. Some residents work in agriculture, while others are employed in nearby Israeli settlements. Additionally, a portion of the population works in the public and private sectors under the Palestinian National Authority or operates private businesses. To the west, the village borders the Israeli settlement of Tzur Hadassah, which is located roughly half a kilometer away and built on village lands that were occupied in 1948, as well as on the lands of the depopulated village of al-Qabu. To the northeast, the Israeli settlements of Beitar Illit and Hadar Beitar dominate the

hilltops surrounding the village. These settlements began construction in the late 1980s on lands belonging to Wadi Fukin and neighboring villages, including Husan and Nahalin. To the south, the village is bordered by the Palestinian village of al-Jab'a. During the Ottoman era, the British Mandate, and Jordanian rule, Wadi Fukin was administratively part of the Jerusalem District. In 1988, the village, along with neighboring villages (al-Walaja, Battir, Husan, and Nahalin), was annexed into the Bethlehem Governorate, while its neighboring village, al-Jab'a, was incorporated into the Hebron Municipality.

Following the Oslo Accords, Wadi Fukin came under the jurisdiction of the Palestinian National Authority. Its land was divided into Area C (are under Israeli occupation civil and security control), which comprises 92.7% of its territory, and Area B, accounting for 7.3% only (ARIJ village profile). Agriculture remains a primary economic activity. Residents grow olives, grapes, figs, and vegetables using traditional and sustainable farming practices. The community relies on water-saving techniques and significant organic agricultural practices. Wadi Fukin features a traditional irrigation network, fed by 11 perennial springs in the valley. These springs originate from a shallow aquifer fed by local rainfall (approximately 6 square kilometers of watershed). The spring water is collected in dozens of dams and small canals and conveyed to the terraced fields at the bottom of the valley. This ancient system supports a rich Mediterranean agriculture: villagers grow a variety of vegetables, grapes, and olives, as well as citrus groves (near the springs), providing them with food and income. It is worth noting that many farmers in Wadi Fukin use ecological and organic techniques that reflect traditional knowledge and enhance soil fertility. Like the neighboring village of Battir, Wadi Fukin is located within the Mediterranean Basin and is a global center for biodiversity. Recent botanical surveys have identified many rare and endangered plant species in the hills south of Jerusalem (which include Wadi Fukin).

The ecological and cultural landscape of Wadi Fukin is under severe pressure. The expansion of neighboring Israeli settlements poses the greatest threat. On the southern and eastern hills overlooking the village, the predominantly Jewish settlement of Beitar Illit has expanded significantly on land long cultivated by Wadi Fukin farmers. The western expansion of the Beitar Illit settlement already covers a significant portion of the aquifer feed area for the Wadi Fukin springs, significantly reducing water seepage.

Indeed, official Israeli land orders and state declarations have confiscated up to a third of the village's land for use as "state land" and settlements. This loss of land has already reduced the area of irrigated fields and stripped villagers of their historic orchards. A proposed route for the West Bank barrier would further encircle Wadi Fukin: a 50–100-meter-wide strip of fences, roads, and ditches between Tzur Hadassah and Wadi Fukin would cut off farmers from their land. Such construction could disrupt water recharge and isolate the community, echoing experiences in 2006 when plans to “sandwich” Wadi Fukin between Beitar Illit and a barrier would have left only a fraction of cultivable land. Despite the threats and challenges discussed in section 8, Wadi Fukin has significant opportunities for sustainable development that leverage its cultural and natural heritage. Traditional olive and grape cultivation can be combined with agro-tourism (e.g. olive harvest events) and demonstration gardens. Indeed, outside groups have organized olive-picking and ecological farming workshops in Wadi Fukin. The village could tap into the wider “Olives and Vines” cultural heritage of the region, akin to the UNESCO-listed Battir terraces. Given the threat to its springs, Wadi Fukin is a natural site for educational and conservation projects around water. FoEME (Friends of the Earth Middle East) and locals have proposed creating green spaces for rainwater recharge: for example, rehabilitating the central Ein al-Balad spring and establishing a nearby park to demonstrate sustainable irrigation and limit built areas. Such initiatives would protect the land while also serving as learning centers for sustainable agriculture and climate adaptation.

Wadi Fukin has attracted significant attention from international conservation and heritage bodies. Environmental planners and local advocates have repeatedly called for formal protection of the

valley as a whole. In particular, an overarching vision is to designate Wadi Fukin's unique landscape as a UNESCO-protected site or transboundary biosphere reserve. Just as the adjacent Battir area received UNESCO World Heritage status for its cultural terraces, experts note that Wadi Fukin's combination of ancient farming, biodiversity, and springs merits similar recognition. Recent studies recommend protecting the whole area as a Hima or a Biosphere Reserve format because it is both a human cultural site as well as an eco-corridor for rich biodiversity (Gedeon and Qumsiyeh 2023; Qumsiyeh et al. 2023b; Gedeon et al. 2025).

In summary, Wadi Fukin exemplifies a biocultural landscape of global significance, with intact water-driven agriculture and rich biodiversity. Its preservation requires integrated planning – treating the entire valley as a unit that blends heritage conservation with sustainable use. Stakeholders (e.g., villagers, scholars, NGOs, government agencies) have put forward proposals like biosphere-designation, education parks, organic farming cooperatives and joint stewardship programs. These efforts, backed by credible international organizations and laws, aim to ensure that Wadi Fukin's springs continue to flow, its terraces remain cultivated, and its villagers can live sustainably on their land. Strengthening such initiatives – with technical aid (e.g. UNESCO, UNDP, PWA) and legal protection – will be crucial to balancing the village's ecological value and the rights of its people.

Nahhalin: The name "Nahhalin" comes from the Arabic word *nahhal* (beekeeper), meaning "those who collect honey from bees." The village has been famous for beekeeping for centuries, and many families historically maintained beehives. Even today, beekeeping remains part of the local identity. Two springs exist Ain Fares and Ain Al-Balad. Parts of the old village preserve traditional Palestinian stone houses with arches, domes, and narrow alleys that reflect rural architecture of the central highlands. We are initiating a new project to rewild the area with pollinator-friendly plants and encourage beekeeping for the villagers (see section 9 for action plans).

Beit Jala: Beit Jala is 1.8 km (horizontal distance) west of Bethlehem City and is the biggest urban center of the ABR areas. The city currently hosts approximately 15,670 people (data from Beit Jala Municipality 2024), up from 13,367 recorded in the 2017 Palestinian Central Bureau of Statistics census. Beit Jala is bordered by Bethlehem city to the east, Jerusalem city and Gilo settlement to the north, Al Walaja and Battir villages to the west, and Ad Doha city and Al Khader town to the south. The total area of Beit Jala is about 9,749 dunums of which 5,289 dunums are cultivated land (5,199 dunums of fruit trees, 55 dunums of open field of vegetables, 2 dunums of vegetables are planted under plastic houses, and 33 dunums of field crops and forages). Agriculture activities in Beit Jala depend mostly on rainwater. As for irrigated fields they depend on water springs and domestic harvesting cisterns. For the livestock production in Beit Jala there are 567 head of sheep and goats, 7 farms of broiler chickens, 1 farm of layer chickens and 56 beehives (Agricultural Directorate of Bethlehem 2018). The economy in Beit Jala is dependent on several economic sectors, mainly the services sector, which absorbs 30% of the city workforce. Other important sectors are the trade sector and the industry. The unemployment rate mostly due to the Israeli restrictions affects the agricultural sector that covers only 5% of the work force of the city. Beit Jala city has been exposed to many Israeli confiscations, of thousands of dunums of land, for various purposes (ARIJ 2010).

Artas: The village of Artas is named after *Hortus conclusus* (a closeted or hidden garden) and has been inhabited since antiquity. With a population of approximately 6,000 (PCBS 2017), Artas is growing at a steady rate, with half of its population involved in agriculture. Before October 2023 and its subsequent restrictions on work and circulation in Israel, a quarter of the villagers were employed in Israel (Egoz & Williams 2017). The village land in Ottoman times was mainly dedicated to agricultural use. The surface of land available for agriculture has since been shrinking significantly.

, partly due to the establishment of the Dheisheh refugee Camp to the north and the growing urbanization due to demographic pressure on its northern boundaries. But the other and main reason for the shrinking of Artasian land and space is the landgrab, establishment of colonies and separation wall constructed on the southern part of the village (see Fig. 35).

The three large pools above Artas called Suleiman's pools (after Turkish Ottoman Sulemian the magnificent) used to supply water even to Jerusalem through stone aqueducts (Lemire 2011a, b). They were rich in biodiversity but were drained and "cleaned". Reconstituted with frogs, fish, and some water plants partially by our institute and partially by birds, the pools have been restored as a good attraction for local and migratory birds. Artas has a rich ethnographic history. The village gained attention from evangelical European missionaries as the place of the biblical gardens of Salomon. A colony of American evangelical Zionists was established in the village in the 19th century. The beginning of the 20th century witnessed the settlement in the village of French missionary, Philippe Baldensperger, accompanied by his sister and botanist, Louise Baldensperger, to whom we owe the first complete study of Palestinian wild plants and botanical local knowledge as a result of her experience in Artas (Crowfoot & Baldensperger 1932). Danish ethnographer, Hilma Grandquist, conducted some seminal studies in the village on family ties and social life, a work that was followed up in the late 90's by the research of American anthropologist, Celia Rothenberg, focusing on the role of jinns in the context of Israeli occupation. An important feature of the village is, in this regard, the Center of Folklore Research, founded in 1993 by local teacher, Musa Sanad, which has been keeping records of this rich ethnographical history, as well as the village family trees and local folklore (Naili 2008).

As some recent studies have shown, the rich traditional ecological knowledge, specifically the use of medicinal plants, recorded a hundred years ago by Crowfoot & Baldesperger is still present in Artas, although fading, partly due to restricted access to wild plants and land (Mourad Hanna et al. 2022). But the enclosed garden also faces threats from the Israeli occupation which is slowly strangulating the village (Egoz & Williams 2017). Artas is an ideal location for a research center focused on cultural heritage.





Fig. 35. Photos before (1960s) and after (2026) of Artas village development. Note mosque for reference and new building development.

8. Threats

In Palestine, even in ancient times there is evidence of Canaanitic villages stripping their populations of gazelles. In the more modern era, forests in the Eastern Mediterranean region were cut down for household, industrial, and commercial uses. Under British occupation (1917–1948), and Israeli and Jordanian rule (>1948), destruction continued. Public perceptions of threats to the rich biodiversity and the environment in Palestine emphasize occupation, urbanization, and pollution (AlHirsch et al. 2016; EQA 2022). As early as 1950, scientists warned of an environmental disaster in Palestine should the trends then evident persist (Ives 1950). The current threat status did not emerge suddenly. A 2021 institutional review of Palestinian protected areas (PIBS/CEBioS 2021) ranked habitat fragmentation due to urbanization, deforestation, climate change, and Israeli colonial activities as the highest-level threat in the West Bank, followed closely by land degradation, overexploitation, and pollution. Notably, colonial residential and industrial settlements and their associated infrastructure, including the segregation wall, were classified as a very high threat in the West Bank, a ranking that distinguishes the Palestinian conservation context sharply from most other settings in the world. The same review noted that the combination of these threats along with weak enforcement of existing environmental law, limited Palestinian sovereignty over Area C, and inadequate coordination among governmental bodies created a compounding effect that significantly undermined conservation outcomes. Understanding the current situation of the Al-Arqoub protected area therefore requires situating it within this broader, long-documented pattern of environmental pressure. The environmental impacts of the geopolitical changes of the past 100 years have been dramatic (see relevant chapters in Qumsiyeh 1996; Qumsiyeh 2004), but direct studies of our environment are still in the early stages. Most studies of fauna and flora within Palestine were completed by Western visitors who came on short trips to study the "Holy Land" and many of those visitors were connected to Western imperial powers such as France and England (e.g. Tristram 1884).

Nevertheless, collected scientific data show that like other parts of the world five main threats exist (often operating together): climate change, habitat destruction, pollution, overexploitation and invasive species, all of which are exacerbated by wars and conflict. Human induced climate change will drastically affect local biodiversity. For example, there was a decline in vertebrate biodiversity as desertification spread into the Bethlehem District including this study area (Qumsiyeh et al. 2014). In the valley of Al-Makhrou, the diet of the Eagle owl studied from pellets under its nest showed dramatic decline in hunted vertebrate biodiversity (Amr et al. 2016).

Other threats to local wildlife include the construction of the separation barrier (Husein and Qumsiyeh 2022) and the over 34 invasive plant species in the West Bank including in the target area (Dufour-Dror 2012; Gedeon and Al-sheikh 2026). Nine invasive bird species are reported in SP and four of them are detected in the West Bank: Indian Silverbill (*Lonchura malabarica*), Common Myna (*Acridotheres tristis*), Monk Parakeet (*Myiopsitta monachus*) and Rose-ringed Parakeet (*Psittacula krameri*). The Common Myna was introduced in 1997 after a group of birds escaped from a park in Tel Aviv (Handal & Qumsiyeh 2021). A survey of areas around walls in Bethlehem Governorates showed many invasive species proliferating, including *Ricinus communis*, *Ailanthus altissima*, *Nicotiana glauca*, and *Ambrosia confertiflora* (Husein and Qumsiyeh 2022).

Sometimes, emerging situations like COVID-19 pandemic have variegated effects both positive and negative on wildlife management (Qumsiyeh and Abusarhan 2022). Another threat is human culling of wildlife (e.g., bird trapping/killing and illegal trade in wildlife) (Handal et al. 2021). This is driven by both cultural traditions and economic hardship (Duffy et al. 2015) as well as weak law enforcement and confusion arising from Israeli and Palestinian laws applying to the same territory, but absent local people's agency (Qumsiyeh and Albaradeiya 2022).

Effective protection in the study area must involve mechanisms that connect these domains. Part of our area was recognized as a World Heritage Site (MOTA 2015) and was placed in the UNESCO state of Conservation Report 2017 on the list of WHSs in Danger, as it is affected by a number of threats including: (1) changes in traditional ways of life and knowledge systems, (2) changes in local population and community identity and social cohesion, (3) invasive/alien terrestrial species and (4) potential construction of a separation wall²⁷. Threats in the study area were evaluated using the IUCN threat scheme²⁸. The area is subject to a range of significant environmental and socio-economic pressures, including inadequate solid waste management, water scarcity, hunting, climate change, excessive pesticide use, pollution, habitat fragmentation, and broader sociopolitical challenges (Tamimi 1996; Daibes & Daibes-Murad 2003; Garstecki et al. 2010; Falah 2010, 2015; Qumsiyeh & Amr 2017; Qumsiyeh et al. 2023b). Water scarcity remains the most critical threat to both human well-being and biodiversity conservation in Palestine. Additional pressures arise from land-use change and activities associated with the ongoing geopolitical situation, which further complicate conservation management efforts.

Another threat is Israeli stone quarries which are built in the occupied West Bank mountains, harming the environment and depriving locals of a key resource (Abdallah and de Leeuw 2020). Beitar Illit Settlement Quarry is an active Israeli stone quarry operating directly within the footprint of the Beitar Illit settlement, surrounded by Al-Arqoub villages like Wadi Fukin, Husan, and Nahalin. While Surif is administratively part of the northwestern Hebron Governorate, these threats are exacerbated by the fact that many protected areas in the West Bank remain under direct Israeli control, limiting effective local management and conservation interventions. Nevertheless, environmental conservation offers substantial ecological, social, and economic benefits. Görlach et al. (2011) highlighted the potentially significant economic returns associated with successful conservation and environmental restoration efforts in Palestine such as from eco-tourism.

²⁷ <http://whc.unesco.org/en/soc/3541>

²⁸ <https://www.iucnredlist.org/resources/threat-classification-scheme>

As emphasized by the Ministry of Tourism and Antiquities (MOTA 2015), the long-term goal is to ensure that natural and cultural heritage values, ecological integrity, and community well-being are conserved and enhanced in a manner that allows present and future generations to appreciate and benefit from them.



Figure 36. Trees cut by unknown actors (locals or Israeli settlers).



Figure 37. Photo from Al-Walaja village showing green line (near railroad track in valley), west Jerusalem on left and settlement of Gilo on right with segregation barrier in foreground. After Qumsiyeh et al. (2026a by permission).

The study area includes the last green open areas in Bethlehem District and as a key biodiversity area is facing threats. Natural reserves and green areas were exploited in Palestine for political issues. Threats were assessed using the IUCN Threat Classification Scheme, integrating data from the 2018 baseline survey, the 2021 follow-up survey, the current 2025 survey phase, and community and government stakeholder input (Table 4).

Table 4. Threat changes. Key: ↑ = increasing; → = stable/persisting; ↓ = reduced; ↓↓ = no longer observed; ? = insufficient data.

Threat	2018	2020	2025	Trend
Overgrazing	Observed	Observed	Reduced	↓
Tree cutting	Observed	Observed	Reduced	↓
Burning	Observed	Observed	Not observed	↓
Solid waste dumping	Observed	Observed	Persists	→
Destructive plowing	Observed	Observed	Persists	→
Use of pesticides/insecticides	Observed	Observed	Observed	→
Unregulated visitor activity	Observed	Observed	Persists	→

Stray dogs	Observed	Not observed	Increased	↑
Invasive alien species	Observed	Observed	Intensifying	↑
People digging for heritage objects	Observed	Observed	Persists	→
Israeli settlement expansion	Observed	Observed	Intensifying	↑
Separation Wall	Observed	Observed	Persists	→
Urban encroachment		Observed	Intensifying	↑

The above Table 4 updates our 2023 study of threats in the study area (Table 5).

Table 5. the severity, impact and permanence of each threat identified by Qumsiyeh et al. (2023b). Threat levels from 1 (minimal) to 5 (very high).

Pressure	Threats/notes	Threat level	Impact	Permanence
Habitat fragmentation	Encroachment (Figures 2 and 3)	4	Severe	Permanent (>100 years)
Agricultural practices	The use of fertilisers, pesticides and other chemicals (e.g., impact on pollinators)	3	Moderate	Medium (5–20 years)
Israeli occupation activities	The Separation Wall and land degradation (Husein & Qumsiyeh, 2022)	4	Severe	Permanent (>100 years)
Overexploitation of resources	Cutting trees and overgrazing. Steeper slopes more protected (Thaler et al., 2020). Gathering of wild plants in decline (e.g., in Artas, see Mourad Hanna et al., 2021)	3	Moderate	Medium (5–20 years)
Solid waste	Pollution impacts on wildlife (clean-up efforts underway)	4	High	Medium (5–20 years)
Invasive alien species	The Tree of Heaven (<i>Ailanthus altissima</i>) and two invasive insects have also been recorded in this area (Handal, 2017; Handal & Qumsiyeh, 2019), and the Myna Bird <i>Acridotheres tristis</i> is widely present (Handal & Qumsiyeh, 2021)	3	Moderate	Medium (5–20 years)
Increased local and international tourists	New less damaging hiking paths and trained tour guides can minimise threats	2–3	Moderate	Medium (5–20 years)
Feral/stray dogs and cats	Disruption in species numbers	3	High	Short (<5 years)
Climate change	Desertification resulting in changed habitats and loss of Mediterranean species	4	High	Medium (5–20 years)

Taken together, the two tables show that while some threats such as overgrazing and tree cutting (Fig. 36) got reduced over the last few years, others are intensifying; most notably Israeli settlement expansion, invasive alien species, urban encroachment and stray dogs. When assessed against IUCN Ecosystem Criteria (IUCN 2024) (See Table 3,4), this combination of declining species distributions (e.g. orchids), restricted habitat range, ongoing degradation of the abiotic environment and altered biotic interactions (Amr et al. 2016) suggests that the Al-Arqoub ecosystem may qualify as either vulnerable (VU) or even endangered (EN). This underlines the urgency of the management measures outlined in this plan.

The most significant structural threat remains Israeli settlement expansion into and around the WHS buffer zone (Fig. 38). Between 2018 and 2026, documented encroachments have included settler road construction on lands of Battir and Beit Jala. PIBS has engaged UNESCO directly on these violations.

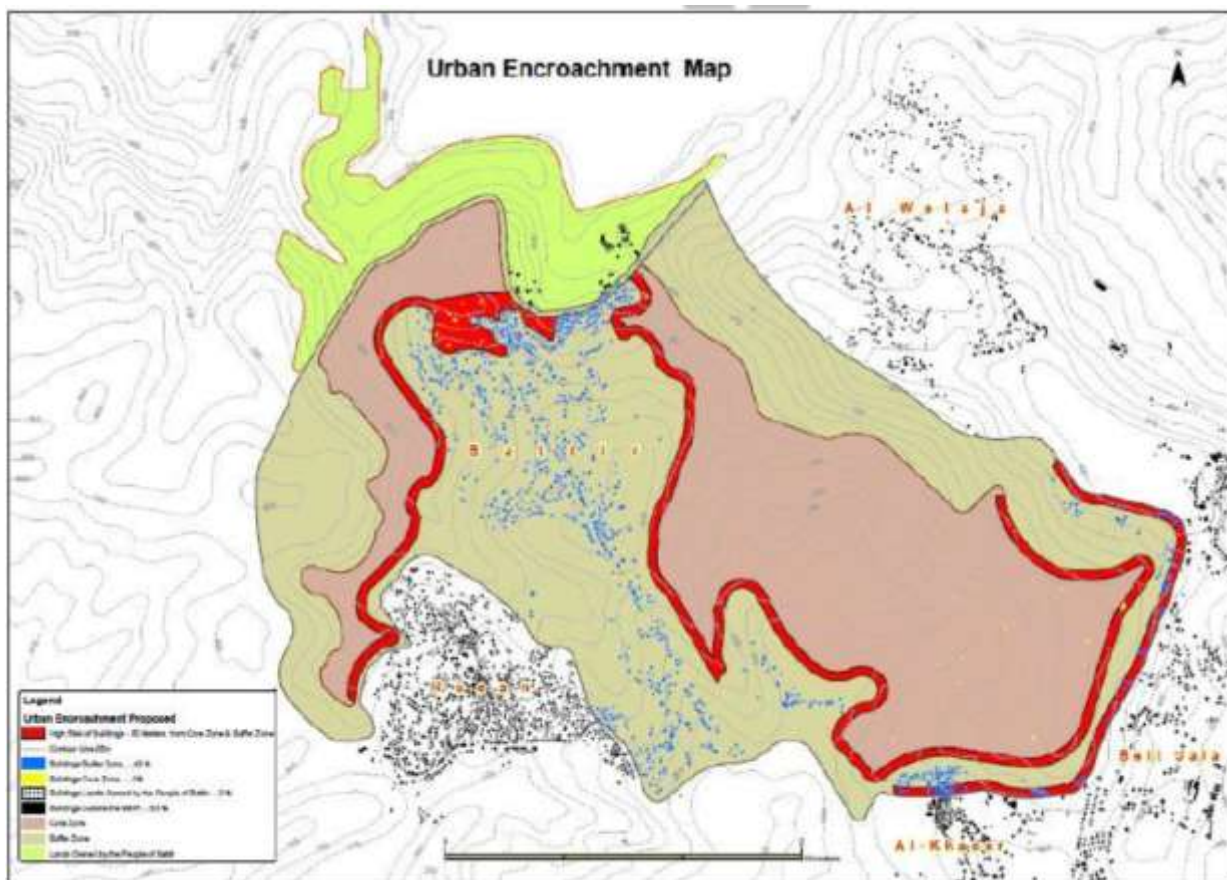


Fig. 38. Urban encroachment (red area) on the World Heritage site area including Al-Makhrouf (MOTA 2015).

Since Israel has control of the area C land, Palestinians are prevented from constructing or benefiting from this land in any way possible. Area C includes mainly agricultural land and open areas that represent an important economic backbone of the local people and part of the natural and cultural heritage of indigenous people. Moreover, the Israeli racist discrimination plan, represented mainly by the construction of the Segregation Wall, not only put Battir and the rest of the villages west of Bethlehem city among which Husan and Al Walaja in complete isolation from the big urban centers in Bethlehem governorate, but also is a threat for the natural movement of wild and grazing animals. For large mammals like Hyenas, the wall impedes their movements in ways that reduce availability of food because they have large foraging areas (Handal et al. 2019). Wild animals are also frequently trapped by the electric fences as they try to cross (Abdallah & Swaileh 2011).

As the majority of the study area is located in Area C (under full control of the Israeli authority), it is subjected to a variety of ecological and environmental pressures:

- (1) habitat loss and land fragmentation, causing biodiversity loss (Fig. 39 & 40);
- (2) challenging livelihood conditions as a result of (among others) the lack of economic motivations, no subsidies for farming practices, and inadequate markets for extra production (almakhrou.palestinature.org).



Fig. 39: Damage to a valley from a Palestinian “development” with roads also cutting water flow in valley.



Fig. 40. Use of heavy machinery destroying the landscape for "development".

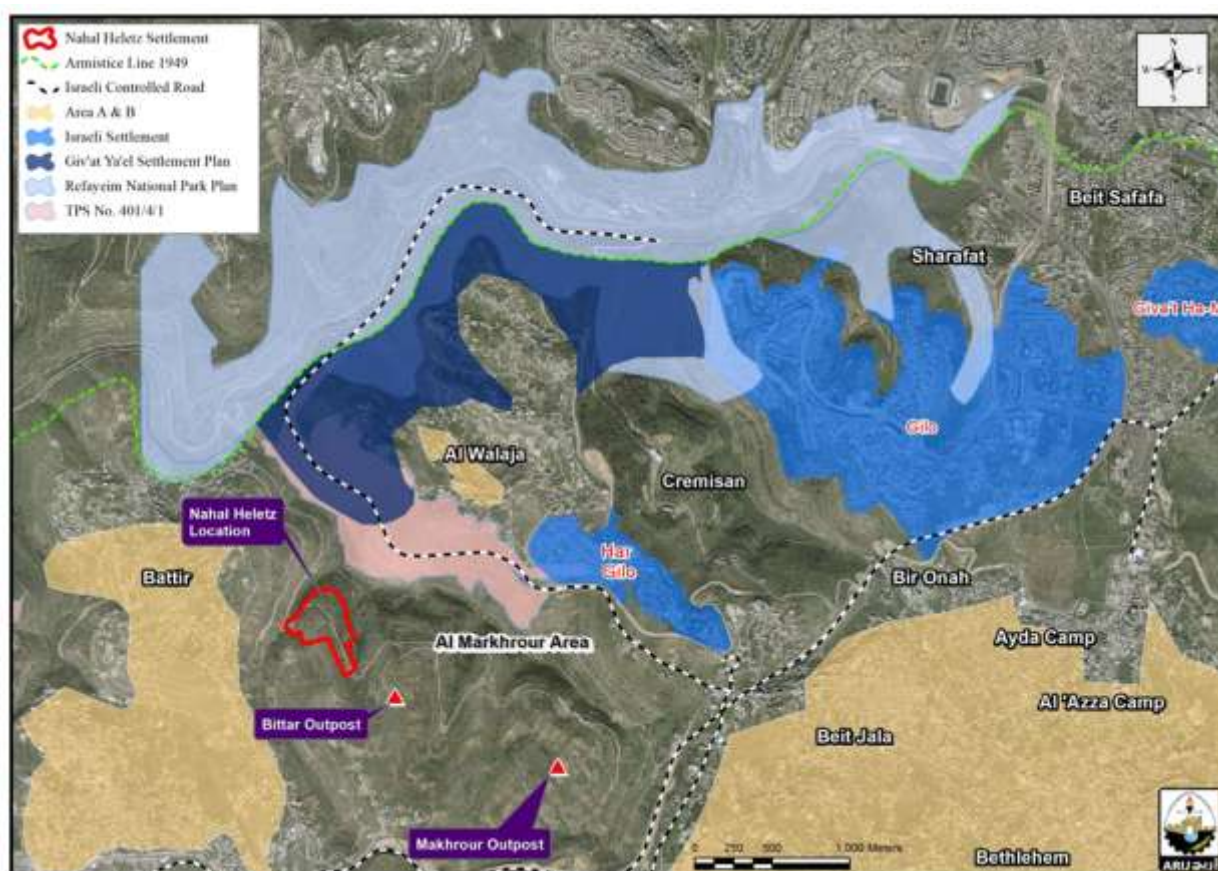


Figure 41. Latest Israeli settlement encroachment in Al-Arqoub area (ARIJ)

In short, the Palestinian environment suffers from an ecocide (Qumsiyeh & Abusarhan 2021) and a spaciocide (Hanafi 2006) that impact the environment and limits actions that could help.

However, even in light of the power structures of occupation and colonization (Qumsiyeh & Albardeiya 2022), there are actions that can be done, and in this target area, we proposed a management plan that is flexible and adjusting to current and future circumstances.

9. Management plan

9.1 Introduction

Conservation efforts that exclude human factors and set up protected areas while trying to exclude the indigenous people are destined to fail, especially in developing countries (Adenle et al. 2015). There has to be benefit sharing from conservation and biodiversity initiatives (Schroeder and Lucas 2014). Social movements can be transformative in biological conservation (Walter et al. 2026). The use of plants and animals for humans relates directly to environmental conservation, especially in terms of sustainable use of resources. In Palestine as elsewhere, there is an interest in ethnobotany and ethnozoology (Ali-Shtayeh *et al.* 2008; Palevits and Yaniv 2000; Said et al. 2002). Cultural heritage and biodiversity conservation are also intertwined (Hjelle et al. 2012). In the context of Palestine/the Holy Land some ethnoecological work was done by travelers such as pilgrims and researchers of the British survey of Western Palestine in the 19th century and became sparse in the 20th and 21st century (Crowfoot and Baldensperger 1932; Ali-Shtayeh et al. 2008). Ecosystem benefits are provided by close and sustainable human-nature interactions, especially in a cultural-ecological landscape such as the Al-Arqoub area (Tengberg et al. 2012; Plieninger et al. 2023; Qumsiyeh et al. 2024a).

The study area is the last remaining biodiversity-rich area in the Bethlehem district. It is rich in cultural and natural heritage. Yet it is mostly included in area C of the West Bank (Israeli military and civilian control on Palestinian areas since 1967), and thus containing marginalized villages. The threats highlighted in section 8 are serious and impact both people and nature and these threats are related. Poverty reduction and environmental conservation are directly linked (Adams et al. 2004; Thomas 2011). It is possible to use socioeconomic incentives at the periphery of protected areas or even allow managed use of natural resources as a form of poverty reduction which also incentivizes the local people to protect their environment (Sunderlin et al. 2005). Modern conservation philosophy argues that local buy-in is critical for success of conservation efforts. We in Palestine certainly need to think strategically about how people around protected areas are to benefit from protection. There are existing models in nearby areas, for example the way the Royal Society for Conservation of Nature (RSCN) in Jordan worked with local communities to ensure active buy-in via direct benefit from things like ecotourism and environmentally sensitive agriculture.

Religious attitudes can be of potential use to promote environmental awareness and conservation. Religious clerks (Muslim and Christian) can introduce many concepts of conservation and environmental practices in the Friday and Sunday sermons. Several authors dealt with the ethical and divine relation of Islam to environment conservation (Amr & Quatrameez 2002). Islamic teachings are full of orders and events that encourage conservation such as the concept of “*Al Hima*”, to save natural resources, a clean environment and many others. Similarly in Christianity, basic teachings include many environmentally friendly practices. In Palestine, religious institutions, mosques, churches and their leaders, represent deeply trusted community networks with direct reach into all eight communities of the area. Rather than framing religion as a pathway to environmental awareness, it is more accurate to recognize that for many Palestinians, attachment to the land is already inseparable from cultural, spiritual and ancestral identity. Conservation efforts that acknowledge and build on this existing relationship will be far more effective than those that treat environmental stewardship as a new concept to be introduced.

Palestine, including areas like the prospective ABR, are part of the fertile Crescent where humans first developed agricultural practices including domestication of plants and animals. Wadi Al-Natuf as a valley in the northern West Bank was the first place archeologists identified such areas and hence we speak of Natufian Agriculture (Bar-Yosef et al. 2017). Our cultural heritage relating to nature and agriculture is very extensive, for example on the use of plants from nature for medicinal purposes (Said et al. 2002). Knowing and using this cultural heritage can inform and promote biodiversity conservation (Alves 2012). Wadi Al-Makhrur is a prime example of this because of the existence of agricultural models practiced over thousands of years (Fig. 15), making cultural protection of this landscape critical (Tengberg et al. 2012). Some ethnoecological work in our region was started in the 19th century and some of those were also done in the study area (Canaan 1928; Crowfoot & Baldensperger 1932; Dafni 1984).

Biodiversity conservation and protected areas in light of global and local threats are covered by the National Biodiversity Strategy and Action Plan (EQA 2022). Objectives related to the protection of biodiversity and protected areas can be summarized as follows:

- Conservation of Palestinian biodiversity, and the development and establishment of a representative protected areas system is listed as an immediate priority action. The Plan also includes project concepts on the “Development and management of a Palestinian protected areas system”, and the “Development of management plans/structures in designated protected areas based on biodiversity surveys and inventories”.
- Ensure involvement in management of local communities in the establishment of protected areas.
- Assessment of capacity building needs and Palestinian priorities in biodiversity.

The plan also addressed gaps that are essential to develop concepts in biodiversity and protected areas conservation. These gaps include: lack of primary scientific data, information and documentation on biodiversity in Palestine, lack and/or limited human resources. For example there are very few biologists, especially wildlife biologists and taxonomists, conservation managers, etc. There is also a need for adequate legal frameworks and environmental policy on which to base all activities for the conservation and sustainable use of biodiversity in Palestine, a lack of coordination among national and local stakeholder agencies in biodiversity, and inadequate awareness and commitment to biodiversity.

Bridging the Science-Policy-Practice Interface

Conservation requires effective translation of scientific knowledge into actionable policy and community practice. Yet, in contexts like Palestine, the divide between research, decision-making, and on-the-ground implementation remains wide. Integrating these spheres can be difficult.

- Science: Research on biodiversity, water systems, and cultural practices provides valuable data for informed decision-making yet remains under-resourced. For instance, Qumsiyeh et al. (2017) documented several plant and animal species unique to the Battir area that need protection.
- Policy: Policies protecting heritage sites often exist but lack enforcement or coordination with local governance structures. Legal ambiguity in areas under military occupation or contested sovereignty further weakens policy efficacy.
- Practice: Local farmers and residents hold generational knowledge essential to sustainable land management. Yet, their voices are often marginalized in formal conservation planning or, in the context of Israeli occupation, are physically excluded from undertaking sustainable practices on their land.

The objectives of the NBSAP for Palestine (EQA, 2022) are as follows:

- The conservation of Palestine's biodiversity.
- The sustainable use of Palestine's biodiversity.
- The enhancement of local knowledge and skills and the improvement of people's attitudes for the conservation of biodiversity and the sustainable use of biodiversity.
- The equitable sharing of biodiversity benefits within Palestine.
- The development of Palestinian institutional and human resource capacity in the field of biodiversity.

In designing the management plan for the Al-Arqoub area, we integrated scientific, social, legal and adaptive dimensions into a single coherent framework. The plan is grounded in all data collected on fauna, flora, habitats and threats, and draws on national strategies including the NBSAP, the national climate change adaptation plan²⁹, and previous PIBS research in the area. It is further guided by local, regional and international experience, and makes use of modern scientific tools including drones, GIS and remote sensing for biodiversity planning, alongside social surveys of the socio-economic situation of the eight communities.

Conservation and human development are treated as inseparable objectives. The plan aims to minimize harmful agricultural, social and industrial practices while developing local structures that protect the area as both a biodiversity hotspot and an eco-corridor of regional significance. Local communities are placed at the centre of this effort: fostering their identification with and responsibility for the protected area, enhancing farmer success through eco-friendly practices, empowering women entrepreneurs to create and sustain eco-friendly small and medium enterprises, and growing ecotourism economies through well-designed trail systems and tourism-affiliated services.

Dozens of focus group meetings with both locals and experts were carried out to pinpoint the challenges and design appropriate interventions. For example, expert facilitation of meetings in each community came up with management and action plans based on scientific studies and local input. The eight communities worked with us over the years and especially in 2025/26 as this plan was developed, to produce and verify the best and most feasible action plans that suit their communities.

The plan is also designed to be flexible and adaptive. Regular reporting and documentation of activities, achievements, challenges, and outcomes ensure that new information, particularly on evolving environmental and socio-economic threats, can be used to modify and improve the plan over time. Periodic stakeholder consultations and reviews should complement scientific monitoring, allowing local knowledge and community experience to contribute to the ongoing development of the management strategy. In this way, the management plan remains a living document that evolves alongside the needs of both people and nature. Finally, all elements of the plan are aligned with local laws, global treaties, and governance structures, ensuring both legal compliance and international legitimacy.

The analysis with community participation can be summarized as follows. **The Vision** is to conserve and restore the ecological integrity, cultural heritage, and sustainable livelihoods of Al-Arqoub area through participatory, science-based, and community-centered management.

The strategic objectives for the management plan include:

1) Ecological Objectives:

- Restore degraded ecosystems

²⁹ https://unfccc.int/files/national_reports/non-annex_i_parties/application/pdf/national_adaptation_plan_state_of_palestine.pdf

- Protect habitats and species of conservation importance
- Improve ecological connectivity
- Reduce threats to biodiversity
- 2) **Socioeconomic Objectives**
 - Support sustainable livelihoods
 - Promote ecotourism and agroecology
 - Enhance community participation
 - Strengthen local economic resilience
- 3) **Cultural Objectives**
 - Preserve agricultural terraces and traditional knowledge
 - Protect archaeological and cultural sites
 - Promote cultural identity and heritage
- 4) **Governance Objectives**
 - Establish participatory governance structures
 - Improve institutional coordination
 - Develop monitoring and evaluation systems

Below, we introduce the key management elements and associated action plans developed through scientific assessment and community participation. These actions are intended to guide implementation while remaining sufficiently flexible to accommodate new knowledge, changing circumstances, and evolving community priorities.

9.2 Community Conservation (leading and benefiting from conservation)

The new Kunming-Montreal global biodiversity framework (CBD 2022) set new parameters and goals to address the failure to achieve the older 2010-2020 Aichi targets. The failure was due to a top-down approach and minimal local community involvement in conservation efforts. The reprioritization was incorporated in a new Palestinian NBSAP (led by our team). This project aimed to generate a community led conservation plan for the study area bridging science-policy-practice gaps towards conservation. Part of the site selected was designated recently as a new protected area (Qumsiyeh et al. 2023b). Our earlier work in the area showed importance as a biocultural landscape (for more on this see Plieninger et al 2023). In these South Jerusalem hills, we note the first Palestinian political awakening vis a vis their environment/natural resources in 1925 (Lemire 2011b). In reviewing the literature, visiting other countries (especially our team's travels to Jordan and Lebanon), and workshops led by members in the eight communities, we narrowed down on two models of conservation that work to enhance sustainability of human and natural communities near areas of rich biodiversity: biosphere and hima models. These are briefly discussed below explaining why we decided on the Hima model in the end. But first, we discuss community engagement.

Stakeholders and consultation: PIBS started to work in the study area since its founding in 2014 because it was the closest natural area to the institute. All projects and research work done in the area in the past 12 years involved local community members. The second project proposal to NGS was formulated based on the need to create a proper management plan and model of protection (now to be a Hima model) for the newly designated protected area (Qumsiyeh 2023b). We consulted the eight communities to produce an integrated system of protection of people and nature. The key stakeholders are: 1) vulnerable sectors of society in the eight targeted communities including farmers (management plan will emphasize empowerment via permaculture), women (plan to include a special section on empowerment of cooperatives and entrepreneurship), and children (via the educational modules highlighted in the methodology). The civil society landscape relevant to biodiversity conservation in Palestine has been mapped in several institutional reviews. As of the most recent comprehensive assessment (PIBS/CEBioS 2021), twelve NGOs were identified as actively engaged in conservation, environmental

education, ecotourism, research, and capacity building in the West Bank. These include the Applied Research Institute Jerusalem, the Palestine Wildlife Society, the Environmental Education Center, the Environmental Field Research Center, the Biodiversity and Environmental Research Center, and the Palestine Museum of Natural History, among others. While all twelve organizations share an interest in public awareness, their activities vary considerably: only a small number engage simultaneously in research, conservation, education, ecotourism, and capacity building. A recurring finding across institutional reviews has been the lack of coordination among these organizations, with duplicated efforts and donor-driven rather than nationally-driven agendas, weakening the overall impact of civil society on conservation outcomes. The Palestinian Environmental NGOs Network (PENGON) was established partly to address this coordination gap, though its effectiveness has been uneven. The governance model proposed for the Al-Arqoub Hima explicitly brings together NGOs, community councils, academic institutions and government bodies under a shared framework designed to build on existing civil society strengths while addressing these longstanding coordination weaknesses. A successful plan will ensure the new Hima fosters inclusion, equality, and respect among stakeholders and partners. Respect levels include self-respect (i.e. empowerment), respect for others (diversity/inclusion) and respect for nature (environmental stewardship).

Towards this, workshops were held from 2019 and intensified with meetings held in 2025 and early 2026 and culminated with a presentation of this report to the local communities 8 June 2026 (Fig. 42)³⁰. The main deliverable is that beneficiaries, team members, and stakeholders have a roadmap (the participatory produced management plan) that helps them and helps nature for decades to come.



Fig. 42. Example of Community meeting: Battir.

³⁰ e.g. <https://www.facebook.com/PIBS.PMNH/posts/2528852917393232> <https://bit.ly/3qy1R0M> and see detailed report submitted to NGS including the last community meeting 8 June 2026.



التاريخ: 2025/09/11

رقم 12655-صادر 2025/09

السيد الدكتور مازن قمصية المحترم
مدير متحف فلسطين للتاريخ الطبيعي

تحية طيبة وبعد،،

الموضوع: "مقترحات واحتياجات زراعية وبنية لتعزيز التنمية المستدامة في بلدة نحالين"

بلدة نحالين، الواقعة إلى الغرب من محافظة بيت لحم، تعد من البلدات الفلسطينية العريقة ذات الجذور العميقة في الزراعة وتربية النحل، وهو ما تعكسه تسميتها المشتقة من "النحل"، في دلالة واضحة على تراثها القبياني والإنتاجي. وقد اشتهرت نحالين عبر العصور بمهارة إنتاجها من العسل الطبيعي، وما تزال تضم حتى يومنا هذا عددًا من مربى النحل الذين يمارسون هذه الحرفة كجزء أصيل من الموروث المحلي والاقتصاد القروي. في ضوء التحديات البيئية والزراعية التي تواجهها المنطقة، وسعيًا نحو تعزيز مفهوم الزراعة المستدامة والاقتصاد الأخضر، ونؤكدًا على أهمية حماية التنوع الجيني، فإن بلدية نحالين تتوجه إليكم بهذه الرسالة التي تتضمن قائمة بالاحتياجات ومشاريع تنمية ذات أولوية، نأمل أن تحظى باهتمامكم الكريم ضمن إطار التعاون المشترك بين مؤسسات العمل القبياني والتنمية. 1. تطوير قطاع تربية النحل من خلال:

- توفير خلايا نحل وأدوات إنتاج حديثة.
- تنفيذ تدريبات متخصصة لمربي النحل.
- دعم صليات التعبئة والتغليف والتسويق.
- إشهار بلدة نحالين كمركز وطني متميز في إنتاج العسل الطبيعي ومشتقاته.
- زراعة 1000 شجرة من نبات حمصي البان (أكليل الجبل)، لما له من أهمية بيئية وعلاجية، ولدوره في دعم التنوع النباتي.
- 2. زراعة نباتات داعمة لتربية النحل مثل الازتر، الميرمية، الخراسي، واللافندر، ما يعزز من بيئة النحل وجودة إنتاج العسل.
- 3. تعزيز السياحة الزراعية البيئية المستدامة من خلال:
 - إنشاء مسارات بنية وزراعية داخل البلدة.
 - دعم نقاط عرض وبيع للمنتجات المحلية (مثل العسل والأعشاب الطبية).
 - إشراك العائلات في تقديم تجارب زراعية مبلترة للزوار.
- 4. إنشاء مشاتل زراعية صغيرة لإنتاج النباتات الطبية والعطرية، كجزء من برنامج تخضير البلدة ودعم الاكتفاء الذاتي.
- 5. تنفيذ برامج توعية بيئية وزراعية في المدارس والمجتمع المحلي، لنشر ثقافة الحفاظ على الموارد الطبيعية.
- 6. دعم النساء العاملات في القطاع الزراعي والحيواني عبر برامج تمكين اقتصادي وتدريب على تصنيع منتجات العسل والأعشاب وغيرها من المنتجات الريفية.
- 7. إنشاء معمل لمعالجة النباتات الطبية والعطرية، يتضمن تجهيزات للتجفيف والتحنين، لضمان استمرارية الاستعمال وحماية المنتج النهائي.
- 8. تنفيذ مشروع معصرة زيتون حديثة، تخدم مزارعي البلدة وتعود إحياء تراثها العريق، خاصة أن البلدة تضم معصرة زيتون رومانية قديمة من نوعها، تمثل رواية تاريخية وشاهدة على العمل الحضاري للمنطقة.
- 9. توفير مناكيب لعصر العنب، لدعم سلسلة إنتاج العنب ومشتقاته وتشجيع الزراعة المتنوعة المرتبطة بالتقاليد الريفية في البلدة.
 - أرض استراتيجة متاحة للمزارع: يسرنا إعلامكم بأن بلدية نحالين تملك قطعة أرض بمساحة 75 دونمًا، تقع ضمن حدود التنظيم، ولقد فرصة استراتيجة يمكن استغلالها في تنفيذ مشاريع زراعية وبنية، منها:
 - إقامة مشتل بيئي دائم.
 - تطوير محطة نحل تعليمية مفتوحة للزوار والطلبة.
 - إنشاء حديقة بنية مجتمعية.
 - تنفيذ مشاريع زراعة مكثفة للأشجار والنباتات الداعمة للنحل.

نرى في هذه المقترحات فرصة حقيقية لبناء شراكة مستدامة بين بلدية نحالين ومتحف فلسطين للتاريخ الطبيعي، بهدف تنمية البلدة بيئيًا وزراعيًا بشكل متكامل، بطريقة تعكس إيجابيًا على السكان، وتعزز من سموهم في أراضيهم، وتحافظ على الموروث القبياني والمليبي للمنطقة. عليه، نأمل من حضرتكم دراسة هذه الاحتياجات والمقترحات بعين الاهتمام، وننتظر إلى التفاعل معكم في تنفيذ مشاريع رائدة ومؤثرة تخدم المنطقة وسكانها.

رئيس بلدية نحالين
اجمال سالم نحارة



مع فائق الاحترام والتقدير

Fig. 43. Example of needs statement from Nahhalin Municipality outlining needs.

Three members of our institute traveled to Cyprus 7–11 April 2025 for the 5th Mediterranean Plant Conservation Week³¹. Over 150 people attended and we had sessions discussing protection of rare plants especially in special conservation areas, microreserves, protected areas, Himas, and biosphere reserves.

³¹ <https://cyprusconferences.org/mpcw2025/>



Fig. 44. From Left to Right: Banan Alsheikh, Prof. Qumsiyeh, Jessie Chang, Princess Basma, Dr. Hatim Taifour at RBGs



Fig. 45. Prof. Qumsiyeh at the Royal Botanic Gardens, Jordan.



Fig. 46. From L to R: Dr. Ibrahim Khader (Bird Life regional director), Fadi Ghanem (Consultant to Minister of Agriculture, Lebanon), Assad Serhal (Director General of Society for Protection of Nature in Lebanon), unidentified (Royal Society of Protection of Nature), Banan Al-Sheikh, unidentified, Prof. Qumsiyeh, Fadi Nasser (RSCN Director), Dr. Neshat Hamidan (RSCN), Jessie Chang (PIBS).

A biosphere reserve is an internationally recognized and nationally designated area that includes representative examples of natural or minimally disturbed ecosystems blending biodiversity and cultural conservation with benefit to local people (Batisse 1997; Bridgewater 2002; Bouamrane et al. 2019; Ferreira et al. 2018; <https://en.unesco.org/mab/> UNESCO 1985, 1996). An important aspect of BRs is the conservation, where practicable, of traditional land use systems. These systems often reflect centuries of human experience and can provide information on improving the productivity and sustainability of modern land management. Biosphere reserves are growing globally with over 700 biosphere areas in >120 countries and constitute a world-wide network linked by international understanding on purposes, standards, and exchange of scientific information. This network will eventually include **significant representation of biomes/ecosystems around the world**. The International Coordinating Council of the MAB Program was held virtually in 2020 where the Technical Guidelines for Biosphere Reserves were adopted (see https://en.unesco.org/sites/default/files/tgbr_en.pdf) (Figs. 45, 46). Biosphere reserves typically consist of three interrelated zones: Core Zone (strict conservation), Buffer Zone (sustainable development practices), and Transition Zone (managed for communal and local use like controlled pastoralism).

The Arab MAB Network was officially launched in Amman (Jordan) in 1997. The concept has evolved over the years and now covers three functions: biodiversity conservation, sustainable development, and logistical support for research and capacity building (Reed 2016)³². While there are BRs in nearby countries (e.g. Lebanon and Jordan), none exist in Palestine now. Based on this,

³² Also see www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biospherereserves/world-network-wnbr/wnbr/

and on the global system of work and UNESCO descriptions, we propose to examine here three areas as candidates to be BR to help both people and nature in Palestine and analyze their local situation. Currently, the only two biosphere reserves recognized in Palestine-Israel are managed by the Jewish National Fund under UNESCO's Europe and North America network. "Biosphere Reserves," UNESCO, accessed July 27, 2022, . Presenting itself as the "oldest green organization in the world," the Jewish National Fund, a quasi-public institution, has been advancing the aggressive Judaiza-tion of lands (Cohen 2004; Braverman 2009).



Fig. 47. Team visiting Wadi Al-Mujib Biosphere reserve.

Hima: The Hima (Arabic: *حمى*, meaning "protected place") is one of the oldest documented conservation systems in the world, with origins in the Arabian Peninsula dating back over 1,500 years. Historically, Himas were areas set aside by communities to protect natural resources, such as water sources, grazing land and forests from overuse, with management decisions made collectively (Gari 2006; Kilani et al. 2007). The contemporary Hima model, as revived and promoted by the Society for Protection of Nature in Lebanon (SPNL), has been applied successfully across Lebanon and serves as the primary reference model for this project. Key features of the modern Hima include: community ownership and decision-making; multi-use zonation balancing conservation with livelihoods; branding of local products and ecotourism; and alignment with national and international conservation frameworks (Talhok et al. 2019; SPNL 2023).

Whether one adopts a biosphere reserve model or a Hima model, communities' land tenure security is fundamental to good governance and conservation (IUCN 2011; Herrera et al. 2014). Management plans in more modern concepts emphasize ecosystem services or more properly 'people benefit from nature' as fundamental to conservation efforts. Local communities are the custodians of cultural and natural heritage. Engaging them in conservation efforts is not only ethical but also practical. Research shows that community-managed systems are often more resilient and adaptive to change (Pretty 2003). In Palestine, several community-led initiatives have proven effective. The Battir Landscape Eco-Museum, for example, offers environmental education, promotes local crafts, and engages visitors in guided heritage tours. Traditional

knowledge holders, such as local elders and farmers, have also played a critical role in maintaining irrigation schedules and terrace upkeep. However, community engagement must go beyond consultation to genuine co-management. Strategies such as participatory mapping, heritage cooperatives, and youth training programs can ensure that local people remain at the heart of conservation efforts. Hima began as a mechanism to control grazing by local tribes (Chehod 1971; Kilani et al. 2007). The origin of the concept of Hima predates Islam but it was mostly protected areas for chieftains to ensure good lands were kept from less fortunate peasants. The concept evolved during the Islamic period to focus on more community use (Llewellyn 2003). Hima al-Naqi' was established by the Prophet Mohammad near al Medina to ensure protected rangeland for cavalry. The Prophet also declared Mecca and al Medina two sanctuaries. Hunting in al Madina was forbidden (Haram) within a radius of four miles and destruction of plants forbidden within a radius of twelve miles (Foltz et al. 2003; Gari 2006; Verde 2008).

The Criteria for selecting an area to be a Hima are 1) Ownership as Communal lands; 2) Nature & Biodiversity values (i.e. IBBA's/KBA's/IPA's, etc); and 3) Socio Economic & Cultural values. The study area fits perfectly into these criteria. The Hima system was noted to be particularly relevant to the Palestinian context because it: (a) is rooted in Arab cultural heritage and therefore resonates strongly with local communities; (b) does not require a specific legal designation that might be compromised by occupation conditions; (c) allows communities to claim stewardship over their land and resources; and (d) integrates conservation with livelihood improvement, including sustainable agriculture, ecotourism, and women's enterprises (Fig. 48).

Globally, similar community-based heritage protection systems have been implemented such as indigenous-led Protected Areas in New Zealand and the Satoyama Initiative in Japan (which links traditional ecological knowledge with modern sustainability goals). The Biosphere model was initially contemplated by the local community and the experts we consulted within countries like Lebanon and Jordan. Collectively we settled the Hima model and four of our communities agreed on principles for adopting this. Others also leaned towards this model. We thus collectively built this management plan in the area based on the Hima model as practiced in Lebanon. There, the Society for the Protection of Nature in Lebanon (SPNL), collaborates with local councils, religious leaders, cooperatives, and other societal segments to protect communal lands for sustainable use and biodiversity conservation (Talhouk et al. 2019).



الوزارة. وبعد هذا أحد أهم الإنجازات البيئية في فلسطين خلال السنوات الأخيرة ومع ذلك، لا يزال العمل الجاد يتطلّب دراسة جميع المناطق بشكل كامل ووضع خطط إدارية لها (مناخاً جالياً لمحميات محمية فقط). إحدى المناطق المحمية التي اعتمدها في PIRBS كنموذج هي منطقة العرقوب جنوب القدس. وقد حصلنا على منح من National Geographic Society لوضع خطط لها لتشمل المجتمعات المحلية. في نيسان (أبريل) 2025 قام أعضاء فريقنا برحلات إلى الأردن ولبنان للتعلم من العمل المماثل الذي يتم إنجازه في هذين البلدين. وعلى وجه الخصوص، نلقا "حسدنا" نضال الحمى التي لم تطورها في لبنان، وكانت جولة الحمى التي قمنا بها والتحدث مع مسؤولي جمعية حماية الطبيعة (SPNL) والجمعيات المحلية عديدة للغاية. نحن ملتزمون الآن بإنشاء أول حمى في فلسطين في منطقة العرقوب. كما طوّرت الرحلة أفكاراً للتعاون الإقليمي في مجال حماية الطبيعة والمشاركة المجتمعية. ونحن نشكر بالشكر لجمعية حماية الطبيعة في لبنان على كرم الضيافة.

Protecting Nature and Serving People in Palestine: Learning from Regional Experiences

Summary: The Palestine Institute for Biodiversity and Sustainability (PIBS) at Bethlehem University is learning from regional partners. PIBS led efforts to collectively write national strategies including designating a new protected areas network. Tips by our team members are undertaken to learn from the work being done in nearby countries. The tour of the Hima in Lebanon and speaking with SPNL officers and the local communities increased our commitment to create similar Hima odes in Palestine. The trip also developed ideas for regional collaboration in research, conservation, and community participation.

By Dr. Mazin Qumsiyeh, university professor and founder of the Palestine Institute for Biodiversity and Sustainability (PIBS) and the Palestine Museum of Natural History (www.palnatmuse.org)



د. قمصية (اليسار) مع أعضاء فريقه (من اليمين) في حمة حما.

حماية الطبيعة وخدمة الإنسان في فلسطين: الاستفادة من التجارب الإقليمية

د. مازن قمصية

في ورقة بحثية خُفّعت من قبل خبراء PIRBS ومجلة جودة البيئة IUCN، وكما ورد في الملخص القديم على موقع آية نبادل للعلوم لخدمة فلسطين (<https://pi.chm-cbd.net/protected-areas-0>) تضمنت عملية التقييم التي قادها الاتحاد العالمي لحفظ الطبيعة وسلطة جودة البيئة ووزارة الزراعة ووزارة الحكم المحلي ومعهد فلسطين للتنوع الحيوي والاستدامة لتحليل المناطق الخمسين الموجودة في شبكة المحميات الطبيعية، بالإضافة إلى إجراء تحليل ماركسان ودمج بيانات جديدة بناءً على معايير الاتحاد العالمي لحفظ الطبيعة. أدت عملية التقييم إلى إزالة بعض المناطق ودمجها وتحويلها، مما أدى إلى شبكة جديدة للمحميات الطبيعية تتكون من 28 منطقة. تمثل شبكة المحميات الطبيعية جميع أنواع النباتات والمناطق الجغرافية النباتية في فلسطين، مما يوفر حماية فعالة للمناطق البيئية الرئيسية في منطقة البحر الأبيض المتوسط الساحلية.

كان العمل جماعياً مع جميع أصحاب المصالح: منظمات المجتمع المدني، والنظم غير الحكومية، والأكاديميين، والجمعيات البيئية المحلية والعالمية، والسلطات المحلية والوطنية. ونمت الوافدة على شبكة المناطق الجديدة من أعلى مستويات سلطة جودة البيئة IUCN والوزارات والجهات اللاحقة (CEPF). تم اعتمادها على أعلى مستويات الحكومة، وأدرجت في الخطط الاستراتيجية الوطنية التي وافقت عليها المجموعة

نحن ملتزمون بإنشاء أول حمى في فلسطين منطقة العرقوب

لجري معهد فلسطين للتنوع الحيوي والاستدامة (PIBS) في جامعة بيت لحم هذا العام دراسة حول حماية أراضيها وخدمة الإنسان، بالتعلم من شركائنا الإقليميين في لبنان والأردن. نشأت شبكة المناطق المحمية لخدمة فلسطين بعد تأسيس السلطة الوطنية الفلسطينية عام 1994. وقد أعلن عن 51 منطقة محمية (لاحقاً 50) وافقت عليها السلطة الوطنية بحلول عام 1999 وخلال العشرين الأول من القرن الحادي والعشرين. وفي الفترة 2016 - 2017 عملاً على تقرير يستعرض قضايا المناطق المحمية، وأوصينا بإعادة تقييمها بناءً على معايير الاتحاد الدولي لحماية الطبيعة (IUCN). وساهم معهدنا بدور قيادي في صياغة التقرير الوطني السادس لاتفاقية التنوع البيولوجي، والاستراتيجية الوطنية للتنوع البيولوجي وخطط العمل لخدمة فلسطين، وأكدنا على ضرورة إعادة التقييم والتنفيذ الفعال. خلال 2021 - 2022 عمل مكتب IUCN لمنطقة غرب آسيا في عمان، وبمساعدة من المعهد ميدانياً وبالتعاون مع سلطة جودة البيئة والجهات المعنية، على إنشاء شبكة جديدة من المناطق المحمية. ونشر ملخص لها الدكتور مازن قمصية (شمالاً)، مؤسس معهد فلسطين للتنوع الحيوي والاستدامة (PIBS) ومعهد فلسطين للتاريخ الطبيعي، (تحتوي على) www.palnatmuse.org

Fig. 48. Article in SPNL Hima magazine May 2025 on visit and consultation 2025. مازن قمصية. حماية الطبيعة وخدمة الإنسان في فلسطين: الاستفادة من التجارب الإقليمية. مجلة الحمى (لبنان) أيار/مايو

The project is in line with local Bethlehem Governorate needs (ARIJ 2010) and is in line with the new NBSAP, the UN SDG, and the Arab sustainable development goals, the National Adaptation Plan to Climate Change, and the protected area network strategy (see Qumsiyeh et al. 2023a). 62,700 individuals (half under age 18) live in the project area in eight marginalized communities (PCBS 2021). The socioeconomic situation is rather poor (ARIJ, 2010) despite the fact that Bethlehem receives millions of (mostly religious) tourists per year. Developing a BR here will benefit local people and nature. It will also increase collaborations regionally and globally, influence local, regional, and even international policies (for uniqueness of success under stressful situations) (Fig. 49).





Fig. 49. Beneficiary woman selling produce at festival held in 2019 (Credit PMNH-BU), Team member Summer Shaheen in the field, Cooperatives supported selling stands (Credit PMNH-BU)

Community conservation engagement within the Al-Arqoub Hima should be understood as an ongoing process rather than a one-time consultation. The active participation of local communities in planning, implementation, monitoring, and periodic review of management activities is essential for long-term success. Regular meetings, open communication among stakeholders, and mechanisms for incorporating local knowledge and community feedback will help ensure that management remains responsive to changing environmental, social, and economic conditions while maintaining broad local support and ownership.

Table 6. Action plans and responsibility: Community engagement

Action plans	The responsible party
Along the Hima model, the eight local communities need to create active local coordination committees with a clear mandate of oversight, planning and coordination.	Local Councils
Each committee selects a representative to a new Al-Arqoub Hima Council (AHC). The management measures and methods will be led by the target communities with collective decisions to ensure wider buy-in and formal community adoption of the Hima model with its three key principles: Community ownership and decision-making; Integration of cultural values and ecological sustainability; and Long-term stewardship over short-term exploitation (SPNL 2023).	AHC will also include representatives of relevant ministries (MOA, MOTA, EQA), PIBS, NGOs and any others decided by AHC.
Develop the concept of Hima for Peace to address conflict over land and natural resources (SPNL 2023).	PIBS, EQA, Local councils
Biodiversity conservation and community development including poverty reduction need to be linked via nature based solutions (see Qumsiyeh et al. 2024a).	Local Committees
Establish an annual Al-Arqoub Hima Community Forum to review progress, exchange experiences among the eight communities, identify emerging challenges and opportunities, and recommend adaptive improvements to management activities.	AHC, Local Councils, PIBS

9.3 National Policies and Legal Issues

The Ottoman Forestry Law (1870, updated 1903) placed most forests under state ownership and management (Kark and Levin 2012). The British mandate on Palestine passed in 1927, a law for the protection and development of forests, created reserves, and started planting *Pinus halepensis* (Aleppo Pine) replacing the local plant cover (Evans & Farquhar 1948). Under the Jordanian administration of the West Bank (1948-1967), the nature reserves continued to operate. Since 1967 the Israel occupation authorities used nature to facilitate colonial activities starting in 1969, with military order number 363 (Braverman 2023). Military Order number 373 issued 1970 stipulated that the commander of the area can appoint an authority to manage nature reserves and this was delegated to the Israel Nature and Parks Authority (INPA). Forty-eight “nature reserves” were declared but many were established for Israeli military objectives and settlement expansion rather than ecological conservation (Qumsiyeh et al. 2023a; Allombert and Qumsiyeh 2024).

When the Palestinian Authority (PA) was established in the 1990s, nature and wildlife conservation was vested in the Palestinian Ministry of Agriculture (MoA) and the Environment Quality Authority (EQA). Wildlife conservation was aided by a) the designation of the new protected area network and its adoption by the government at the highest level (including the spatial plan for the state in 2023), b) the adoption of the National Biodiversity Strategy and Action Plan (EQA 2022), and the new PAN (IUCN 2025). A persistent structural challenge in Palestinian protected area governance has been the unresolved jurisdictional overlap between the Ministry of Agriculture and the Environmental Quality Authority. The Agricultural Law No. 2 of 2003 designates the Ministry of Agriculture as responsible for developing nature reserve management plans and conserving living organisms within protected areas, while the Environmental Law of 1999 assigns the EQA authority to prescribe standards for protection, declare and supervise nature reserves, and establish national parks. No formal memorandum of understanding between the two bodies has been concluded to clarify their respective roles, and the draft of the Protected Areas Law prepared in 2005, which would have created a national committee for nature protection with clear mandates, remained unapproved as of the most recent institutional review (PIBS/CEBioS 2021).

This gap has had practical consequences: in the case of Wadi Al-Quff, one of the first properly studied protected areas in Palestine, management responsibility was transferred to the Hebron Municipality rather than retained within a specialized conservation authority, a decision widely considered problematic for long-term ecological outcomes. The governance structure proposed for the Al-Arqoub Hima, with local community councils, EQA oversight, and clear coordination protocols with relevant ministries, is designed in part to avoid repeating this pattern. We in Palestine as a nascent state need to ensure not only that we have signed all the relevant treaties but that we actually implement them. An excellent review of these issues entitled “*Legal implications of accession of the State of Palestine to international conventions on resources and protection of natural resources*” was published (Jaradat and Awad Allah 2015). Joining international agreements consolidates the legal, political and international personality of the newly formed Palestinian State. In addition, it promotes the momentum of international solidarity, the sovereignty of the Palestinian State over its natural resources and geographical boundaries. These conventions and treaties are excellent podiums to address the world regarding the Israeli occupation’s violations of all aspects of Palestinian people rights.

Here are some relevant agreements signed that relate to issues of the environment which gives the state of Palestine both responsibilities and benefits for conservation of our areas: Convention on Biological Diversity (CBD); Basel Convention Controlling Trans-boundary Movement of Hazardous Wastes and their Disposal; Cartagena Protocol; United Nations Framework Convention on Climate Change (UNFCCC); United Nations Convention to Combat Desertification.

Palestine accession to these and other conventions³³. The State of Palestine, even if not a signatory, is active in a number of other international treaties that are not directly concerned with conservation and biodiversity and relate to conservation of the study area: the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on Migratory Species (CMS), and (International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). CITES would be highly beneficial in curbing trade in endangered species even though currently Palestine has no control of its ports of entry (still under Israel control). The potentiality of independence would make it more urgent to do this and prepare to implement our national strategy relating to the environment (EQA 2010). CMS should likewise be joined because 500 million birds migrate through Palestine on annual migrations between Eurasia and Africa. This would ensure protection of this important migratory site.

The Fourth Geneva Convention 1949 on protected persons asserts the protection and rights of people who live under occupation including their natural resources (Abouali 1998; Al-Haq 2015). International Humanitarian Law (IHL) including the articles in several conventions relating to occupation (which is by definition temporary) and numerous UN resolutions including UNC 242 and 338 reiterate illegality of acquiring territory by force and this includes extending sovereignty and laws of the belligerent occupiers on the land occupied. Advisory opinions from the International Court of Justice (ICJ) did provide a number of rulings reiterating the illegality of the occupation measures. While technically a non-state member of the UN, Palestine cannot bring a case unilaterally to the International Court of Justice (ICJ). Palestine can do so in one of two ways: 1) if both Palestine and Israel agree to go before ICJ or 2) if both Palestine and Israel signed an international convention. The latter possibility is intriguing since the two states did sign environmental conventions like the Convention on Biological Diversity and the Convention on Climate Change. An environmental law for the State of Palestine was adopted 1999 and updated 2025.

The 1999 National Biodiversity Strategy and Action Plan (NBSAP), Palestine's first, identified 13 priority areas for action: basic faunal and floral surveys at specialized centers; development and management of a national protected areas system; creation of management plans based on biodiversity inventories; protection of traditional indigenous knowledge; implementation of biosafety measures; habitat restoration across rangelands, forests and wetlands; collaborative management of biodiversity; combating desertification and climate change; elaboration of national biodiversity legislation; establishment of a biodiversity information and education center; promotion of ecotourism; coastal zone management in Gaza and the Dead Sea; and establishment of a national gene bank (Palestinian Environmental Authority 1999; PIBS/CEBioS 2021). Reviewing this list today is instructive: some priorities, such as the biodiversity information center (now realized through the Palestine Museum of Natural History) and the new protected area network, have been partially or substantially achieved. Others, including the gene bank, comprehensive faunal surveys, and fully functioning management plans for all designated areas, remain works in progress. The persistence of these gaps across more than two decades underlines the importance of the community-led, science-based approach that the Al-Arqoub management plan attempts to model. The 6th National report to CBD (EQA 2021) highlighted the limitations faced as well as achievements related to regulatory and legal elements. The new NBSAP (EQA 2022) attempted to remedy these issues but there are still implementation challenges.

Despite all these challenges, we Palestinians took initiatives to protect the environment. Organizations and individuals are utilizing a wide range of initiatives to conserve nature and biodiversity through public education, incorporating traditional knowledge, in situ and ex situ conservation, habitat restoration, and more. The study area in particular received much attention from the EQA, PIBS, and other local groups using these combinations of tools. Effective conservation depends not only on the existence of legal frameworks and international

³³ See <http://www.birdlife.org/datazone/country/palestinian-authority-territories/policy>

commitments but also on practical coordination among institutions and local communities. The Al-Arqoub Hima seeks to bridge policy and implementation by encouraging collaboration between government agencies, local councils, civil society organizations, academic institutions, and community stakeholders. This collaborative approach can strengthen the application of existing legislation, improve compliance, and ensure that conservation policies are adapted to local realities and community needs. This Hima concept, developed here could also become a model for other protected areas and even in small conservation sites like that in the Jinsafut area (Qumsiyeh et al. 2022).

Finally, since part of this Hima is designated a WHS, we should note that the Decree Law on Tangible Cultural Heritage no. 11/2018 requires that a Heritage Impact Assessment (HIA) and/or Environmental Impact Assessment (EIA) be conducted prior for all potential developments within the State Party's World Heritage properties in order to evaluate effectively the potential impacts on their Outstanding Universal Value (OUV).

Table 7. Action Plans and responsibility: policies and legal issue

Action plans	The responsible party
Along the Hima model, the eight local communities need to create active local coordination committees with a clear mandate of oversight, planning and coordination.	Local Councils
Enforce the 2025 Environmental law to hire and train rangers. Several articles are directly relevant to the Al-Arqoub Hima. Article 40 mandates the EQA to coordinate with specialized agencies to prescribe standards for the protection of nature reserves and national parks, to monitor and declare them, and to establish and supervise national parks. Article 41 prohibits Wildlife Trafficking, Poaching, and Wildlife Exploitation. Article 42 requires the EQA to specify conditions necessary to guarantee the preservation of biodiversity in Palestine. Article 44 forbids any person from conducting activities that may cause damage to nature reserves, with Article 72 stipulating fines and potential imprisonment for violations. In practice, enforcement of these articles has been inconsistent, and violations have rarely resulted in legal consequences (PIBS/CEBioS 2021). The updated 2025 Environmental Law represents an opportunity to strengthen these provisions and ensure that the Al-Arqoub protected area benefits from a more robust and actively enforced legal framework.	EQA and Green Police
Sign and ratify additional treaties including CITES, CMS, and ITPGRFA but also take seriously both responsibilities and benefits from existing signed treaties. The urgency of signing additional international treaties has been consistently recognized in Palestinian environmental planning. A 2021 institutional review (PIBS/CEBioS 2021) produced a ranked prioritization of treaties to which Palestine had	MFA, President's office

not yet acceded. The same review noted that preparations for signing several of these agreements were already underway pending completion of the new NBSAP, a process now concluded. The action plans outlined in this management plan therefore build on a consistent multi-year institutional consensus about which legal frameworks Palestine needs to strengthen.	
Strengthen coordination mechanisms among the EQA, MOA, local councils, relevant ministries, academic institutions, and civil society organizations to facilitate the effective implementation of environmental legislation and biodiversity policies within the Al-Arqoub Hima. Regular coordination meetings and information sharing should support coherent decision-making and reduce institutional overlap.	EQA, MOA, Local Councils, PIBS

9.4 Conservation efforts

Conservation activities in the Al-Arqoub area build on a range of ongoing initiatives implemented over recent years by local communities, governmental institutions, and international and national NGOs (Qumsiyeh et al 2023b; Qumsiyeh et al. 2024). ActionAid, WorldVision, and Caritas have all made efforts at helping farmers and community members to have sustainable living in ecofriendly ways (Fig. 50). The Good Water Neighbors project from Friends of Earth Middle East (FoEME) has helped establish cross-border committees for Wadi Fukin and Battir that actively manage springs and lobby against damaging development. FoEME and partners have also prepared a draft watershed master plan advocating strict protection of the recharge hills and banning further major construction there. Yet, these initiatives all are a small fraction of what is really needed in the Al-Arqoub area (Fig. 60 & 61). Multi-stakeholder platforms, participatory policy development, and inclusive conservation science are vital strategies to ensure that research informs policy and policy empowers practice.

These conservation interventions are designed to be mutually reinforcing, where ecosystem restoration supports sustainable livelihoods, biodiversity monitoring informs land management decisions, and community-based governance ensures long-term implementation and compliance. Integration across sectors is therefore a core principle of the Al-Arqoub Hima approach. The following conservation actions are organised according to their implementation horizon, ranging from immediate institutional measures to long-term landscape-scale restoration and cultural conservation initiatives.

Table 8. Action Plans and responsibility: Conservation efforts

Action plans	The responsible party
Promote ecofriendly production and consumption (e.g. Dajani and Isma'il 2014).	EQA, local councils
Develop and implement programs for a) soil biodiversity conservation, b) monitoring species, c) watershed conservation, d) use of greywater (Al-Khatib et al. 2022),	PIBS, NGOs, with local communities

and e) assessing the conservation status of species and ecosystems red-listing as needed per IUCN criteria. ³⁴	
Control of spreading and the removal of invasive species in the area per the national strategy adopted for that and the IUCN guidelines (IUCN 2018).	EQA with local councils
Hire enforcers (at least four part time or two full time) and train them for core protected area duties.	MOA
Expand use of community seedbanking.	PIBS with local seedbanks
Expand restoration efforts using native species via agroforestry/afforestation including use of Miyawaki method (Schirone et al. 2011). In an earlier project done in 2020, a total of three dunums of land that are parts of existing land in Al-Makhrouf belonging to three farmers were planted with wild trees ³⁵ . Site visits conducted in spring 2026 confirmed that the majority of the planted trees were surviving and growing well, consistent with observations and information provided by landowners.	PIBS, NGOs, MOA
The designation of a national flower (<i>Iris haynei</i>) and a national bird (Palestine Sunbird, <i>Cinnyris osea</i>) helped educate the public. Programs like this can be expanded (national mammal, national butterfly etc).	EQA (with support of NGOs, CSOs and other stakeholders)
Implementation of projects to restore the traditional irrigation systems and agricultural terraces and their components, including the watch-towers and dry stone walls throughout the property using eco friendly techniques and traditional knowledge.	MOA, FAO

9.5 Communication and mainstreaming

Communication and awareness activities constitute a central pillar of the Al-Arqoub Hima approach, supporting biodiversity conservation through education, public engagement, knowledge exchange, and the strengthening of environmental stewardship across local communities. These activities have been implemented through a combination of formal education programmes, mobile outreach, media engagement, cultural initiatives, and continuous community interaction.

Key communication tools include posters, exhibitions, mobile education platforms, and community-based awareness events. Fig. 50 illustrates the mobile museum initiative in Cremisan, while Fig. 52 presents an educational exhibit on rare plants in the study area delivered for community children on 9 May 2026. These initiatives reflect an emphasis on experiential and visual learning as core components of environmental awareness.

Communication efforts have been significantly amplified through media dissemination and public outreach across national and international platforms. The project has been featured in mainstream

³⁴ <https://docs.google.com/document/d/1n38zV1NJ0qzwa-aFMOIdEy7rS9z6Jo2l/edit>

³⁵ <https://almakhrouf.palestinature.org/wp-content/uploads/2020/05/Annex-10-Habitat-Restoration.pdf>

media articles, scientific and popular publications, television programmes, online platforms, and social media channels, contributing to wider public visibility of biodiversity conservation in the study area. Four televised episodes were produced and broadcast on local TV, addressing themes of biodiversity, sustainability, community agriculture, and environmental stewardship. Additional video materials include documentaries on the study area, training activities, and educational content for children on climate change and environmental awareness.

Between 2025 and 2026, continuous community engagement programmes further strengthened local participation in conservation communication. These included workshops, school visits, capacity-building sessions, thematic environmental days, and structured educational programmes for children and youth. The mobile museum programme alone reached approximately 9,800 schoolchildren and 1,180 adults across 80 stops in 40 communities, demonstrating the scale of outreach achieved (Fig. 50).

Community engagement also included regular meetings across the eight communities of the Hima area, including Wadi Fukin, Artas, and Battir, supporting participatory dialogue on conservation planning and implementation. In parallel, international engagement through conferences, training programmes, and workshops contributed to knowledge exchange and strengthened the visibility of the initiative within global conservation networks.

Overall, communication and awareness activities serve not only as dissemination tools but as active components of the conservation system, reinforcing links between science, policy, and community practice, and fostering a culture of environmental stewardship aligned with the Hima model. Figure 51 shows a poster produced to encourage conservation and was distributed to all 8 communities in the study area.



Fig 50. Education mobile Museum in Cremisan.

محمية العرقوب: كنز طبيعي فلسطيني



تقع محمية وادي العرقوب غرب بيت لحم، وتضم اودية كريمزان والمخرو وحوسان، وتعد من أبرز المشاهد الطبيعية والزراعية في فلسطين

تحيط بها ثمانية تجمعات سكانية: بتير، حوسان، الولجة الخضراء، أرطاس، وادي فوكين، بيت جالا، ونحالين، والتي ارتبطت تاريخياً بالمكان من خلال الزراعة التقليدية واستخدام الموارد الطبيعية



نعمل بالشراكة مع هذه المجتمعات نحو الوصول إلى نموذج الحمى، حيث تُحمى الموارد الطبيعية وتدار بشكل مستدام بما يضمن استمراريتها للأجيال القادمة

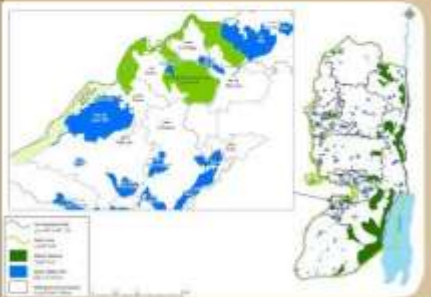
تتميز المنطقة بتنوعها الطبيعي بين التلال والوديان وبأراضيها الزراعية المعتمدة على الينابيع، مثل عين البلد في بتير وعين الهوى في حوسان، إلى جانب أشجار أصيلة كالبلوط والزعرور والخروب، ونباتات برية مميزة كالسحليات والسوسن

تحتضن المحمية تنوعاً حيوياً غنياً، يشمل غزال الجبل الفلسطيني وإبن آوى، والضبع المخطط، وخفاش الفواكه، إلى جانب مجموعة من الطيور المميزة

توفر الأودية ممرات طبيعية للحياة البرية، كما تتيح مسارات للمشاة والتجوال في الطبيعة، مثل المسار الممتد بين بيت جالا وبتير، مروراً بين ينابيع المياه والكهوف والمواقع الأثرية والمناظر الحجرية التقليدية

التحديات

رغم أهميته البيئية والثقافية، تواجه محمية وادي العرقوب تحديات تهدد استمراريتها، مثل التوسع الإسكاني، النفايات الصلبة والرعي الجائر مما يستدعي جهوداً متواصلة للحفاظ عليه ككنز طبيعي فلسطيني



لماذا تزور المنطقة؟

1. تجربة مسارات المشي البيئي
2. مشاهدة التنوع الحيوي الفريد
3. الإستمتاع بالطبيعة والهواء النقي
4. التعرف على التراث الزراعي الفلسطيني



www.palestinenature.org

Figure 51. Poster produced to encourage conservation.



Fig. 52. Exhibit about rare plants in the study area done 9 May 2026 for community children.

Other achievements from this work is that posters and signs and relevant information on protected areas were developed for the new natural history museum (xxx). Our work was also published and disseminated via mainstream and social media (Annex 1).

Table 9. Action Plans and responsibility: Communication and mainstreaming

Action plans	The responsible party
Plan and execute educational programs about the new protected area/hima and the UNESCO World Heritage Site including highlighting involvement of community (MOTA 2025; Desclaux-Salachas 2020; Qumsiyeh et al. 2023b) and benefit to community (e.g. Qumsiyeh et al. 2024). Educational programs, workshops, guided tours, and community engagement efforts help foster a sense of stewardship among local communities and visitors.	PIBS with local committees
Develop more local environmental clubs, national network of environmental enthusiasts, and a regional environmental awareness network to exchange expertise and educational modules etc.	PIBS, NGOs
Develop and arabize our knowledge and our communications and strengthen investigative journalism and article publishing then conduct capacity building workshops for community influencers on Hima management.	All sectors
Develop a responsible marketing strategy that highlights the unique natural and cultural attributes of the area. Focus on attracting visitors who are genuinely interested in	MOTA

experiencing and respecting the environment through social media, schools, and local groups.	
Encourage local activist communities for empowerment ³⁶ and build new ones.	Local Committees
Develop culture and nature connection on a regional basis: Fertile crescent cultural heritage related to nature. Bilad Al-Sham medicinal and herbal plants, ethnobotany, and ethnozoology. Network environmental enthusiasts in Bilad Al-Sham and enhance their value both as homat al Hima and more.	PIBS, NGOs
Build relationships with groups (local and international) that protect Palestinian and environmental rights ³⁷ , then do advocacy work ³⁸ and link peace education to environmental education (see Qumsiyeh et al. 2025).	Local Committees, PIBS, NGOs, others
Develop monitoring and evaluation systems to assess the effectiveness of communication and awareness activities, including outreach reach, community engagement levels, and learning outcomes.	PIBS, NGOs



Fig. 53. From a workshop with key community members discussing the management plan of the Hima.

³⁶ Examples: <https://friendsofwalaja.wordpress.com/> al-makhroun.org, <https://www.palestinenature.org/palestine-action/>

³⁷ Examples include: <https://btselem.org/> <https://machsomwatch.org/> <http://bimkom.org>

³⁸ see for our intervention via UNESCO <https://www.palestinenature.org/conservation/Letter-from-UNESCO.pdf>

9.6 Agriculture and pastoralism

Data from the agricultural census published by the Palestinian Central Bureau of Statistics (PCBS) indicates that the agriculture sector contribution to GDP has been declining over the years. Where the contribution of agriculture to GDP was about 37% in the mid-seventies, but reached to 2.8% only in the year 2016 (MoA 2016; El Zein 2017). There are several reasons behind the decline of the agricultural sector's contribution to GDP over the years, but the main reason is the growth in other sectors such as services, construction, and information technology. This caused significant reduction of agriculture's contribution to employment over the years. In 2006 the labor force in the agricultural sector constituted 16.7% of total labor force (12.6% male, 35.1% female), falling to 8.7% in 2015 (PCBS 2000-2015). The percentage of men working in the sector was estimated at 7.8% of the total male workers in 2015, while 13.1% of the total female workers were employed in agriculture, which indicates the relative importance of the agricultural sector to women (MoA 2016).

Thousands of meters of dry-stone walls compose the terraces that dot the landscape in the study area (Fig 54). The dry-stone walls (senasel) create a flat earthen surface known as habaleh, and thus prevent soil erosion and preserve soil moisture. The traditional cultivation of olive trees is an essential component in the historical development of the cultural landscape systems in this area, and has multiple functions and meanings at the environmental, agricultural, socio-cultural, and symbolic levels. Most of the olive tree plantations are rain-fed, along with other crops such as fruit trees and field crops, and occupy extensive hilly and mountainous areas that are susceptible to soil erosion due to water runoff. Palestinian natural trees such as oak can be found amongst the olives in terraces that are away from the village, while vines and fruit trees, such as apricots, almonds, and plums are planted near the villages. The agricultural activities related to olive cultivation are usually managed by individual families, and the olives and oil produced is used prevalently for self-consumption and for the local market. In the eight communities of the study area, we noted cultivation of wheat, barley, battiri eggplants, baladi zucchini, baladi green beans, baladi cauliflower, thyme baladi, and others. There are also important wild plants of economic value: Syrian pear (*Pyrus syriaca*), cultivated green Pistachio (*Pistacia vera*), fennel (*Foeniculum vulgare*), and Biblical Hyssop (*Origanum syriacum*).

The ancient pools and the water canals are used during the dry season to irrigate the terraces (Fig 55), and the distribution of the water among the farmers follows a traditional system known as shares (al-ma'dud). Ecosystem benefits come from the biocultural landscape both globally (Mitchell et al. 2009; Tengberg et al. 2012) and in the study area (Qumsiyeh et al. 2024). Ethnobotanical methods are available with support from UNESCO (e.g. Martin 2004). In the context of Palestine, such studies can also enhance the attachment of people to their lands (Tsykalova 2015; Qumsiyeh 2018) (Figures 56, 57, & 59).



Fig. 54. Traditional ploughing is still practiced throughout the Palestinian areas (photo Masar Falastin).



Fig. 55. Battir agricultural terraces.



Fig. 56. One of the farmers utilizing eco-friendly agriculture.



Fig. 57. Learning composting.



Fig. 58. Shepherding sheep and goats (photo Masar Falastin).



Fig. 59. Agricultural cooperative greenhouse in Artas 25/12/2025.



Fig. 60. Example of terraced family land that can be rehabilitated to be productive agricultural lands.

Table 10. Aromatic and Medicinal plants. Status: C= common, CC=very common, F=frequent.

Species Name	Common Name	Family	Status
<i>Ajuga chia</i>	Chian Bugle	Labiatae	CC
<i>Amygdalus communis</i>	Wild Almond	Rosaceae	CC
<i>Ceratonia siliqua</i>	Carob	Leguminosae	C
<i>Chiliadenus iphionoides</i>	Goldy-Locks	Compositae	CC
<i>Cistus creticus</i>	Soft-Hairy Rockrose	Cistaceae	CC
<i>Cistus salviifolius</i>	Sage-Leaved Rockrose	Cistaceae	CC
<i>Coridothymus capitatus</i>	Headed Thyme	Labiatae	CC
<i>Crataegus aronia</i>	Spiny Hawthorn	Rosaceae	C
<i>Ephedra aphylla</i>	Leafy shrubby Hosetail	Ephedraceae	CC
<i>Ficus carica</i>	Fig	Moraceae	CC
<i>Foeniculum vulgare</i>	Common Fennel	Umbeliferae	CC
<i>Inula viscosa</i>	Clammy Inula	Compositae	CC
<i>Lactuca serriola</i>	Prickly lettuce	Compositae	CC
<i>Parietaria judaica</i>	Wall Pellitory	Urticaceae	CC
<i>Phagnalon rupestre</i>	African Fleabane	Compositae	CC
<i>Rhus coriaria</i>	Sumach	Anacardiaceae	C
<i>Sarcopotrium spinosum</i>	Prickly Burnet	Rosaceae	CC
<i>Satureja thymbra</i>	Savory of Crete	Labiatae	CC
<i>Teucrium capitatum</i>	Cat Thyme	Labiatae	CC

Teucrium creticum	Cretan Germander	Labiatae	F
Teucrium divaricatum		Labiatae	C
Thymbra spicata	Spiked thymbra	Labiatae	F

An earlier project established the ethnography section of PMNH, developing a web-based database containing thousands of intangible cultural heritage records (<http://Turathna.palestinenature.org>), created an educational mobile game application (apple store <http://apple.co/2n5f1Ww>, google play store <https://play.google.com/store/apps/details?id=pmnh.learning.game>) and implemented capacity-building activities for tour guides and university students. However, a key gap identified was the need for greater localized impact within marginalized communities. The present project addresses this need by directly benefiting more than 7,000 residents of two villages.

These agricultural and pastoral systems play an important role in climate change adaptation and resilience, particularly in relation to water scarcity, soil degradation, and increasing climatic variability in the region. The following actions aim to strengthen the integration of ecological sustainability, traditional agricultural knowledge, and local livelihoods within a coherent agro-ecological landscape management approach.

Table 11. Action Plans and responsibility: Agriculture and pastoralism

Action plans	The responsible party
Promote research and education. This includes natural history, sociology of village life, and the traditional cultural expression of stories, fables, proverbs, and other artistic manifestations. Regularly monitor the impact of agricultural activities on the ecosystem and adjust strategies as needed to ensure the balance between conservation and development.	PIBS, MOA
Develop local seedbanks and farmers cooperatives as centers of knowledge and enhance agrobiodiversity (Amri 2018).	PIBS & Local seed banks
Capacity building: Provide training and educational programs for farmers in the biosphere reserve area. This can include workshops on sustainable farming techniques, resource management, and value-added product development (Fig. 57).	MOA + others
Expand projects like the one already done in the area to help farmers meld traditional indigenous knowledge with modern scientific knowledge. This approach proved effective: eco-friendly agricultural practices introduced through earlier project phases led to an average 40% increase in agricultural production among the 81 targeted farmers (Qumsiyeh et al. 2023).	MOA, NGOs
Promote pride in agricultural heritage [Centers like Artas Cultural Heritage Center and Battir's Hasan Mustafa Cultural Center].	MOTA, NGOs

Help farmers access markets for their products by establishing local cooperatives, supporting direct sales, and assisting with value addition through processing and packaging. Implement existing village business plans and strengthen them in some areas.	MOTA, MOA, EQA, NGOs
Promote crop diversification using native and locally adapted varieties.	PIBS, MOA
Implement and promote sustainable farming techniques such as agroforestry, organic farming, crop rotation, and reduced chemical pesticide and fertilizer use. These methods maintain soil health, reduce erosion, and minimize negative impacts on the ecosystem.	MOA
Encourage farmers to grow a diverse range of crops. Crop diversity enhances ecosystem resilience, improves soil fertility, and provides economic stability for farmers by reducing the risk of crop failure due to pests or climate events.	MOA, PIBS
Promote the cultivation of native and local plant varieties that are well-suited to the local climate and soil conditions. These varieties often require fewer inputs and are better adapted to the local ecosystem.	MOA, EQA, PIBS
Livestock Management: Implement sustainable livestock management practices to prevent overgrazing and soil degradation. Rotational grazing, mixed livestock-crop systems, and proper waste management can help maintain ecosystem health.	MOA
Focus on efficient water use by implementing techniques like drip irrigation and rainwater harvesting. This conserves water resources and prevents waterlogging or soil erosion.	MOA
Encourage the adoption of integrated pest management strategies that combine biological, cultural, and chemical methods to control pests. This minimizes the use of harmful pesticides and preserves the natural balance of the ecosystem.	MOA, EQA
Incorporate traditional knowledge and practices of local communities with modern scientific knowledge.	MOTA, EQA, NGOs
Regular feedback mechanisms with farmers and local stakeholders should be established to evaluate the effectiveness of implemented measures.	MOTA, MOA, EQA

9.7 Tourism

Gola et al. (2010) explained why tourism paths in this area of Battir are critical for social and territorial development of the local people, especially that all locals still connect to each other as if it is pre-1948 despite the obstacles. There is an existing path in Wadi Makhrouf already used for hiking (Figures 61, 62 & 63) but it passes through private lands in many parts and is not marked and will need to be redesigned based on new criteria adopted at the ministerial level (EQA, Ministry of Tourism, Ministry of Agriculture) with help of this and other projects in the valley.



Fig. 61. Earlier trail maps of Al-Makhrouf.

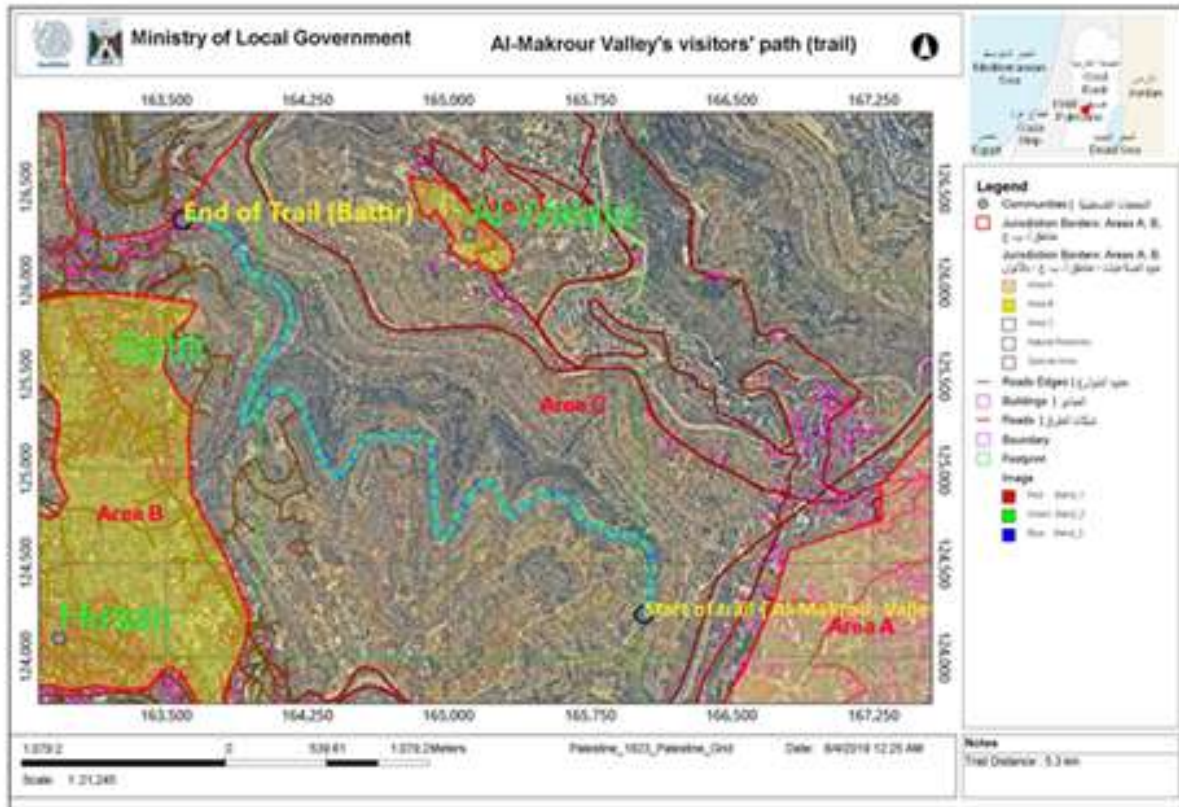


Fig. 62. Some of the trails considered and the trail adopted by the ministries (EQA, MOTA, MLG).



Fig. 63. Trail usage.



Fig. 64. The oldest olive tree in the Southern area of Palestine: Badawi tree at Al-Walaja.



Fig. 65. Photo of Byzantine remains and pool in Judean Mountains National Park with an uncultivated hillside and security cameras visible in the background.



Fig. 66. Children playing at a spring in Husan (PIBS).

Table 12. Action Plans and responsibility: Tourism

Action plans	The responsible party
Expand the initial tourism plan ³⁹ and ensure a balance between promoting sustainable tourism and conserving the natural and cultural resources of the region. Include recreational activities which help ecotourism align better with conservation goals (Lee & Jan 2015).	MOTA
Allocate a portion of tourism revenue to conservation efforts. Support habitat restoration, species protection programs, and initiatives that enhance the overall health of the biosphere area.	MOTA
Reinstall damaged signs ⁴⁰ and mark existing trails better (Atrash 2015).	MOTA
Do voluntary cleaning campaigns ⁴¹ .	EQA, NGOs
Formalize and mark new ecotourism trail NETWORK connecting all eight communities.	MOTA, EQA
Train a minimum of 20 local ecotourism guides.	MOTA

³⁹ <https://almakhrou.palestinenature.org/wp-content/uploads/2020/05/Annex-14-Tourism-Business-plan.pdf>

⁴⁰ See <https://bit.ly/2TaXcG5> <https://bit.ly/3jqVif2>

⁴¹ Example: <https://www.facebook.com/PIBS.PMNH/posts/2236083246670202>

Develop community-specific ecotourism plans building on the draft plans developed during prior projects.	MOTA
Develop birdwatching information and infrastructure.	NGOs, MOTA
Develop bilingual (Arabic/English) interpretive materials for the Hima area.	MOTA
Hold three community festivals in Battir, Artas, and Beit Jala.	MOTA, NGOs
Involve local communities in tourism activities to provide them with economic benefits and a sense of ownership. Encourage the development of community-based tourism enterprises, such as guided tours, handicrafts, and traditional performances.	MOTA, EQA
Conduct a thorough environmental impact assessment to understand the potential effects of increased tourism on the ecosystem. Identify vulnerable areas and species, and establish guidelines to minimize negative impacts. Implement visitor quotas or limits to preserve the delicate balance of the area.	PIBS, NGOs, EQA
Develop and enforce responsible behavior guidelines for visitors, including staying on designated trails, not disturbing wildlife, waste management and control.	MOTA, EQA
Build eco-friendly infrastructure that minimizes the ecological footprint. This includes using sustainable building materials, renewable energy sources, and low-impact designs.	MOTA
Provide educational opportunities for visitors to learn about the local environment, biodiversity, and cultural heritage. Mobile applications, guided tours, informative signage, a booklet for each community, and maps, can enhance the visitor experience and foster a deeper appreciation for the area.	MOTA, NGOs
Establish a participatory monitoring and feedback mechanism to assess visitor impacts, carrying capacity, and community benefits, ensuring that tourism development remains adaptive and aligned with conservation objectives.	NGOs, MOTA

9.8 Research and Monitoring

Research is the first and most important component upon which conservation, education, and community service efforts are built. It is also necessary to strengthen taxonomic and systematic research, ecology, habitats and wildlife population studies, indigenous genetic resources, GIS and remote sensing, and popular knowledge assessments. Implementing field measurement and assessment surveys to get a grip on existing biodiversity and the identification of those under threat or are presumed lost or extinct is a first step that should be taken. Research and monitoring

results should directly inform adaptive management decisions, ensuring that conservation strategies are continuously updated based on new scientific and field data.

There are 60 Publications involving the study area done by our team (47 before 2025, and 13 in 2025–2026). These are shown in Annex 2. Over the years, we also supervised a number of master theses related to the study area⁴².

Table 13. Action Plans and responsibility: Research and monitoring

Action plans	The responsible party
Enhance scientific basis for Hima and other PAs management. Expert data driven knowledge must be strengthened and scientific publications undertaken to understand local flora, fauna, habitats, and threats. New research complimented existing end-line biodiversity report ⁴³ but much more work is needed especially timeline studies showing changes over the years. Key indicator groups include orchids, frogs, large mammals, and IUCN redlisted threatened, vulnerable or endangered birds. There is a necessity to enhance the level of cooperation and coordination among academic and research institutions whether they are governmental or non-governmental organizations that work in the field of biodiversity. There is also a need to outline participatory investment in relevant projects, plans, and actions at international and national levels to raise the quality and volume of Palestinian biological resource data.	PIBS
Develop a database of experts and utilize regional experts instead of creating redundancies. Hold local and regional biodiversity conferences (can be cosponsored by SPNL, RSCN, PIBS) and develop joint regional projects/proposals.	PIBS
Develop citizen science programs. This can leverage local ecological knowledges alongside ecotourists (e.g. birdwatchers) and other interested parties.	PIBS, NGOs
Establish long-term biodiversity monitoring with clear indicator species and protocols for annual measurement ⁴⁴ . Monitoring indicators developed in previous project phases ⁴⁵ can serve as a baseline for this expanded monitoring framework.	Researchers, PIBS, EQA

⁴² Examples: Tamara Sobeh, Master in Biotechnology, Bethlehem University, Molecular Phylogeny of Beetles in West Bank; Lina Handal Master in Biotechnology, Bethlehem University, Environmental DNA of Wetlands; Amal Handal, Master in Biotechnology, Bethlehem University, Molecular Phylogeny of Orchids (Orchidaceae) in the West Bank; Eman Ziyad Eltiti. Master in Tourism and Hotel Management, Bethlehem University, Developing Cultural Heritage Tourism in Bethlehem. 2018-2021; Elias Handal, Master in Environmental Studies, Birzeit University, Land Snails in the Occupied Palestinian Territories; Mohammad Najajreh, Master in Environmental Studies, Birzeit University, Lady Beetles (Coccinellidae) of the southern West Bank and Jordan Valley.

⁴³ <https://www.palestinature.org/conservation/Plant-Biodiversity-End-line-Report.pdf>

⁴⁴ <https://www.bipindicators.net/national-indicator-development/bidf>

⁴⁵ <https://www.palestinature.org/conservation/Monitoring-indicators-Makhrour.pdf>

Develop CHMs for Western Asian countries and a regional Biodiversity Information network (library).	EQA
Develop the area as a center for scientific research for faculty and students at universities and colleges in the area and beyond.	PIBS, Universities

9.9 SWOT summary

Strengths

- Cultural heritage richness (cultural sites, traditional knowledge, and historical tools and practices).
- Biodiversity and ecological richness and abundant water resources.
- Strong human capacities and local knowledge within the Arqoub area.
- A history of intensive studies (fauna, flora, geology, paleontology, habitats, and anthropology) are more intensive than any other area in Palestine.
- Presence of institutions (academic and NGOs) that have interest in conservation of natural and human communities.
- A global interest in this area (as Holy Land/Birthplace of Jesus, as part of the cradle of civilization, as part of the Fertile Crescent, the first domestication of plants and animals) that can help bring resources (money and collaboration) to wildlife projects.

Weaknesses

- Absence of effective, actual, collaborative and long-term environmental commitment.
- Continued habitat loss and land-use change, including the conversion of agricultural and natural areas into urban developments.
- Weak implementation of shared environmental responsibilities among individuals and governmental institutions.
- Persistent public dissatisfaction, negative perceptions, and the spread of misinformation and misleading narratives regarding environmental issues.
- Limited active management has facilitated external claims over biodiversity and water resources.
- Overgrazing pressures caused by uncontrolled grazing activities in agricultural lands.
- Conflict, occupation, colonization have all devastated the environment and impoverished the indigenous population that remains while creating refugee crises that impacts population distribution and sustainability.
- Cultural and religious norms that view humans as superior to other living things and give license to engage in projects that damage the environment or create unsustainable conditions.
- Government structures that are outdated and have not cleared out corruption.
- Limited resources (financial/people).

Opportunities

- Potential for Enhancement of the local economy through ecotourism and nature-based initiatives.
- Increasing environmental awareness and education can change behaviors towards sustainable human and natural communities.
- Global emphasis and resources dedicated to environmental conservation and tackling threats like climate change with a significant proportion of resources being directed to developing countries.
- Potential buildup of resources and capacity training in dozens of NGOs/CSOs focused on nature in Palestinian areas.
- There are opportunities for rewilding and for better management of protected areas and OECMs.

- Ecotourism could enhance the value of wildlife protection while helping the local economy (Qumsiyeh & Bibee 2025).
- Leveraging local knowledge.

Threats

- Increasing populations of invasive species, stray dogs, and wild boars.
- Continued habitat degradation and destruction including urban expansion at the expense of agricultural and natural landscapes.
- Continued occupation, settlement expansion and annexation, instability, and conflict.
- Continued social and economic pressures.

9.10 Structuring and governance

We propose through this study to incorporate a part of Wadi Fukin into the three valleys (see Fig. 6). The expanded protected areas containing sensitive habitats, endemic species, springs, and forest patches become a Hima connected system. A landmark consultation meeting held on June 8, 2026, brought together representatives of all eight communities of the Al-Arqoub area to agree on the governance principles of the Hima. The meeting reached a foundational consensus: that each valley would be stewarded primarily by the communities directly adjacent to it, rather than managed collectively by all eight communities as a single unit or delegated entirely to national government authorities. This principle of subsidiarity, placing decision-making as close as possible to the land and the people who depend on it, reflects both the traditional logic of the Hima system and the practical realities of the diverse land tenure and administrative situations across the four valleys. National authorities, including the Ministry of Agriculture overseeing forested areas, the Ministry of Tourism and Antiquities overseeing the World Heritage Site, and the Environmental Quality Authority responsible for overall policy coordination, retain their respective statutory obligations and oversight roles within this decentralized framework. Activities permitted in the protected area zone include scientific research, biodiversity monitoring, and controlled educational visits. We also propose creation of Ecological Restoration Zones in areas degraded by erosion, quarrying, or land-use change. These patches are to be selected with local landowners (and if state land is returned to local sovereignty with EQA and MOLG) and will be targeted for reforestation, soil restoration, native species planting, and erosion control. A third zoned area category will be called Sustainable Use Areas where traditional agriculture, grazing, and ecotourism are permitted under sustainability guidelines. Superimposed on these areas are Cultural Heritage Sites which are areas containing terraces, archaeological sites, monasteries, and traditional agricultural systems. Within the built up area of communities like Battir and Artas, we need to develop visitor and recreation amenities (see tourism section 9.7).

The best approach we think is to create a local committee of 5–9 people in each community to oversee the obligations of oversight and to help guide the implementation of local action plans agreed to as outlined above. These eight committees also elect representatives to a regional committee (eight people). The regional committee shall also include with them national representatives (especially from EQA, MOTA, MLG, MOA) and scientific representation (e.g., PIBS), and relevant interested NGOs (e.g., EEC or PWS). The latter committee meets monthly or bimonthly to review progress on the ground.

10. DISCUSSION

The plan developed above by community partnership with experts is knowledge based and will help bridge science-policy-practice gaps to achieve our vision of sustainable human and natural communities. We also believe the plan is in line with the State of Palestine commitments towards sustainable development goals:

- 1) Reducing poverty reflecting on SDGs 1 & 2 by strengthening local communities' food security through sustainable agriculture; mainly increasing agricultural productivity and incomes of small-scale food producers, in particular women; secure agro-resources; and implement resilient agricultural practices.
- 2) Sustaining community development reflecting on SDGs 8 & 11, by strengthening efforts to protect and safeguard Palestine's cultural and natural heritage, reducing the adverse environmental impact of human population, promoting sustainable tourism/agriculture that creates jobs (for women and youth) and promotes local culture and products.
- 3) Advocating for responsible consumption and production; reflecting on SDG 12 by introducing organic production concepts, reducing household's/community's waste through composting and adopting the traditional farming concepts.
- 4) Securing gender equality reflecting on SDG 10 by integrating women in the project activities, where gender inclusion and women's full and effective participation and equal opportunities will be taken into consideration at all levels throughout project implementation, and giving women equal rights to economic resources; mainly through the business enterprises initiative that will take place during the project.
- 5) Improving quality of life reflecting on SDG 13 & 15 by introducing nature protection concepts, ecotourism, promoting the implementation of sustainable management, restoring degraded areas, enhancing adaptation to climate change, and integrating Al-Makhrour ecosystem and biodiversity values into national and local planning.

Using research, education/empowerment, and conservation measures whilst helping people and nature in this key area of Palestine starts a ripple effect in other less-studied protected areas. We can undertake a range of actions to conserve nature in Palestine despite the persistent threats discussed above, whilst also beginning to comply with international treaty obligations (See Section 8.4). The community-led management plan, especially its stated action plans, provide a roadmap for protection of human and natural communities. Ultimately, and despite operating in one of the most politically constrained environments on earth, this work shows that meaningful biodiversity conservation is achievable when it rests on two complementary foundations: rigorous scientific knowledge and genuine commitment to the well-being of local people and communities.

Even though this project and this publication were focused on exploration, research, and community planning (rather than implementation of action plans highlighted in Chapter 9), the process itself created a considerably positive impact in the local community and among partners and government agencies where these actions were being implemented. Project proposals were written and some projects started to be implemented in conjunction with this work. For example, thanks to this project, we produced a paper on butterflies and plants that has direct relevance to conservation in the four valleys (Gedeon et al. 2025). A project being executed this year (2026) and funded by CEPF is engaged in direct conservation of rare and endangered plants in the study area. These projects and the implementation of other action plans will carry a ripple effect to other protected areas in Palestine. The AlArqoub area represents a rare confluence of cultural tradition, environmental sustainability and historical continuity. However, preservation depends on more than World Heritage and protected area designations. It requires an integrated approach that bridges science, policy, and practice, and puts communities at the center. Lessons from Lebanon's Hima model and other global examples illustrate the value of participatory conservation rooted in cultural context. By harnessing the strengths of its people, its traditions, and its biodiversity, This can serve as a model for heritage protection not only in Palestine but across the region.

11. References

- Abdallah, M. and de Leeuw, L., 2020. Violations set in stone. Al-Haq, Ramallah.
- Abdallah, T. & Swaileh, K. (2011) Effects of The Israeli Segregation Wall on Biodiversity And Environmental Sustainable Development in The West Bank, Palestine. *International Journal of Environmental Studies*, 68:543-555.
- Abouali, G. (1998) Natural resources under Occupation: The Status of Palestinian Water under International Law. *Pace International Law Review*, 10(2):411–574.
- Abu Hammad, A. (2016) Identification of important landscape areas in Palestine: The case of Battir area. *International Journal of Urban Planning and Sustainable Development* 3:1-16.
- Abu Shammalah, M. & Baha El-Din, M. (1999) *Birds of Gaza*. Darwish Consulting Engineers Ltd., 44 pp.
- Abusarhan, M.A., Handal, E.N., Ghattas, M.M., Amr, Z.S. & Qumsiyeh, M.B. (2016) Some records of butterflies (Lepidoptera) from the Palestinian Territories. *Jordan Journal of Biological Sciences*. 9(1): 11-23.
- Abusarhan, M., Amr, Z.S., Ghattas, M., Handal, E.N. & Qumsiyeh, M.B. (2017) Grasshoppers and locusts (Orthoptera: Caelifera) from the Palestinian territories at the Palestine Museum of Natural History. *Zoology and Ecology*, 27(2):143-155.
- Adams, W. M., Aveling, R., Brockington, D., Dickson, B., Elliott, J., Hutton, J., Roe, D., Vira, B. & Wolmer, W. (2004) Biodiversity Conservation and The Eradication of Poverty. *Science*. 306: 1146-1149.
- Adawi, S.H., Qasem, K.R., Zawahra, M.M. & Handal, E.N. (2017) On some Records of Dragonflies (Insecta: Odonata: Anisoptera) from the West Bank (Palestine). *Jordan Journal of Biological Sciences*. 10(3):151-158.
- Adenle, A.A., Stevens, C. & Bridgewater, P. (2015) Global conservation and management of biodiversity in developing countries: An opportunity for a new approach. *Environmental Science and Policy*. 45:104-108.
- Akamani, K. (2020) Integrating deep ecology and adaptive governance for sustainable development: implications for protected areas management. *Sustainability*, 12(14): 5757.
- Al-Haq. (2015) *Environmental Injustice in Occupied Palestinian Territory: Problems and Prospects*. Al-Haq Organization, Ramallah, Palestine.
- Al-Khatib, I. A., Al Shami, A. A. H. U., Garcia, G. R., & Celik, I. (2022). Social acceptance of greywater reuse in rural areas. *Journal of Environmental and Public Health*, 2022(1), 6603348.
- Al-Sheikh, B. (2011) Occupied Palestinian territories. In: *Important Plant Areas of the south and east Mediterranean region: priority sites for conservation*. Radford, E.A., Catullo, G. & Montmollin, B. de. (eds.). IUCN, Gland, Switzerland and Malaga, Spain. Gland, Switzerland and Malaga, Spain: IUCN. VIII + 108 pp.
- Al-Sheikh, B. (2018) Conserving Wild plants in Palestine. 15,32-33,73-77. In Valderrabano, M.,G,T., Heywood, V. & Montmollin,B.(eds) *Conserving Wild plants in the south and east Mediterranean region*. Gland, Switzerland and Malaga. Spain: IUCN. XIII+146 pp.
- Al-Sheikh, B. (2019) *Checklist and Ecological Data Base of Wild plants of the West Bank – Palestine*. National Agricultural Research Center, Palestine.
- Al-Sheikh,B. & Gedon, J. (2025) Newly Documented Invasive Alien Plant Species in the West Bank, Palestine. *Feddes Repertorium - Journal of Botanical Taxonomy and Geobotany* 36(2):136-145; <https://doi.org/10.1002/fedr.70006>.
- Al-Sheikh, B. & Mahassneh, M. (2016) *Flora of Wadi Al-Quff Protected Area, Hebron Governorate, Palestine*. *Jordan Journal of Natural History*. 3:47-57.
- Al-Sheikh, B. & Qumsiyeh, M.B. (2021a) Imperiled ecosystems in Palestine: Rare plants as indicators. In D. DiPaolo & J. Villella (Eds.), *Imperiled: The Encyclopedia of Conservation* (pp. 1-7). Elsevier.

- Al-Sheikh, B. & Qumsiyeh, M.B. (2021b) New records to the flora of the West Bank, occupied Palestinian territories. *Jordan Journal of Natural History*, 8(2):11-19.
- Al-Sheikh, B., Qumsiyeh, MB, & Hubbeih, A.S. (2024) Noteworthy Records of Vascular Plants from the West Bank, Occupied Palestinian Territories. *Journal of Threatened Taxa* 16(12):26225-26233.
- Albright, W.F. (1921) Contributions to the historical geography of Palestine. *The Annual of the American School of Oriental Research in Jerusalem*. 2: 1-46.
- Alhirsh, I., Battisti, C. & Schirone, B. (2016) Threat Analysis for A Network Of Sites In West Bank (Palestine): An Expert-Based Evaluation Supported By Grey Literature And Local Knowledge. *Journal for Nature Conservation*. 31: 61–70.
Available at: <http://debpal.veltha.org/Home/images/Documents/alhirsh%20et%20al.pdf>
- Ali-Shtayeh, M.S., Zohara, Y. and Mahajna, J. 2008. Ethnobotanical survey in the Palestinian area: a classification of the healing potential of medicinal plants. *Journal of Ethnopharmacology*, 73, pp. 221-232.
- Allombert, C. & Qumsiyeh, M. B. (2024) [Israel designation of “Nature Reserves”: A tool of colonization](#). *International Review of Contemporary Law*. 6(4):9-14.
- Alon, A., (2010) Bird migration and conservation in the Middle East. *Avian Migration Studies*. 7(2):101–123.
- Alves, R.R.N. (2012) Relationships between fauna and people and the role of ethnozoology in animal conservation. *Ethnobiology and Conservation*. 1(2):1-69.
- Amr, Z. & Quatrameez, M. (2002) Wildlife Conservation in Jordan: A Cultural and Islamic Perspective. In: Heaven and Earth and I. *Ethics of Nature Conservation In Asia*. Menon, V. & Sakamoto, M (Eds.). Penguin Enterprise. Delhi. 172-184.
- Amr, Z. S., Abu Baker, M. & Qumsiyeh, M. B. (2006) Bat Diversity and Conservation In Jordan. *Turkish Journal Of Zoology*. 30:235-244.
- Amr, Z.S., Handal, E.N., Bibi, F., Najajrah, M.H. & Qumsiyeh, M.B. (2016) Change in diet of the Eurasian eagle owl (*Bubo bubo*) suggests decline in biodiversity in Wadi Al Makhrou, Bethlehem Governorate, Palestinian Territories. *Slovak Raptor Journal*. 10(1): 75-79.
- Amr, Z. S., Mohamad H. Najajreh, Mubarak Zawahreh, Eike Neubert, Elias N. Handal, Mohamad A. Abu Baker & Mazin B. Qumsiyeh. (2018) Diversity and Ecology of the land snails of the Occupied Palestinian Territories. *Zoology and Ecology*. 28(1):25-35.
- Amri, A. (2018) Importance of agrobiodiversity and options for promoting its on-farm conservation and sustainable use: Case of West Asia dryland agrobiodiversity project.
- Ansari, Abid A, Sarvajeet Singh Gill, Zahid Khorshid Abbas, M Naeem (editors). 2017. *Plant Biodiversity: Monitoring, Assessment and Conservation*. CABI International, Oxfordshire.
- ARIJ (Applied Research Institute) (2006) Environmental impact assessment of the Israeli Segregation Plan on Battir village. Bethlehem: Applied Research Institute – Jerusalem.
- ARIJ (2010) Locality profile and needs assessment of Bethlehem Governorate. https://www.arij.org/wp-content/uploads/2013/12/1Locality_profiles_and_needs_assessment_in_Bethlehem_Governorate.pdf
- ARIJ (2016) Status of the environment in OPT 2015. <http://www.Arij.Org/Latest-News/779-The-Status-Of-Env-2015-2016.Html>
- Atallah, S.I. (1977) Mammals of the Eastern Mediterranean region: their ecology, systematics and zoogeographical relationships (part 1). *Säugetierkundliche Mitteilungen*. 25: 241-320.
- Atallah, S. I. (1978) Mammals of The Eastern Mediterranean Region; Their Ecology, Systematics and Zoogeographical Relationships. *Säugetierkundliche Mitteilungen*. 26: 1-50.
- Atrash, N. (2015) World Heritage Site in Bethlehem and its potential reflections on tourism. In *The politics and power of tourism in Palestine* (pp. 79-94). Edited by Rami K. Isaac, C. Michael Hall and Freya Higgins-Desbiolles, Routledge.
- Avi-Yonah, M. (1962) Historical geography of Palestine from the End of the Babylonian Exile up to the Arab Conquest. Bialik Inst.
- Awad, S. (2009) *Birds of Palestine* [In Arabic], Beit Jala, Environmental Educational Center.

- Awad, S.I., Farhoud, M.H., Saada, R.K.A. & Busse, P. (2017) Long-term bird ringing in Palestine. *The Ring*. 39(1): 83-102.
- Azim, M. A. & Gismann, A. (1956) Bilharziasis Survey in South-Western Asia: Covering Iraq, Israel, Jordan, Lebanon, Sa'udi Arabia, and Syria: 1950-51. *Bulletin of The World Health Organization*. 14: 403.
- Backleh, S. & Atrash, I. (2007) Lesser Kestrel *Falco naumanni* in habitat around Mar Saba Monastery, Jerusalem wilderness, Palestine. *Sandgrouse*: 29(2):219.
- Bar, A. & Haimovitch, G. (2011) *A Field Guide To Reptiles And Amphibians of Israel*, Pazbar Limited.
- Barrel, J. (1980) *The dark side of landscape*. Cambridge: Cambridge University Press
- Bar-Yosef, O., Bar-Matthews, M. and Ayalon, A. (2017) 12,000-11,700 cal BP: the collapse of foraging and origins of cultivation in Western Asia. In: Weiss, H. (Ed.), *Megadrought and Collapse: From Early Agriculture to Angkor*. Oxford University Press, Oxford, pp. 33-68.
- Barnard, R. & Muamer, H. (2016) Ongoing dispossession and a heritage of resistance: the village of Battir vs. Israeli settler-colonialism, in *The Politics and Power of Tourism in Palestine*, eds. Isaac, Rami K., C. Michael Hall & Freya Higgins-Desbiolles (London: Routledge).
- Becker, N. (2020) How much is the designation of a new biosphere reserve worth? Landsenses ecology valuation evidence from Israel. *International Journal of Sustainable Development & World Ecology*. 27(3): 224-232.
- Ben-Avraham, Z., Ginzburg, A., Makris, J. & Eppelbaum, L. (2002) Crustal structure of the Levant Basin, eastern Mediterranean. *Tectonophysics*. 346(1-2):23-43.
- Benda, P., Lucan, R., Obuch, J., Reiter, A., Andreas, M., Backor, P., Bohnenstengel, T., Eid, E. K., Sevcik, M. & Vallo, P. (2010) Bats(Mammalia: Chiroptera) Of The Eastern Mediterranean And Middle East. Part 8. Bats Of Jordan: Fauna, Ecology, Echolocation, Ectoparasites. *Acta Societatis Zoologicae Bohemicae*. 74: 185-353.
- Benyamini, D. (1997) *A field guide to the butterflies of Israel including butterflies of Mt. Hermon and Sinai*. Keter Publishing House Ltd. pp.234.
- Benzinger, J. (1895) Bericht über neue Erscheinungen auf dem Gebiet der Palästinaliteratur 1894. *Zeitschrift des Deutschen Palästina-Vereins* (1878-1945), 189-236.
- Berkes, F., Colding, J. & Folke, C. (2000) Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications*. 10(5): 1251-1262.
- Bibby, C.J. Burgess, N.D., Hill, D. A., Mustoe, S. and Lambron, S. (2000). *Bird Census Techniques*, Second Edition. London, Academic Press.
- BirdLife International (2018a) Country profile: Palestinian Authority Territories. Available from <http://www.birdlife.org/datazone/country/palestinian-authority-territories>
- BirdLife International (2018b) *The World Database of Key Biodiversity Areas*. Developed by the Key Biodiversity Areas Partnership: BirdLife International, IUCN, Amphibian Survival Alliance, Conservation International, Critical Ecosystem Partnership Fund, Global Environment Facility, Global Wildlife Conservation, NatureServe, Royal Society for the Protection of Birds, World Wildlife Fund & Wildlife Conservation Society. Available from <http://www.keybiodiversityareas.org/site/results?reg=8&cty=240&snm=>
- Blanckenhorn, M. (1925) Die Seeigelfauna der Kreide Palästinas. *Palaeontographica* (1846-1933): 67: 83-114.
- Bodenheimer, F. S. (1935) *Animal Life In Palestine*. Jerusalem.
- Boettger, O. (1878) Reptilien Und Amphibien Aus Syrien. Bericht Über Die Senckenbergische Naturforschende Gesellschaft In Frankfurt Am Main. 1879: 57-84.
- Botmeh, J. (2006) *Civil resistance in Palestine: the village of Battir in 1948*. Master of Arts, Coventry University. www.preparingforpeace.org/pdfpapers/s2-JawadBotmeh.pdf
- Bouamrane M., Dogsé, P. & Price M.F. (2019) Biosphere reserves from Seville, 1995, to building a new world for 2030: A global network of sites of excellence to address regional and global imperatives. In *UNESCO Biosphere Reserves* (pp. 29-44). Routledge.

- Boulos L. (1997) Endemic flora of the Middle East and North Africa. pp. 229-260. In H.N. Barakat & A.K. Hegazy (eds.): Reviews in Ecology-Desert Conservation and Development. A festschrift for Prof. M. Kassas on occasion of his 75th birthday, Metropole, Cairo.
- Bourdieu, P. (1977) Outline of a theory of practice. Cambridge University Press, Cambridge.
- Bourdieu, Pierre & Loïc Wacquant. (1992) An Invitation to Reflexive Sociology. University of Chicago Press.
- Boyko, H. (1947) On the role of plants as quantitative climate indicators and the geo-ecological law of distribution. The Journal of Ecology. 138-157.
- Brancucci, G. Gherzi & Ruggiero, E. (2000) Paesaggi liguri a terrazze. Riflessioni per una metodologia di studio. Firenze: Alinea Editrice.
- Brandt, J. & Vejre, H. (Eds.) (2004) Multifunctional Landscapes Vol. I: Theory, Values and History. Southampton : WIT Press.
- Braun, M. & Hirsch, F. (1994) Mid Cretaceous (Albian-Cenomanian) carbonate platforms in Israel. Cuadernos de Geología Ibérica.18: 59-81.
- Braun, M. and Hirsch, F. (1994) Mid Cretaceous (Albian-Cenomanian) carbonate platforms in Israel. Cuadernos de Geología Ibérica. 18: 59-81.
- Braverman, Irus (2009) Planted Flags: Trees, Land, and Law in Israel/Palestine Cambridge University Press.
- Braverman, I. (2023) Settling nature: The conservation regime in Palestine-Israel. University of Minnesota Press.
- Bregbiet A. & Qanam K. (1998) Implementation of Modern Technology in the Development of Forest Resource. Ministry of Agriculture. Department of Forestry. West Bank.
- Brett, J. (1988) Birds Of Prey In Palestine. Proc. Of The 1st Palestinian Ecology Conf., Department Of Life Sciences, Bethlehem University. 109-112.
- Bricker, K. S., Black, R. & Cottrell, S. (2012) Sustainable Tourism And The Millennium Development Goals, Jones & Bartlett Publishers.
- Bridgewater, P.B. (2002) Biosphere reserves: special places for people and nature. Environmental Science & Policy. 5:9–12. [https://doi.org/10.1016/S1462-9011\(02\)00018-7](https://doi.org/10.1016/S1462-9011(02)00018-7)
- Bucholtz Mary. (2000) “The Politics of Transcription.” Journal of Pragmatics. 32:1439–1465.
- Canaan, T. (1924) Water and the water of life. Journal of Palestinian Oriental Society vol. IV.
- Canaan, T. (1928) Plant-lore in Palestinian superstition. Palestinian Oriental soc.
- Cardinale, B.J., Duffy, J.E., Gonzalez, A., Hooper, D.U., Perrings, C., Venail, P., Narwani, A., Mace, G.M., Tilman, D., Wardle, D.A. & Kinzig, A.P. (2012) Biodiversity loss and its impact on humanity. Nature. 486(7401):59.
- CBD (Convention on Biological Diversity) (2022). Decision adopted by the Conference of the Parties to the Convention on Biological Diversity 15/4. Kunming-Montreal Global Biodiversity Framework <https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf>
- CEPF (Critical Ecosystem Partnership Fund) (2017) Mediterranean Basin Biodiversity Hotspot. Birdlife International https://www.cepf.net/sites/default/files/mediterranean-basin-2017-ecosystem-profile-english_0.pdf
- Chehod, J. "Hima", Encyclopaedia of Islam, vol. 3 (1971): 393, quoted in Gari Lutfallah, "Ecology in Muslim Heritage: A History of the hima Conservation System ," The White Horse Press, vol. 12, no. 2 (May 2006): 213-228, available at <http://www.muslimheritage.com/article/ecology-muslim-heritage-history-hima-conservation-system>
- Chimhowu, A. & Woodhouse, P. (2006) Customary vs private property rights? Dynamics and trajectories of vernacular land markets in Sub-Saharan Africa. Journal of Agrarian Change. 6(3):346-371.
- Cirino, P. (2002) Indagini antropologiche in ambito ambientale nel rapporto tra paesaggio e cultura, in “Atti del Convegno CNR-ISAFOM”, Portici (Napoli), 23-24 Settembre 2002, pp. 40-44, Napoli: Istituto per i Sistemi Agricoli e Forestali del Mediterraneo.

- Cirino, P. (2004) L'olivo e il paesaggio umbro: definizione di un concetto crocevia. pp. 10-12 in "Olivi secolari della provincia di Perugia, vol. I, Il Bacino del Lago Trasimeno", Perugia: APROL.
- Cirino, P. (2006) Tradizioni popolari connesse all'olivicoltura. In "Dell'arte di cavar l'olio in Umbria. Tradizione e Innovazione", Perugia: APROL.
- Cirino, P. (2007) Valorizzazione territoriale, paesaggio, identità, sviluppo locale: appunti per un ecomuseo. In "Percorsi Umbri" Rivista di Informazione Antropologica della Provincia di Perugia, Università degli studi di Perugia. 1: 62-64.
- Clement, G. (1999) *Le jardin planétaire. Réconcilier l'homme e la nature*. Paris: Albin Michel.
- Clementi, A. (2002) Interpretazioni di paesaggio. Roma: Meltemi.
- CMP (The Conservation Measures Partnerships), Version3, (April 2013) Open Standards for the Practice of Conservation of the Conservation Measures Partnership.
- Cohen, S. (2004) *Plant-ing Nature* Berkeley: University of California Press.
- Conservation International (2013) Global Biodiversity Hotspots: Mediterranean Basin. Downloaded from http://www.conservation.org/where/priority_areas/hotspots/europe_central_asia/Mediterranean-Basin/Pages/default.aspx
- Cosgrove and Daniels (1989) *The iconography of landscape*. Cambridge: Cambridge University Press.
- Crowfoot, G.M. (1952) Folktales of Artas. *Palestine Exploration Quarterly* LXXXIII / LXXXIV
- Crowfoot, G.M.H. & Baldensperger, L. (1932) *From Cedar to Hyssop: A Study in the Folklore of Plants in Palestine*, Sheldon Press, London.
- Dagan, Y. (2010) "Nahal Rephaim, Final report," *Journal* 122, Hadashot Archeologiyot: Excavations and Surveys in Israel. Available at: http://www.hadashot-esi.org.il/report_detail_eng.aspx?id=1625
- Daibes, F. & Daibes-Murad, F. (2003) Water in Palestine: problems, politics, prospects. PASSIA, Palestinian Academic Society for the Study of International Affairs.
- Dajani, M. & L. Isma'il. (2014) *Conscious Choices: A Guide To Ethical Consumerism In Palestine*. Heinrich-Böll-Stiftung. Available at: <http://Ps.Boell.Org/En/2015/05/12/Conscious-Choices-Guide-Ethical-Consumerism-Palestine>
- Damhoureyeh, S. A., Qarqaz, M. A., Baker, M., Himdan, N., Eid, E. & Amr, Z. (2009) Reptiles And Amphibians In Dibbeen Nature Reserve, Jordan. *Vertebrate Zoology*. 59: 169-177.
- D'Andrade, R.G. (1981) The cultural part of cognition. *Cognitive Science*. 5: 179-195.
- Danin, A. (1988) Flora and vegetation of Israel and adjacent areas. pp. 129- 157. *The Zoogeography of Israel*. Junk, Dordrecht.
- Danin, A. (1992) Flora and vegetation of Israel and adjacent areas. pp. 129-159 in Y. Yom Tov and E. Tchernolv (eds) *The Zoogeography of Israel*. Dr. W. Junk Publishers, Dordrecht.
- Danin, A. (2004) *Distribution Atlas of Plants in the Flora Palaestina Area*. The Israel Academy of Sciences and Humanities.
- Danin, A. & Feinbrun-Dothan N. (1991) *Analytical Flora of Eretz-Israel*. CANA Publishing House Ltd, Jerusalem.
- Dayan, T. Z. Ben-Avraham, R. Nathan, et al. (2011) Biodiversity Research and Higher Education at the Research Universities of Israel. YAHALOM — Academy Unit for Scientific Counsel and Evaluation, The Israel Academy of Sciences and Humanities, Jerusalem. <http://www.academy.ac.il/SystemFiles/21705.pdf>
- DELTA & IMED (2007) *Methodological guide for the development of territorial cultural systems*. Roma: Edigraf.
- Desclaux-Salachas, J. (2020) Civilian Cartography: Between Geodesy and Art: Battir, An Unprecedented Cartographic Citizen Patrimony, A Valuable Common Good Endlessly Restored. The Cartographic Citizen University. In Bandrova T., Konečný M. & Marinova S. (editors) *Proceedings Vol. 1, 8th International Conference on Cartography and GIS*, Nessebar, Bulgaria.

- Disi, A.M. & Amr, Z.S. (2010) Morphometrics, Distribution and Ecology of the Amphibians in Jordan. *Vertebrate Zoology*. 60:147-162.
- Dolev, A., Perevolotsky, A. & Lachman, E. (2004) *Vertebrates in Israel: the red book*. Israel Nature and Parks Authority.
- Donadieu, P. (1998) *Les Campagnes urbaine*. Versailles: Actes Sud / ENPS
- Dondina, O., Saura, S., Bani, L. & Mateo-Sánchez, M.C. (2018) Enhancing connectivity in agroecosystems: focus on the best existing corridors or on new pathways?. *Landscape Ecology*. 33(10): 1741-1756.
- Donevska, N. (2021) *Participatory Governance of UNESCO Biosphere Reserves in Canada and Israel*. Routledge, London and New York.
- Dudeen, B. A. (2001) "The soil of Palestine. Current Status and future perspectives." In: P. Zdruli, P. Steduto, C. Lacirignola & L. Montanarella (eds.): *Soil Resources of Southern and Eastern Mediterranean Countries. Options Méditerranéennes*. no. 34. Bari : CIHEAM-IAMB.
- Dudeen, B.A. (2012) *Land Degradation In Palestine: Main Factors, Present Status And Trends, Recommended Actions*. Land Research Center, Soil And Environment Department, Jerusalem. Available at:
<http://Dm.Pcd.Ps/Sites/Default/Files/Land%20degradation%20in%20palestine.Pdf>
- Dudley, N., Robinson, J., Andelman, S., Bingham, H., Conzo, L.A., Geldmann, J., Grorud-Colvert, K., Gurney, G., Hickey, V. & Hockings, M. (2022) Developing an outcomes-based approach to achieving Target 3 of the Global Biodiversity Framework. *Parks*. 28: 33-44.
- Duffy, R., St. John, F., Büscher, B. & Brockington, D. (2015) Toward a new understanding of the links between poverty and illegal wildlife hunting. *Conservation Biology*. 30: 13–22.
- Dufour-Dror, J.M. (2012) *Alien invasive plants in Israel*. The Middle East Nature Conservation Promotion Association. Ahva Publishing, Jerusalem (IL), 1:213.
- Eagles, P.F., McCool, S.F., Haynes, C.D. & Phillips, A. *Sustainable tourism in protected areas: Guidelines for planning and management* Gland. IUCN. (2002) Vol. 8.
- Egoz S. & Williams T. (2017) Garden and landscape, the spatial and the ethical: the impact of enclosure on an enclosed garden, the case of Artas, Palestine", *Landscape Research*. 42(5): 425-438, DOI: [10.1080/01426397.2016.1243658](https://doi.org/10.1080/01426397.2016.1243658)
- El Zein R. (2017) *Developing a Palestinian Resistance Economy through Agriculture Labor*. Palestine Studies Organization.
- Elmusa, S.S. (1998) *Water Conflict: Economics, Politics, Law and Palestinian-Israeli Water Resources*. Institute for Palestine Studies, Washington DC.
- El-Sadek, A., & Mahmoud, M. (2018) Resilience and Adaptation of Traditional Ecological Knowledge Systems in Arid Environments. *Journal of Arid Environments*. 152: 67-78
- EQA (Environmental Quality Authority) (2010) *Isrategiayat Albi'a Alqita'iya* (Environmental Sector Strategy). Environmental Quality Authority.
- EQA (2015) *Fifth National Report To The Convention On Biological Diversity*.
<https://www.cbd.int/doc/world/ps/ps-nr-05-en.pdf> [Accessed May 13, 2016].
- EQA (2017) *Battir as an Environmental Significant Eco-System*, Ramallah: Environment Quality Authority
- EQA (2021) *Sixth National Report to the Convention on Biological Diversity*. <https://chm.cbd.int/database/record?documentID=257520> [Accessed 23 April 2026].
- EQA (2022) *National Biodiversity Strategy and Action Plan for the state of Palestine*. EQA
<https://ps.chm-cbd.net/sites/ps/files/2024-08/NBSAP%202022.pdf>
- Ervin, J. (2002) *WWF Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) Methodology*. Gland, Switzerland, WWF: 18.
- Evans, J. & Farquhar, J. D. (1948) *Forestry in Palestine under the mandate*. *Empire Forestry Review*, 27: 219–226.
- Eshed, V., Gopher, A., Gage, T.B. & Hershkovitz, I. (2004) Has the transition to agriculture reshaped the demographic structure of prehistoric populations? New evidence from the Levant. *American Journal of Physical Anthropology*. 124(4): 315-329.

- Falah, G.W. (2010) Political geography and biodiversity conservation. *Middle East Environmental Journal*. 9(3): 112–131.
- Falah, G.W. (2015) Political ecology and land use change. *Middle East Environmental Journal*. 13(2): 77–98.
- FAO (2005) Management of Natural Resources Including Medicinal & Aromatic Plants to Benefit Rural Women in the Near East Region (Case Study of Egypt). Desert Development Center, The American University in Cairo. Available at: <http://collaborationplatform.net/Pages/GoodPracticeDetails.aspx>
- Feinbrun-Dothan, N. (1986) *Flora Palaestina*. Vol. 4. The Israel Academy of Sciences and Humanities, Jerusalem.
- Festa, E. (1894) Viaggio del Dr. E. Festa in Palestina, nel Libano e regioni vicine. Parte narrativa. *Bollettino dei Musei di Zoologia ed Anatomia Comparata della R. Università di Torino*. 172: 1–38.
- Foltz, Richard, Fredrick Denny & Azizan Baharuddin (eds.) (2003) *Islam and Ecology*. A Bestowed Trust. 212–215.
- Fontana Antonelli, G. (2007) Preserving cultural landscapes in Palestine: Safeguarding historical and environmental resources toward a sustainable development. In: *Proceedings of the International Conference: Conservation and Management of Landscapes in Conflict Regions*. Birzeit: Birzeit University.
- Gari, L. (2006) *Ecology in Muslim Heritage: A history of the Hima conservation system*. Muslim Heritage.
- Garstecki, T., Al-Rabi, T., Mahassneh, M. & Mezyed, B. (2010) Assessment of Some Palestinian Nature Reserves. *International Union for Conservation of Nature*.
- Gedeon, J. & B. Alsheikh. (2026) Distribution of Invasive Alien Plant Species in the West Bank (State of Palestine). Submitted.
- Gedeon, J. G. & Qumsiyeh, M. B. (2023) New Floral Records in the Region of Southern Jerusalem Hills, Palestine. *Jordan Journal of Natural History*. 11-20. [Available at: https://www.palestinature.org/research/new-floral-records.pdf](https://www.palestinature.org/research/new-floral-records.pdf)
- Gedeon, J. G., Al-Sheikh, B. & Qumsiyeh, M. B. (2025) Assessment of Flora and Butterflies in Al-Arqoub Valleys in Palestine: Value in Conservation Plans. *Jordan Journal of Natural History*. 12(2): 108-124.
- Geiger, D.L., B.A. Marshall, W.F. Ponder, T. Sasaki & A. Warén (2007). Techniques for collecting, handling, preparing, storing and examining small Molluscan specimens. *Molluscan Research* 27(1), pp. 1–50.
- Ghattas, R., Qumsiyeh, M. & Mahassneh, M. (Eds.). (2019) *Biodiversity Conservation Plan for Palestine: “Land of olives and vines cultural landscape of Southern Jerusalem, Battir”*. PIBS & State of Palestine.
- Gola, A., Perugini, N. & Samir, H. (2010) The recovery of historical paths for tourism as tool for social and territorial development: the palestinian case of Battir. *Almatourism-Journal of Tourism, Culture and Territorial Development*. 1(1): 60-66.
- Görlach, B., Möller-Gulland, J., Bar-On, H. & Atrash, I. (2011) Analysis For European Neighbourhood Policy (Enp) Countries And The Russian Federation Of Social And Economic Benefits Of Enhanced Environmental Protection–Occupied Palestinian Territory Country Report. *Occupied Palestinian Territory Country Report*.
- Greider, T. & Garkovich, L. (1994) Landscapes: the social construction and the environment. *Rural Sociology*: 59 (1): 1-24.
- Halperin, J. & Sauter, W. (1991) An Annotated List With New Records Of Lepidoptera Associated With Forest And Ornamental Trees And Shrubs In Israel. *Israel Journal Of Entomology*. 25: 105-147.
- Hamadni, M.S.S. (1998) ‘Asira el Shamalyia. Traditions and hope. Nablus: El Maktabe el Watanye, National Library Department.

- Hamdan, O. (2005) Problematiche generali di conservazione e gestione del patrimonio culturale della Palestina. In Maniscalco, F. ed. Tutela, conservazione e valorizzazione del patrimonio culturale della Palestina. *Mediterraneum*. 5, 13-24.
- Hammad, K.M. & Qumsiyeh, M.B. (2013) Genotoxic Effects of Israeli Industrial Pollutants on Residents of Bruqeen Village (Salfit District, Palestine). *International Journal of Environmental Studies*. 70: 655-662.
- Handal, E.H. & Amr, Z. S. (2018) Additional localities for the Flower chafers (Coleoptera: Scarabaeidae: Cetoniinae) from the Palestinian Territories (West Bank). *Jordan Journal of Biological Sciences*. 11(4): 389 - 393.
- Handal, E.N. & Qumsiyeh, M.B. (2019) First Record of the Western Conifer Seed Bug *Leptoglossus occidentalis* Heidemann, 1910 (Heteroptera, Coreidae) from Palestine. *Jordan Journal of Biological Sciences*. 12(5): 657 - 658.
- Handal, E. N., & Qumsiyeh, M. B. (2021) [Status and distribution of the invasive *Myna Acridotheres tristis* \(Linnaeus, 1766\) in the Occupied Palestinian Territories \(West Bank\)](#). *Sandgrouse*. 43: 129-132.
- Handal, E.N., Z. S. Amr & M. B. Qumsiyeh. (2016) Some Records of Reptiles from the Palestinian Territories. *Russian Journal of Herpetology*. 23(4): 261-270.
- Handal, E. N. , Aysha M. Al Wahsh , Z.S. Amr , Roberto Battiston, M.B. Qumsiyeh. (2018) Mantids (Dictyoptera: Mantodea) from the Palestinian Territories with an updated list. *Articulata*. 33: 91–105.
- Handal, E.N., G.H. Qumsiyeh, Sh.Y Hammash & M.B. Qumsiyeh. (2019) Status and Conservation of the Striped Hyena (*Hyaena hyaena*) in the Occupied Palestinian territories (West Bank). *Jordan Journal of Natural History*. 6: 11-18.
- Handal, E.N., Amr, Z.S., Basha, W.S. & Qumsiyeh, M.B. (2021) Illegal trade in wildlife vertebrate species in the West Bank, Palestine. *Journal of Asian Pacific Biodiversity*. 14: 636–639.
- Handal, E.N., Al-Shomali, S.L. & Adawi, S.H. (2024) Four New Records of Beetles (Coleoptera) from the Palestinian Territories – West Bank. *Jordan Journal of Natural History*. 11 (1): 18-23.
- Handal, E., Adawi, S., Gedeon, J. and Amr, Z.S. (2023) Notes on the current status of freshwater snails fauna of the Palestinian territories (West Bank). *Folia Malacologica*, 31(2).
- Handal, A. P., Liu, H., Vogler, A. P., Gedeon, J. G. & Qumsiyeh, M. (2026) A molecular re-examination of taxonomy of Orchidaceae in the State of Palestine. *Jordan Journal of Natural History*. In press.
- Hassoun, A., Jarrar, H., Goudali, L., Lisciani, S., Al-Muhannadi, K., Buheji, M., & Bekhit, A. E. D. A. (2025). Life on land in peril: how the recent war on gaza has devastated terrestrial ecosystems. In *War on Gaza: Consequences on Sustainability and Global Security* (pp. 203-218). Cham: Springer Nature Switzerland.
- Harrison, D. L. & Bates, P. J. J. (1991) *The Mammals Of Arabia*, Harrison Zoological Museum Sevenoaks.
- Heller, J. & Arad, Z. (2009) *Land Snails Of The Land Of Israel: Natural History And A Field Guide*, Pensoft.
- Heller, J., Mordan, P., Ben-Ami, F. & Sivan, N. (2005) Conchometrics, Systematics And Distribution Of *Melanopsis* (Mollusca: Gastropoda) In The Levant. *Zoological Journal Of The Linnean Society*. 144: 229-260.
- Herrera, Pedro, Jonathan Davies & Pablo Baena, ed. (2014) *The Governance of Rangelands Collective Action for Sustainable Pastoralism* (New York: IUCN and Routledge). 243.
- Heywood and Watson. (1995) *Regional Overview of the Resource Situation and the Status of Utilization of Medicinal, Culinary and aromatic plants in the Near East*. University of Reading.
- Hill, David (Editor). 2005. *Handbook of Biodiversity Methods: Survey, Evaluation and Monitor-ing*. Cambridge University Press.

- Hjelle, K.L., Kaland, S., Kvamme, M., Lødøen, T.K. and Natlandsmyr, B. (2012) Ecology and long-term land-use, Palaeoecology and archaeology—the usefulness of interdisciplinary studies for knowledge-based conservation and management of cultural landscapes. *International Journal of Biodiversity Science, Ecosystem Services & Management*. 8(4): 321-337.
- Holmes, Oliver & Pablo Gutiérrez (2018) “Seven decades of struggle: how one Palestinian village's story captures pain of 'Nakba',” *The Guardian*, <https://www.theguardian.com/world/2018/may/13/al-walaja-palestinian-village-being-squeezed-off-the-map>
- HSF (Report by M. B. Qumsiyeh & Z. S. Amr, submitted to and edited by Hanns Seidel Foundation). (2017) Environmental conservation and protected areas in Palestine: Challenges and opportunities. Available at http://www.mahmiyat.ps/uploads/171013%20HSF_Bethlehem_Printed%20Version_NC.pdf
- Hull, E. & Fund, P.E. (1888) *The Survey of Western Palestine*. [5]. Memoir on the geology and geography of Arabia Petraea, Palestine, and adjoining districts: with special reference to the mode of formation of the Jordan-Arabah depression and the dead sea. Palestine Exploration Fund.
- Husein, Duaa & Qumsiyeh, M.B. (2022) Impact of Israeli segregation and annexation wall on Palestinian Biodiversity. *Africana Studia*. 37: 19-26.
- Hütteroth, W.D. & Abdulfattah, K. (1977) *Historical geography of Palestine, Transjordan and Southern Syria in the late 16th [sixteenth] century* (Vol. 5). Fränkische Geographische Ges.
- ICJ (2024) *Legal Consequences Arising From The Policies And Practices Of Israel In The Occupied Palestinian Territory, Including East Jerusalem*. International Court of Justice. <https://www.icj-cij.org/sites/default/files/case-related/186/186-20240719-adv-01-00-en.pdf>
- IPCC (2020) *Sustainable Battir: Challenges and Opportunities*. International Peace and Cooperation Center.
- Isaac, R. K. (2010a) *Alternative Tourism: New Forms Of Tourism In Bethlehem For The Palestinian Tourism Industry*. *Current Issues In Tourism*. 13: 21-36.
- Isaac, R. K. (2010b) *Moving From Pilgrimage To Responsible Tourism: The Case Of Palestine*. *Current Issues In Tourism*. 13: 579-590.
- Isaac, R., C M Hall, F. Higgins-Desbiolles (Editors). (2016) *The Politics and Power Of Tourism In Palestine*. Routledge, New York.
- Isaac, R.K. & Abbasi, W. (2022) *Women’s Empowerment through Community-based Tourism in Bethlehem Governorate, Palestine: An Exploratory Study*. In *Tourism Planning and Development in the Middle East* (pp. 28-43). GB: CABI.
- IUCN (2011) *Management and Ownership of Drylands: An Accountability Report for “The Securing Rights & Restoring Lands for Improved Livelihoods Project in Jordan,”* IUCN. <https://www.iucn.org/es/node/19081>
- IUCN (2018). *Guidelines for invasive species planning and management on islands*. Cambridge, UK and Gland, Switzerland: IUCN. viii + 40pp .
- IUCN (2024). *Guidelines for the application of IUCN Red List of Ecosystems* ISBN: DOI: Cover photos: Categories and Criteria, Version 2.0. Keith, D.A., Ferrer-Paris, J.R., Ghoraba, S.M.M., Henriksen, S., Monyeke, M., Murray, N.J., Nicholson, E., Rowland, J., Skowno, A., Slingsby, J.A., Storeng, A.B., Valderrábano, M. & Zager, I. (Eds.). Gland, Switzerland: IUCN
- IUCN (2025) *Protected area network review and design for the state of Palestine*, https://www.palestinenature.org/conservation/PAN_Palestine_15Dec2025.pdf
- Ives, R. L. (1950) *The Palestinian Environment*. *American Scientis*. 38: 85-104.
- Jaradat, T. & Awad Allah, O. (2015) *Legal Implications Of Accession Of The State Of Palestine To International Conventions On Resources And Protection Of Natural Resources* [In Arabic]. [Http://Dspace.Up.Edu.Ps/Xmlui/Handle/123456789/139](http://Dspace.Up.Edu.Ps/Xmlui/Handle/123456789/139)
- Juneidi, F. (1994) *Wild plants of Palestine and their medicinal values*. Amman: International Engineering and Printing Company (IEC).

- Kakish, Kamal (2016) Facilitating a Hima Resurgence: Understanding the Links between Land Governance and Tenure Security. WANA Institute, Royal Scientific Society in Amman, Jordan.
<https://wanainstitute.org/sites/default/files/publications/Facilitating%20a%20Hima%20Resurgence.pdf>
- Kanaana, S. (2005) Struggling for survival. Essays on Palestinian Folklore and folklife. Al-Bireh: Society of In'ash el-Usra.
- Kaplan, R. and Kaplan, S. (1989) The experience of nature: a psychological perspective. Cambridge University Press, Cambridge.
- Kaplan, R. and Talbot, J.F. (1988) Ethnicity and preference for natural settings: a review and recent findings. *Landscape and Urban Planning*. 15 (1/2): 107- 117.
- Kaplan, S. & Kaplan, R. (1982) Cognition and environment : functioning in an uncertain world. Ulrich's
- Kark, R. & Levin, N. (2012) The environment in Palestine in the late Ottoman period, 1798–1918. In *Between Ruin and Restoration: An Environmental History of Israel*. University of Pittsburgh Press. 128 pp.
- Katbeh-Bader, A. & Amr, Z.S. (1998) The Butterflies of Jordan. *Journal of Research on the Lepidoptera*. 37: 11-26.
- Khalilieh, A. (2016) Avifaunal baseline assessment of Wadi Al-Quff Protected Area and its Vicinity, Hebron, Palestine. *Jordan Journal of Natural History*, Special issue 1, 3: 47-57.
- Kilani, H., A. Serhal, and O. Llewelyn (2007) *Al-Hima: A Way of Life*. Amman and Beirut: IUCN and SPNL.
- Lartet, L. (1873) *Essai sur la Geologie de la Palestine et des contrees avoisinantes telles que l'Egypte et l'Arabie*. Deuxieme Partie. *Paleontologie* (p. 98) (G. Masson).
- Lavergne, S., Mouquet, N., Thuiller, W. & Ronce, O. (2010) Biodiversity And Climate Change: Integrating Evolutionary And Ecological Responses Of Species And Communities. *Annual Review Of Ecology, Evolution, And Systematics*. 41: 321-350.
- Lee, T. H., & Jan, F. H. (2015) The effects of recreation experience, environmental attitude, and biospheric value on the environmentally responsible behavior of nature-based tourists. *Environmental management*. 56(1): 193-208.
- Lemire, Vincent. (2011a) *La soif de Jérusalem : Essai d'hydrohistoire (1840-1948)*. Paris, Éditions de la Sorbonne. <https://books.openedition.org/psorbonne/779>.
- Lemire, V. (2011b) The awakening of Palestinian hydropolitical consciousness: the Artas-Jerusalem water conflict of 1925. *Jerusalem quarterly*, (48).
- Lev E. (2006) Healing with animals in Levant from the 10th to the 18th century. *J Ethnobiol Ethnomed*. 2:11. doi:[10.1186/1746-4269-2-11](https://doi.org/10.1186/1746-4269-2-11)
- Levy, G. (1985) *Fauna Palestina, Arachnida II: Araneae: Thomisidae*. Israel Academy Of Sciences And Humanities.
- Levy, G. 1998. *Arachnida III: Araneae: Theridiidae*. The Israel Academy Of Sciences And Humanities, Jerusalem.
- Levy, G. & Amitai, P. (1980) *Fauna Palaestina. Arachnida I: Scorpiones*, Israel Academy Of Sciences And Humanities.
- Llewellyn, O.A. (2003) The Basis for a Discipline of Islamic Environmental Law, pp. 185-247 in *Islam and Ecology* edited by R. C. Foltz et al. Cambridge, Massachusetts: Harvard University Press.
- Llewellyn, O.A. (2013) Requirements for Successful Revival of the HIMA. In *International Workshop: Towards an Implementation Strategy for the Human Integrated Management Approach Governance System* (p. 198) .
- Lynch, P.W.(1852) *Official Report of the United States Expedition to the Dead Sea and the River Jordan*," Baltimore. 4to. pp. 1–236, pl. 17.
- Martin, G.J. (2004) *Ethnobotany: a methods manual*. Earthscan.& WWF International, Taylor and Francis, Oxon.

- Matar, D.A. & Anthony, B.P. (2022) BREMi—a new tool for the evaluation of UNESCO biosphere reserve management effectiveness: Case-study in the Arab Man and Biosphere (ArabMAB) regional network. *Environmental Management*. 70(5): 730-745.
- Mauro S., Santarossa L. & Pigliacelli P. (2014) Mediterranean Experience of Ecotourism; A Survey of Ecotourism Best Practices in the World. Reviewed by Abu-Izzeddin F.. Federparchi-Europarc Italy / Al Shouf Cedar Society.
- McCorriston, J. & Hole, F. (1991) The ecology of seasonal stress and the origins of agriculture in the Near East. *American Anthropologist*. 93(1): 46-69.
- Mendelssohn, H., and Yom-Tov, Y. 1999. Fauna Palaestina. Mammalia of Israel. Israel Academy of Sciences and Humanities.
- Millar, I. M., V. M. Uys, R. P. Urban (editors). 2000. Collecting and preserving insects and Arachnids. SAFRINET, the Southern African (SADC) LOOP of BioNET-International.
- Mitchell, N., Rossler, M. & Tricaud, P.M. (2009) World Heritage paper № 26. World Heritage Cultural Landscapes. A hand book for conservation and management. 4/2/UNESCO/Cult/09/E
- MNE (Ministry of National Economy; with Paltrade and International Trade Center) (2013) The State of Palestine National Export Strategy: Tourism Sector Export Strategy. 2014-2018. <https://www.paltrade.org/upload/multimedia/admin/2014/10/5448e728e1bd3.pdf>
- MOPAD (Ministry of Planning and Administrative Development) (2014) State of Palestine National Development Plan 2014-2016. http://www.mopad.pna.ps/en/images/PDFs/Palestine%20State_final.pdf
- MOTA (Ministry of Tourism and Antiquities) (2015) Palestine, Land of Olives and Vines Cultural Landscape of Southern Jerusalem, Battir. World Heritage Site Nomination Document. Palestinian Ministry of Tourism and Antiquities. Department of Antiquities and Cultural Heritage Palestine.
- Mourad Hanna, E., Friberg, K. G., & Qumsiyeh, M. B. (2022) [Temporal changes in traditional knowledge and use of wild plants in Artas, Palestine](#). *Palestine Exploration Quarterly*. 154(2): 81-94.
- Muhawi, F.Y. (2007) A landscape of surveillance and control. In: Proceedings of the International Conference: Conservation and management of landscapes in conflict regions. Birzeit: Birzeit University.
- Myers, N., Mittermeier, R. A., Mittermeier, C. G., Da Fonseca, G.A.B. & Kent, J. (2000) Biodiversity Hotspots For Conservation Priorities. *Nature*, 403: 853-858.
- Naïli, Falestin. (2008) « Hilma Granqvist, Louise Baldensperger et la « tradition de rencontre » au village palestinien d'Artas ». *Civilisations*. 57 (1/2): 127-38.
- Najajrah, M., Swaileh, K., & Qumsiyeh, M. (2019) Systematic list, geographic distribution and ecological significance of lady beetles (Coleoptera: Coccinellidae) from the West Bank (Central Palestine). *Zootaxa*. 4664(1): 1-46.
- Nassauer, J.I. (1995) Messy ecosystems, orderly frames. *Landscape Journal*. 14 (2): 161-170.
- Nazarea, V. (1998) Cultural memory and biodiversity. University of Arizona Press, Tucson.
- Nazer, Geelmyden, Jorgensen and Abu Hammad (2007) Perception of landscape change in Artas Valley, West Bank, Palestine. In: Proceedings of the International Conference: Conservation and management of landscapes in conflict regions. Birzeit: Birzeit University.
- Negev, M., Sagie, H., Orenstein, D.E., Shamir, S.Z., Hassan, Y., Amasha, H., Raviv, O., Fares, N., Lotan, A., Peled, Y. & Wittenberg, L. (2019) Using the ecosystem services framework for defining diverse human-nature relationships in a multi-ethnic biosphere reserve. *Ecosystem Services*. 39: p.100989.
- Neto, F. (2003) A New Approach To Sustainable Tourism Development: Moving Beyond Environmental Protection. In *Natural Resources Forum* (Vol. 27, No. 3: pp. 212-222). Blackwell Publishing Ltd.
- Numa, C., van Swaay, C., Wynhoff, I., Wiemers, M., Barrios, V., Allen, D., Sayer, C., López Munguira, M., Balletto, E., Benyamini, D., Beshkov, S., Bonelli, S., Caruana, R., Dapporto, L., Franeta, F., Gar-cia-Pereira, Karaçetin, E., Katbeh-Bader, A., Maes, D., Micevski, N.,

- Miller, R., Monteiro, E., Moulai, R., Nieto, A., Pamperis, L., Pe'er, G., Power, A., Šašić, M., Thompson, K., Tzirkalli, E., Verovnik, R., Warren, M. and Welch, H. 2016. The status and distribution of Mediterranean butterflies. IUCN, Malaga, Spain. x + 32 pp.
- Obeidi, F. (2001) The Impact Of The Palestinian-Israeli Conflict On The Environment and The Role Of The Palestinian Environmental NGOs In Protecting The Environment. Peace Research Institute In The Middle East Talitha Kumi, Po Box, 7.
<http://Vispo.Com/Prime/Enviro.Htm>
- Ochs, Elinor. (1979) "Transcription as Theory." pp. 43–72. Developmental Pragmatics. Elinor Ochs & Bambi Schieffelin, editors. Academic Press.
- Olson, D. M. & Dinerstein, E. (2002) The Global 200: Priority ecoregions for global conservation. *Annals of the Missouri Botanical Garden*. 89(2): 199-224.
- Onaindia M, F Ballesteros, G Alonso et al. (2013) Participatory process to prioritize actions for a sustainable management in a biosphere reserve. *Environmental science & Policy*. 33: 283-294.
- Orams, M.B. (1995) Towards A More Desirable Form Of Ecotourism. *Tourism Management*. 16: 3-8.
- Orenstein, D. & Hamburg S. P. (2009) "To Populate or Preserve? Evolving Political demographic and Environmental Paradigms in Israeli Land-Use Policy". In *Land Use Policy*. Vol. 26: 984-1000.
- Pahl, Julius & Mazin Qumsiyeh. (2021) Orchids of the Occupied Palestinian Territories (West Bank, Palestine). *Mediterranean Botany*. 42: e72120.
- Palestine Museum of Natural History (PMNH). (2018) Actions for environmental sustainability in Wadi Al-Zarqa Al-Ulwi. Bethlehem University.
- Pappe, I. (2006). The ethnic cleansing of Palestine. Oxford: Oneworld.
- PCBS (Palestinian Central Bureau of Statistics), 2000-2015. Population.
<http://pcbs.gov.ps/Portals/Rainbow/Documents/employment-2015-01a.htm>
- PCBS (2016) 2000-2016 Labor Force Survey: Final Results. Ramallah. Palestine.
<http://pcbs.gov.ps/Portals/Rainbow/Documents/employment-2015-01a.htm>
- PCBS (Palestinian Central Bureau of Statistics) (2017). Preliminary results of the general of population, housing and establishments' census. Palestine.
- PCBS (2021) Estimated Mid-Year Population for Bethlehem Governorate by Locality, 2017–2021, accessed April 12, 2025,
<https://www.pcbs.gov.ps/Portals/Rainbow/Documents/BethlehemA.html> and
https://www.pcbs.gov.ps/statisticsIndicatorsTables.aspx?lang=en&table_id=704
- Pearce, F. (2001) Terraces: the other wonders of the world. Eurozine Articles:
<http://www.eurozine.com/authors/pearce.html>
- Philip, J. (1978) Stratigraphie et paléocéologie des formations a rudistes du Cenomanien; l'exemple de la Province. *Geologie Mediterraneene*, 5(1): 155e168.
- PIBS/CEBioS (2021) Academic Cooperation with the Environment Quality Authority to Refine Strategies for Biodiversity Conservation in Protected Areas in Palestine. Final Report. Palestine Institute for Biodiversity and Sustainability, Bethlehem University, Palestine.
- Plieninger, T., Abunnasr, Y., D'Ambrosio, U., Guo, T., Kizos, T., Kmoch, L., Topp, E. and Varela, E. (2023) Biocultural conservation systems in the Mediterranean region: the role of values, rules, and knowledge. *Sustainability Science*, 18(2), pp.823-838.
- Poland, Blake (2002) "Transcription quality." pp. 629–650. *Handbook of interview research*. Jaber Gubrium and James Holstein, editors. Sage.
- Por, F.D. (1975) An Outline of the Zoogeography of the Levant. *Zoologica Scripta*, 4: 5–20
- Portnov, B. A. & Paz, S. (2008) Climate Change And Urbanization In Arid Regions. *Annals Of Arid Zone*, 47: 457.
- Post, G.E. (1933) Flora of Syria, Palestine and Sinai. Publications of the Faculty of Arts and Sciences, American University of Beirut, Beirut, Lebanon.
- Pretty, J. (2003) Social capital and the collective management of resources. *Science*. 302(5652), 1912–1914. <https://doi.org/10.1126/science.1090847>

- Qumsiyeh, M.B. (1985) *The Bats Of Egypt*, Texas Tech Press.
- Qumsiyeh, M.B. (1996) *Mammals Of The Holy Land*, Texas Tech University Press.
- Qumsiyeh, M.B. (2004) *Sharing The Land Of Canaan: Human Rights And The Israeli-Palestinian Struggle*, Pluto Pr.
- Qumsiyeh, M.B. (2016) Fauna of Wadi Al-Quf: Amphibians, Reptiles and Mammals. *Jordan Journal of Natural History*. 3: 72-90.
- Qumsiyeh, MB. (2018) Ethnoecology of Palestine: Preserving Culture Heritage of Palestine's Natural History. Conference Proceeding. In press as a book. 4th Hyperheritage International Seminar (International Conference): Smart Heritage. <http://europia.fr/HIS4>
- Qumsiyeh, M.B. (2023) Developing Institutions that Serve National Goals: Case Study of the Palestine Institute for Biodiversity and Sustainability.. *Al-Quds Journal for Natural Sciences*. 1(3): 6-10. <https://www.palestinenature.org/research/197-Article-Text-480-2-10-20230425.pdf>
- Qumsiyeh, M. B. (2024) Impact of the Israeli military activities on the environment. *International Journal of Environmental Studies*. 1 - 16. <https://www.tandfonline.com/doi/full/10.1080/00207233.2024.2323365>
- Qumsiyeh, M.B. & M.A. Abusarhan (2020) An Environmental Nakba: The Palestinian Environment Under Israeli Colonization, *Science For the People*, 23(1). [:https://magazine.scienceforthepeople.org/vol23-1/an-environmental-nakba-the-palestinian-environment-under-israeli-colonization](https://magazine.scienceforthepeople.org/vol23-1/an-environmental-nakba-the-palestinian-environment-under-israeli-colonization)
- Qumsiyeh M.B. & M. Abusarhan. (2021) Biodiversity and Environmental Conservation in Palestine. pp. 1-22 In Münir Öztürk "Biodiversity Conservation and Sustainability in Asia. Vol. 1. Prospects and Challenges in West Asia and Caucasus." Springer Nature, Switzerland. https://www.palestinenature.org/research/Biodiversity--Conservation-and-Sustainability-in-Asia---Vol.-1_removed.pdf
- Qumsiyeh, M.B. & M. Abusarhan (2022) Impact of COVID-19 pandemic on Biodiversity Conservation in the Israeli Occupied West Bank, Palestine . *Africana Studia*. 37: 49-58.
- Qumsiyeh, MB & B. Al-Sheikh (2023) Flora and Conservation Issues in Two Protected Areas in Palestine: Wadi Al-Zarqa Al-Ulwi and Wadi Qana. *Diversity* 15(2): 142. <https://www.palestinenature.org/research/diversity-15-00142-v2.pdf>
- Qumsiyeh, M. B., & Albardeiya, I. M. (2022). [Politics, power, and the environment in Palestine](#). *Africana Studia*, 37, 9-18
- Qumsiyeh, MB & Amr, ZS. (2016) Protected Areas in the Occupied Palestine Territories. *Jordan Journal of Natural History*. 3: 25-46. <https://www.palestinenature.org/research/122.-Prot-Areas-1.pdf>
- Qumsiyeh, M. B. & Amr, Z. S. (2017) Research, education, and conservation in developing countries in a networked global ecosystem. e-AGE 2017. <http://asrenorg.net/eage2017/sites/default/files/files/e-AGE%202017%20Proceedings.pdf#page=19>
- Qumsiyeh, M.B. & Amr, Z. S. (2025) Northern Great Rift Valley: Deserts and other biomes. pp 23-34 In *Global Biome Conservation and Global Warming: Impacts on Ecology and Biodiversity* edited by Germano Leao Demolin-Leite (Chapter 2 in Volume 2). Elsevier Publishers. <https://www.palestinenature.org/research/Book.pdf>
- Qumsiyeh, M. B., & Bibee, A. (2026) [The nexus of environmental justice and potential for sustainable tourism under colonial occupation in Palestine](#). Pp 167-185 In F. Higgins Desbiolle (Ed.), *Climate Justice in Tourism*. Channel View Publications, Bristol, Jackson
- Qumsiyeh, M.B. and A. Gueverra (2026) Challenging the ecocide of colonization: case study of Palestine. *Protest*. Xx:1-17. In Press
- Qumsiyeh, M.B. & EN Handal. (2018) Ecotourism: Opening a Natural Window to Palestine. *This Week in Palestine*. 244: 38-42. <https://www.palestinenature.org/research/TWIP-244-Qumsiyeh-Handal.pdf>
- Qumsiyeh, M.B. & Isaaq, J. (2012) Research and Development in the Occupied Palestinian Territories: Challenges and Opportunities. *Arab Studies Quarterly*. 34(3): 158-172.

- Qumsiyeh, M. B., Salman, I. N., Salsaa', M. & Amr, Z. S. (2013) Records Of Scorpions From The Palestinian Territories, With The First Chromosomal Data (Arachnida: Scorpiones). *Zoology In The Middle East*. 59: 70-76.
- Qumsiyeh, M. B., Zavala, S. S. & Amr, Z. S. (2014) Decline In Vertebrate Biodiversity In Bethlehem, Palestine. *Jordan Journal of Biological Sciences*. 7: 101-107.
- Qumsiyeh, M. B., Khalilieh, A., Albaradeiya, I. M. & Al-Shaikh, B. (2016) Biodiversity conservation of Wadi Al-Quff protected area (Central Palestine): Challenges and opportunities. *Jordan Journal of Natural History*. 3: 6–24
- Qumsiyeh, M.B., Handal, E., Chang, J., Abualia, K., Najajreh, M. & Abusarhan, M. (2017) Role of museums and botanical gardens in ecosystem services in developing countries: Case study and outlook. *International Journal of Environmental Studies*. 74(2): 340-350.
- Qumsiyeh, M.B., R Saeed, MH Najajreh, et al. (2022a) Environmental Education and Climate Change in a Colonial Context. *Africana Studia*. 37:109-121.
<https://www.palestinature.org/research/159.-Qumsiyeh-et-al.pdf>.
- Qumsiyeh, MB, EN Handal, B Al-Sheikh, MH Najajreh & IM Albaradeiya (2022b) [Designating the first vernal Pool microreserve in a buffer zone of Wadi Qana protected area, Palestine](#). *Wetlands*. 42:119.
- Qumsiyeh, MB, D Husein, N Boulad, et al. (2023a) Updating and Enhancing the Protected Areas Network of the State of Palestine: A step Towards Biodiversity Conservation. *Parks Journal*. 29: 107-118. <https://www.palestinature.org/research/ProtectedAreasNetwork.pdf>
- Qumsiyeh, M.B., R. Bassous-Ghattas, E.N. Handal, M. Abusarhan, M.H. Najajreh & I.M. Albaradeyeh . (2023b) [Biodiversity Conservation of a new protected area 'Al-Arqoub', South Jerusalem Hills, Palestine](#). *Parks*. 29: 33-42.
- Qumsiyeh, M. B., McHugh, C., Shaheen, S., & Najajrah, M. H. (2024a) [Bio-cultural landscape and eco-friendly agriculture in Al-Arqoub, South Jerusalem, Palestine](#). *Agroecology and Sustainable Food Systems*. 48(10): 1489–1513.
- Qumsiyeh, M.B., Najajrah, M. H., Handal, E.N., Gideon, J. & Abusarhan, M.A. (2024b) The importance of urban eco-gardens for biodiversity and human sustainability: A case study from Palestine. *Cities and the Environment*. 17(1): 1-18.
- Qumsiyeh, M.B., Jarrar, K. & Sadr, M. (2025a) Chapter 15. [Durable Peace Education towards Sustainable Communities](#). pp. 245-254 In [Peace Education around the World: Learning from the Past for the Future](#). Edited by Robin Burns and Magnus Haavelsrud. Peace Knowledge Press
- Qumsiyeh, M. B., & Amr, Z. S. (2025b). [Northern Great Rift Valley: Deserts and other biomes](#). Pp 23-34 In *Global Biome Conservation and Global Warming: Impacts on Ecology and Biodiversity* edited by Germano Leao Demolin-Leite (Chapter 2 in Volume 2). Elsevier Publishers
- Qumsiyeh, M. B., J Maidrand, and M. O. Awadallah (2026a) Spacio-politics of colonization around Al-Walaja area (south Jerusalem, Palestine) and its impact on local sustainability issues. *Antipode*.
- Qumsiyeh, M.B., C.A. Buchanan, Z.S. Amr (2026b) Challenges and Opportunities for Wildlife Management and Biodiversity Conservation under Complex Socio-Political Conditions: Case study from Palestine. Chapter accepted in book on Wildlife Management
- Qumsiyeh, M.B., Bibee, A. and Taqatqa, N. (2026c) Legal mobilization against ecocide: Case study from Palestine. *Journal of Human Rights and the Environment*. Submitted
- Qumsiyeh, MB Z Musleh, V Kawwas (2026d) future of sustainability of human and natural communities in Palestine. *Utopic Imagining*.
- Quttaineh, I. (2015) Ecotourism Destinations Evaluation Based on Developmental Indicators: Computational Model. Master Thesis in Sustainable Rural Development, Al Quds University.
- Radford, E.A., G. Catullo & B. de Montmollin (ds) (2010) Important plant areas of the south and east Mediterranean region: priority sites for conservation. IUCN, Gants, Switzerland
<https://portals.iucn.org/library/efiles/documents/2011-014.pdf>

- Radford, E.A., Catullo, G., De Montmollin, B., Al-Eisawi, D., Al Sheikh B., El-Rtaib, F., Ghrabi, Z., Hmidan, H., Qirjo, M., Shaltout, K., Shmida, A., Taleb, M.S., Yah, N. & Yazbic, M. (2011) Important Plant Areas of the south and east Mediterranean region. Priority sites for conservation. IUCN, Plantlife and WWF
- Rinawati, F., Stein, K. & Lindner, A. 2013. Climate Change Impacts On Biodiversity—The Setting Of A Lingering Global Crisis. *Diversity*, 5, 114-123.
- Ritter, C. (1866) The comparative geography of Palestine and the Sinaitic Peninsula (Vol. 1). T. & T. Clark.
- Rjoob, A.A. (2009) The impact of Israeli occupation on the conservation of cultural heritage sites in the occupied Palestinian territories: The case of salvage excavations. *Conservation and Management of Archaeological Sites*. 11(3-4): 214-235.
- Robinson, E. (1856) Biblical Researches in Palestine and the Adjacent Regions: A Journal of Travels in the Years 1838 & 1852: in Three Volumes (Vol. 2). Murray, London.
- Roe, D., Elliott, J., Sandbrook, C. & Walpole, M. (Eds.) (2012) Biodiversity conservation and poverty alleviation: exploring the evidence for a link. John Wiley and Sons.
- RSCN (The Royal Society for the Conservation of Nature (2005) Field Research Manual. RSCN, Amman, Jordan.
- Rueff, H., Parizot, C., Israel, A.B. & Schwartz, M. (2008) Dryland afforestation and poverty alleviation: Bedouin and Palestinian non-timber forest product collectors in contrasting economic environments. *Human Ecology*. 36(6): 923-930.
- Saeed, R. & M.B. Qumsiyeh. (2020) Assessing long-term changes in the raptor fauna of the Fertile Crescent by reference to the nineteenth century works of Canon HB Tristram. *Sandgrouse*. 42: 69-77.
- Sagie, H. & Orenstein, D.E. (2022) Benefits of Stakeholder integration in an ecosystem services assessment of Mount Carmel Biosphere Reserve, Israel. *Ecosystem Services*. 53: 101404.
- Said, O. , K. Khalil, S. Fulder, H. Azaizeh 2002 Ethnopharmacological survey of medicinal herbs in Israel, the Golan Heights and the West Bank region . *Journal of Ethnopharmacology* 83:251-265
- Saleh, R. (2012) In the Seam Zone: Walaja's Fate Between Jerusalem and Nowhere. *Jerusalem Quarterly*.
- Salman, I., Salsaa, M. & Qumsiyeh, M.B. (2014) Distribution and cytogenetics of amphibians from the occupied Palestinian territories (West Bank of Jordan). *Jordan Journal of Natural History*. 1:116-130.
- Sasa, G. (2023) Oppressive pines: Uprooting Israeli green colonialism and implanting Palestinian A'wna. *Politics*. 43(2): 219–235. <https://doi.org/10.1177/02633957221122366>
- Sattout, E. (2020) Biosphere reserves in the Arab Region: outreaching to society. UNESCO Publishing.
- Sayej, G. J. (1999) The origin of terraces in the Central Hills of Palestine. In: *Proceedings of the International Conference: Conservation and management of landscapes in conflict regions*. Birzeit: Birzeit University.
- Sbeah, Y. (2002) The guide program for the olive cultivation sector in Palestine. *Olives in the Palestinian Territories*. oPt: Arabic Organisation for Agricultural Development (in Arabic).
- Scarpa D. (1990) The Geology of the Cremisan Valley, Beit Jala. *Bethlehem University Journal*. 9: 7-31.
- Scazzosi, L. (ed.) (1999) Politiche e culture del paesaggio. Esperienze internazionali a confronto. Roma: Gangemi.
- Scazzosi, L. (ed.) (2003) Landscape policies and cultures. New comparisons. Roma: Gangemi.
- Schama, S. (1995) *Landscape and memory*. New York: Knopf.
- Scherr, S.J. & McNeely, J.A. (2008) Biodiversity conservation and agricultural sustainability: towards a new paradigm of 'ecoagriculture' landscapes. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*. 363(1491): 477-494.
- Schirone, B., Salis, A. & Vessella, F., 2011. Effectiveness of the Miyawaki method in Mediterranean forest restoration programs. *Landscape and Ecological Engineering*, 7: 81-92.

- Schroeder, D. & Lucas, J. C. (2014) Benefit Sharing. *Encyclopedia Of Applied Ethics*. 237-245.
- Seger, K. (ed.) (1981) *Portrait of a Palestinian village*. London: Third World Centre for Research and Publishing.
- Settele, J., Hammen, V., Hulme, P., Karlson, U., Klotz, S., Kotarac, M., Kunin, W., Marion, G., O'connor, M. & Petanidou, T. (2005) *Alarm: Assessing Large-Scale Environmental Risks For Biodiversity*
- Shirihai, H., Dovrat, E., Christie, D. A. & Harris, A. (1996) *The Birds Of Israel*, Academic Press London.
- Shokeh, K. (2012) *The History of Battir*, Bethlehem: CCHP.
- Solinas P.G ed. (1989) *Gli oggetti esemplari. I documenti di cultura materiale in antropologia*, Montepulciano-Siena: Editori del Grifo.
- Soto-Berelov, M., Fall, P.L., Falconer, S.E. & Ridder, E. (2015) Modeling vegetation dynamics in the Southern Levant through the Bronze Age. *Journal of Archaeological Science*. 53: 94-109.
- SPNL (Society for Protection of Nature in Lebanon) (2023) *Hima for Peace: Identification, selection and management*.
- Stager, L.E. (1990) Shemen's estate. *BASOR* 277/278
- Stein, M., Goring-Morris, N., Dor, Y.B. and Erel, Y., 2025. Environmental setting of the neolithic agricultural revolution across the Fertile Crescent. *Quaternary Science Reviews*, 355, p.109265.
- Steiner, (1991) *The living landscape. An ecological approach to landscape planning*. New York: Mac Graw-Hill
- Sternberg, M., Gabay, O., Angel, D., Barneah, O., Gafny, S., Gasith, A., Grünzweig, J.M., Hershkovitz, Y., Israel, A., Milstein, D. and Rilov, G., 2015. Impacts of climate change on biodiversity in Israel: an expert assessment approach. *Regional Environmental Change*, 15(5), pp.895-906
- Stoll-Kleemann, S & M Welp (2008.) Participatory and integrated management of biosphere reserves: Lessons from case studies and a global survey. *GAIA-Ecological Perspectives for Science and Society*. 17(1): 161-168.
- Strahorn, A.T. (1929) "Agriculture and soils in Palestine". *Geographical Review* October 1929. New York: American Geographical Society.
- Sturm, C.F., T.A. Pearce, & Á. Valdés (eds). (2006) *The Mollusks: A Guide to Their Study, Collection, and Preservation*. American Malacological Society. Pittsburgh.
- Sunderlin, W. D., Angelsen, A., Belcher, B., Burgers, P., Nasi, R., Santoso, L. & Wunder, S. (2005) *Livelihoods, Forests, And Conservation In Developing Countries: An Overview*. *World Development*. 33: 1383-1402
- Sutherland, W.J., Adams, W.M., Aronson, R.B., Aveling, R., Blackburn, T.M., Broad, S., Ceballos, G., Cote, I.M., Cowling, R.M., Da Fonseca, G.A.B. & Dinerstein, E. (2009) One hundred questions of importance to the conservation of global biological diversity. *Conservation Biology*. 23: 557-567.
- Szepesi, S. (2012) *Walking Palestine: 25 Journeys Into The West Bank*, Interlink Publishing.
- Tabash, M.I. (2017) The role of tourism sector in economic growth: an empirical evidence from Palestine. *International Journal of Economics and Financial Issues*. 7(2): 103-108.
- Tal, A. (2002) *Pollution In A Promised Land: An Environmental History Of Israel*. University Of California Press.
- Talhok, S. N., Zurayk, R., & Sobh, H. (2019) Reviving the Hima: Community-based conservation in the Middle East. *Sustainability*. 11(7): 1863.
<https://doi.org/10.3390/su11071863>
- Tamimi, A. R. (1996) A Technical Framework For Final Status Negotiations Over Water. *Palestine-Israel Journal Of Politics, Economics And Culture*. 3: 70-2.
- Tchernov, E. & Yom-Tov, Y. (1988) *Zoogeography Of Israel. The Zoogeography Of Israel, The Distribution And Abundance At A Zoogeographical Crossroad*, Dr W. Junk Publishers, Dordrecht, Netherlands. 1-6.

- Tengberg, A., Fredholm, S., Eliasson, I., Knez, I., Saltzman, K. & Wetterberg, O. (2012) Cultural ecosystem services provided by landscapes: assessment of heritage values and identity. *Ecosystem Services*. 2: 14-26.
- Tesdell O, Y Othman, Y. Dowani et al. (2020) Envisioning perennial agroecosystems in Palestine. *Journal of Arid Environments*. 175: 104085.
- Thaler, M., Aysha Al-Wahsh, Alea Meuser, Alyssa Rooks & Mazin Qumsiyeh. (2020) Macrofungi from The Hebron and Jerusalem Hills of Palestine. *Mycotaxon*. 135(1): 1-23. <https://www.palestinennature.org/research/141.-thaler-macrofungi.pdf>
- Thomas, D. (2011) Poverty, biodiversity and local organisations: lessons from BirdLife International. London: International Institute for Environment and Development (IIED).
- Tristman, C. (1892) The Natural History of Palestine. Palestine Exploration Fund.
- Tristram, H. (1866) Report On The Mammals Of Palestine. Proceedings Of The Zoological Society Of London. 84-93.
- Tristram, H.B. (1884) The survey of Western Palestine: the fauna and flora of Palestine. Committee of the Palestine Exploration Fund.
- UNDP (United Nations Development Programme) (2010) Climate Change Adaptation Strategy and Programme of Action for the Palestinian Authority. UNDP.
- UNESCO (1985) International Coordinating Council of the MAB Programme (MAB No. 58). UNESCO, Paris.
- UNESCO (1996) Biosphere reserves: The Seville Strategy and the Statutory Framework of the World Network. Paris. UNESCO, Paris.
- UNESCO (2001), First Proclamation of Masterpieces of the Oral and Intangible Heritage of Humanity, in www.unesco.org/culture/heritage.
- UNESCO World Heritage Center (2016) Operational Guidelines for the Implementation of the World Heritage Convention. Paris
- UNESCO (2020) Biosphere reserves in the Arab Region: Oureaching to Society. UNESCO.
- UNRWA (2011) Al WALAJA: An Analysis under International Law. United Nations Relief and Works Agency for Palestine Refugees in the Near East Report available at <https://www.unrwa.org/userfiles/2011081763638.pdf>
- UNWRA (2015) Western Bethlehem Villages, West Bank: Refugee Communities in the 'Gush Etzion' Settlement Area (Infographic), UNRWA report 2015, https://www.unrwa.org/sites/default/files/content/resources/gush_etzion_2015_final_approved_by_duo.pdf
- Vachon, M. (1966) Liste des scorpions connus en Egypte, Arabie, Israel, Liban, Syrie, Jordanie, Turquie, Irak, Iran. *Toxicon*, 4, pp. 209-218.
- Vachon, M. (1974) Etude des caracteres utilises pour classer les familles et les genres de Scorpions (Arachnides). *Bulletin du Muséum National d'Histoire Naturelle, Paris*, 3, pp. 857-95.
- Van Cuong, C., Dart, P. & Hockings, M. (2017) Biosphere reserves: Attributes for success. *Journal of Environmental Management*. 188: 9–17. <https://doi.org/10.1016/j.jenvman.2016.11.069>
- Verde, Tom. (2008) A Tradition of Conservation. *Aramco World* December 2008, available at <http://archive.aramcoworld.com/issue/200806/a.tradition.of.conservaion.htm>
- Verner, Dorte (Editor). (2012) Adaptation to a Changing Climate in the Arab Countries: A Case for Adaptation Governance and Leadership in Building Climate Resilience. The World Bank, Washington, DC
- Visconti, P., et al. (2016) Projecting global biodiversity indicators under future development scenarios. *Conservation Letters*. 9(1): 5-13.
- Wagner, M.M. & Gobster, P.H. (2007) Interpreting landscape change: measured biophysical change and surrounding social context.
- Wagstaff, M. (1999) The mountain and the plain: some themes of continuity and change in Palestinian landscapes. In: Abu-Lughod, I., Heacock, R. Neshef, K. editors, *Landscape of Palestine: equivocal poetry*. Birzet: Birzeit University Publications.

- Walter, M., Scheidel, A., Vadez, C., Bene, D.D., Temper, L., Fanari, E. & Reyes-García, V. (2026) Social movements are transformative agents for biodiversity conservation. *Proceedings of the National Academy of Sciences*. 123(4): p. e2513327123.
- Weizman, E. (2012) *Hollow land: Israel's architecture of occupation*. Verso Books.
- Werner, Y.L. (2016) *Reptile life in the Land of Israel*. Edition Chimaira. Frankfurt am Main.
- Westphal C., Von Oheimb G., Meyer-Grunefeld M., Tremer T., Hardtle W., Levanomy T., Dayan T. & Assman T. (2009) An old *Quercus calliprinos* forest of high nature conservation value in the Mediterranean region of Israel. *Conservation Studies in Israel*. 57(1-2): 13-23.
- Wezel, A., Casagrande, M., Celette, F., Vian, J.F., Ferrer, A. & Peigné, J. (2014) Agroecological Practices For Sustainable Agriculture. A Review. *Agronomy For Sustainable Development*. 34(1): 1-20.
- Whyte, R.O. (1950) The phytogeographical zones of Palestine. *Geographical Review*. 40(4): 600-614.
- WWF (2003) *Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) Methodology* WWF Gland, Switzerland
- WWF & IUCN (1994) *Centres of Plant Diversity: a Guide and Strategy for their Conservation*. Volume 1: Europe, Africa, South West Asia and the Middle East. Gland, Switzerland and Cambridge, UK: WWF and IUCN.
- Zeder, M. A. (2008) Domestication and early agriculture in the Mediterranean Basin: Origins, diffusion, and impact. *Proceedings of the National Academy of Sciences*. 105(33): 11597-11604.
- Zohary, M. (1947) A vegetation map of Western Palestine. *The Journal of Ecology*. 1-19.
- Zohary, M. (1966) *Flora Palaestina*. Vol. 1. The Israel Academy of Sciences and Humanities. Jerusalem.
- Zohary, M. (1972) *Flora Palaestina*. Vol. 2. The Israel Academy of Sciences and Humanities. Jerusalem.
- Zohary, M. (1973) *Geobotanical Foundations Of The Middle East*. CRC Press.
- Zohary, M. (1978) *Flora Palaestina*. Vol.3. The Israel Academy of Sciences and Humanities. Jerusalem.
- Zohary, M., & Feinbrun-Dothan, N. (1986) *Flora Palaestina*. Vol.4. The Israel Academy of Sciences and Humanities. Jerusalem.
- Zohary, M., & Feinbrun-Dothan, N. (1986) *Flora Palaestina*. Vol.4. The Israel Academy of Sciences and Humanities. Jerusalem.
- Zonstein, S. & Marusik, Y. M. (2013) Checklist Of The Spiders (Araneae) Of Israel. *Zootaxa*. 3671: 1-127.
- Zube, E. & Pitt, D. (1981) Cross-cultural perception of scenic and heritage landscapes. *Landscape Planning*. 8: 69-87.
- Zvi & Y.D. Ron (1985) Development and management of irrigation system in mountainous regions of the holy land *Trans. Inst. Br. Geogr.* NS 149-69.

Arabic references

- 2002-معهد الأبحاث التطبيقية / القدس / "أريج" التاريخ الزراعي في فلسطين
 - ناديا البطمة. فلسطين الفصول الأربعة عادات وتقاليد ومواسم / ناديه البطمة/ مركز القدس للإعلام والاتصال 2012 .
 - تانيا تماري ناصر وماري جبجي تماري / "طلع الرنجس والحنون"، أزهار مطرزة من ربيع فلسطين / 2009
 ARIJ (2026) " في خدمة مستوطنة ناحال حيلنس" طريق استيطاني إسرائيلي جديد على أراضي بتير وبيت جالا في " [Link https://11nq.com/vqeeo20](https://11nq.com/vqeeo20) محافظة بيت لحم

List of Relevant Websites

- <https://almakhrou.palestinenature.org/reports/>
<https://palestinenature.org/conservation>
<https://almakhrou.palestinenature.org>
<https://www.facebook.com/PIBS.PMNH>

<http://www.iucnredlist.org/>
<http://www.keybiodiversityareas.org/>
<http://visitpalestine.ps/wadi-makhrou-just-sunset/>
<http://datazone.birdlife.org/country/palestinian-authority-territories>
<http://datazone.birdlife.org/site/results?cty=240&fam=0&gen=0>
<http://whc.unesco.org/en/list/1492>
<https://gc21.giz.de/ibt/var/app/wp342P/1844/index.php/al-makhrou-just-sunset/>
<http://www.travelpalestine.ps/en/article/41/Battir>
<http://thisweekinpalestine.com/wp-content/uploads/2015/05/MUSEUM-REVIEW.pdf>
http://www.environment.pna.ps/ar/files/Third_national_Report_On_Biodiversity.pdf
<https://www.unrwa.org/userfiles/2011081763638.pdf>
<http://www.bic.com.ps/bcc/images/BaNF%20Final.pdf>
<http://visitpalestine.ps/wadi-makhrou-just-sunset/>
<http://datazone.birdlife.org/country/palestinian-authority-territories> and
<http://datazone.birdlife.org/site/results?cty=240&fam=0&gen=0>
<http://whc.unesco.org/en/list/1492>
<https://gc21.giz.de/ibt/var/app/wp342P/1844/index.php/al-makhrou-just-sunset/>
<http://www.travelpalestine.ps/en/article/41/Battir>
<http://thisweekinpalestine.com/wp-content/uploads/2015/05/MUSEUM-REVIEW.pdf>
http://www.environment.pna.ps/ar/files/Third_national_Report_On_Biodiversity.pdf (page 57)
<https://www.unrwa.org/userfiles/2011081763638.pdf> (more about the political situation of Al
 Walaja but also good one)
<http://www.bic.com.ps/bcc/images/BaNF%20Final.pdf>

Village Profiles

Al-Walaja:

http://vprofile.arij.org/bethlehem/pdfs/VP/Al%20Walaja_vp_en.pdf
https://www.europarl.europa.eu/meetdocs/2009_2014/documents/droi/dv/910_aiwalaja_910_aiwalaja_en.pdf
https://www.palestineremembered.com/GeoPoints/al_Walaja_1082/ar/index.html#Statistics

Husan:

http://vprofile.arij.org/bethlehem/pdfs/VP/Husan_vp_en.pdf
https://www.palestineremembered.com/GeoPoints/Husan_1180/index.html
<http://poica.org/2004/04/husan-a-palestinian-village-undergoes-the-segregation-wall/>
https://www.palestineremembered.com/GeoPoints/Husan_1180/ar/index.html

Battir:

http://vprofile.arij.org/bethlehem/pdfs/VP/Battir_vp_en.pdf
<https://www.bethlehem.ps/en/Article/75/Battir-Village-Profile>
<https://www.bethlehem.edu/2020/03/02/battir-a-palestinian-village/>
https://www.palestineremembered.com/GeoPoints/Battir_845/ar/index.html#Statistics

Beit Jala:

http://vprofile.arij.org/bethlehem/pdfs/VP/Beit%20Jala_cp_en.pdf
<http://beitjala-city.org/en/beit-jala-city/the-occupation/background>
https://www.palestineremembered.com/GeoPoints/Bayt_Jala_866/ar/index.html

Wadi Fukin:

http://vprofile.arij.org/bethlehem/pdfs/VP/Wadi%20Fukin_vp_en.pdf
https://www.palestineremembered.com/GeoPoints/Wadi_Fukin_1684/ar/index.html#Statistics

Nahhalin:

http://vprofile.arij.org/bethlehem/pdfs/VP/Nahhalin_vp_en.pdf
<https://reliefweb.int/report/israel/opt-profile-nahalin-village-west-bank-barrier-update-feb-2006>
https://www.palestineremembered.com/GeoPoints/Nahhalin_1449/ar/index.html%23Statistics

Al-Khader:

http://vprofile.arij.org/bethlehem/pdfs/VP/Al%20Khader_tp_en.pdf
https://www.palestineremembered.com/GeoPoints/al_Khadr_1070/ar/index.html
 Artas:
http://vprofile.arij.org/bethlehem/pdfs/VP/Artas_vp_en.pdf
https://www.palestineremembered.com/GeoPoints/Artas_809/ar/index.html#Statistics

Annex 1 Communication/PR links

Here are samples of coverage for work in the study area

Samples of mainstream outreach and coverage that relate to this project are at:

https://issuu.com/bethlehemuniversity/docs/bethlehem_university_magazine_spri (cover story of BUM)

<https://www.palestinenature.org/research/TWIP-244-Qumsiyeh-Handal.pdf>
<https://www.palestinenature.org/research/002.pdf>
https://www.youtube.com/watch?v=oxxUqk4_PA
https://www.facebook.com/watch/live/?v=2156062017823555&ref=watch_permalink
<https://kuminow.com/week-12-natural-resources-online-gathering/>
<https://youtu.be/n69ALSznHUI>
<https://www.facebook.com/watch/?v=268728494186817>
https://www.facebook.com/watch/live/?v=849193865897151&ref=watch_permalink
<http://www.pn-news.net/news.php?extend.12482.4>
<https://mawwal.ps/ar/mawwal/117153>
<https://youtu.be/AWy6baoaqTE>
<https://www.middleeasteye.net/discover/biodiversity-and-hope-flourish-palestines-first-natural-history-museum>
<https://www.maannnews.net/news/2041159.html>
<https://youtu.be/iUQ2Q3teWtk>
<https://youtu.be/0jHWbhR7wWk>
<https://youtu.be/OrCsh1t4aKs>
<https://www.facebook.com/nativitytv/videos/268728494186817/>
<https://www.facebook.com/page/1454309858180882/search/?q=Darwin>
<https://www.facebook.com/page/1454309858180882/search/?q=makhrour>

Four TV sessions were produced and broadcast on local TVs, during prime times the videos can be viewed at :

First episode about biodiversity & sustainability https://youtu.be/g_gUglWGhtM

Second Episode about biodiversity conservation https://youtu.be/TIJ_lafq-YQ

Third episode about community farmers & Nature https://youtu.be/2CFXt_h2JQM

Fourth episode about community enhancement <https://youtu.be/3FPcR9kPw>

i24 channel made a video about the training <https://youtu.be/OrCsh1t4aKs> .

TV sessions on environment <https://youtu.be/-yA9il9GVYk>

Main video the area <https://youtu.be/MjdvsK6pkec>

Video for children on Climate Change <https://youtu.be/5dzjtSvuA8U>

2025/2026

<https://www.facebook.com/PIBS.PMNH/posts/pfbid0WYQgJ13ibznsPEGbF5e3Ba5Rae85h2jBqZ8ku8CrAfG9yqEM2inq6V5Zm7xrXN61l> (Children and Women activity)

<https://www.facebook.com/PIBS.PMNH/posts/pfbid0HSJjyS6K9rbEsYapyoRh4uGq1YmpbgWs1iXQ1oqGdrZVugRurH9PYp6HkpHq9ydWl>

<https://www.facebook.com/PIBS.PMNH/posts/pfbid02c5vToS64J6P4KBckVtowneDRrVhSj2z4e6s5vKfJtAmArsNj2WZKFefAxp7756dMl>

<https://www.facebook.com/PIBS.PMNH/posts/pfbid0XvBNTxiJb4zFAe2fBPbjsEidNekkUEZBULDthKJqZ8kaxgkq3JckWP8Wde3keogl>

<https://www.facebook.com/PIBS.PMNH/posts/pfbid04SeVob2WdtsKFsBNpijqdEU4UgBM61YnWTXWu7gfhe6MCio8XLsGVtwD9zXKca9xl>
<https://www.facebook.com/PIBS.PMNH/posts/pfbid02hH1nkxFby9rGN8UGw1bNVcTi8EhS7qQBnHM9Fg1aqCuhdJzbVW6ySGMhR6Eg38Zml>
<https://www.facebook.com/PIBS.PMNH/posts/pfbid02LvEZsi4LSJDVxDuuvVzYoQ571gN6aardYJEyrJNSH5Sf9avetpFk9JHHHga19VCAI>

17 Feb 2026 Good Shepherd School Visit

<https://www.facebook.com/PIBS.PMNH/posts/pfbid02u8VVWkjt4DBKoHZigiZv4v39s3NiUT75BZED5Vgz4P8Nufb47GMvneT9vzDyNGUvI>

<https://www.facebook.com/PIBS.PMNH/posts/pfbid0Mog2ePSM8YCxSRDxcom1kVnsSNqPZzJiH4i7GuMgBSgB5j9ocHm5mqJBNqR5PaLnl> (Consulting with cooperatives in Artas 3 Jan 2026)

<https://www.facebook.com/PIBS.PMNH/posts/pfbid0ZxjY2p1LgeJSvk863qErLEap2NRZSJBo4PtLLiR8UtBurLhgxyzkyS53zDHErsCamI> (Dec. 5 Soil biodiversity children educational event)

<https://www.facebook.com/PIBS.PMNH/posts/pfbid02Nebi7CJkStRQ6nXEn5sYi1PcStYo8pYhZeV87yhSm72uMa1jXVGXa7Zi79cCMCP2I> (7 November 2025 Workshop for 50 students of education-future teachers)

<https://www.facebook.com/PIBS.PMNH/posts/pfbid027kJxbHKvLJY33PZjHd9mYKBcE9NmP5bt6vyyz4bwGD1gtH2vaErtsAZvgaRHtZ9ml> 31 Oct 2025 Salesian activities in Cremisan Valley/study area)

<https://www.facebook.com/PIBS.PMNH/posts/pfbid0NDUuXocKMU1KYBJthrx6e4eY2wo3t7byzPAzvrJtj5ZqfJfYXLELLsMYA5ghcYHI> (16 Feb 2026 Capacity building on plant identification and conservation using our botanic garden)

Community meetings

13 Sept 2025 Wadi Fukin

<https://www.facebook.com/PIBS.PMNH/posts/pfbid02aSUMo4ow4JVuHdLh339EiftTsqkMbnp7iTFPGvkXo6BNAxAUoHqhQvnjCwZ9RoEYI>

12 October 2025 Artas

<https://www.facebook.com/PIBS.PMNH/posts/pfbid0BSoLTJtMEviJkBNdpZQMSxPg4cZii1ZwSvDdgm74xnRSe8Coe9oUTPEd6sYGfn3xl>

7 Aug 2025 Battir (for all c8 communities)

<https://www.facebook.com/PIBS.PMNH/posts/pfbid02EvWYTed2MBM3tiBan5kKHZEbzijFyz7cXp1Hhe7LLzpbLCUn74GmRMq6jZb6TDGEI>

24 Jul Battir

<https://www.facebook.com/PIBS.PMNH/posts/pfbid0HdLVduKYvKFLaMhaEhf8exUFhSUuoiGXiRrWUwAAEDnAYrHHJSY8BwdF23GYFBCXI>

Side project development

Seedbank

<https://www.facebook.com/PIBS.PMNH/posts/pfbid02tbFv2nTLYRZCKH8N3AGQvhQnTvNDzYHJEctidp3dHnpt8htPuWJMKFN2V3W6c6P8I>

Educational events and posts (sample)

February to December 2025 80 stops at 40 communities of the mobile museum reaching 9800 schoolchildren and 1180 adults

<https://www.facebook.com/PIBS.PMNH/posts/pfbid024FQ3Lj2fRMW77BXhjKjbNmmZ5vGutfRDBcrrUnvN4NwKQoEQWsZeSU58stkzjkXKl>

We have an ongoing series of workshops every Thursday on environmental issues. This is in arabic (see for example this announcement of events in March 2026

<https://www.facebook.com/PIBS.PMNH/posts/pfbid02vkXE7F8qP9z3TYSPPFcREt416ZvAaXiX9aWvw5Mt5UFvsoKWONdsqdSqsZVbNPDyZl>

Here are example recordings #77 by Kevin Smithof IUCN speaking about his area of invasive species https://youtu.be/gtJk_fbVwmo and #63 on camera trapping <https://youtu.be/yjY6w-YvjV8> and #61 on the new Palestinian Environmental law <https://youtu.be/1K8aIMBxaho>

10 Oct 2025 On International migrating bird day
<https://www.facebook.com/PIBS.PMNH/posts/pfbid0vjYH8eF2TaLwdMi8Df9uQZLgjbCfda5kbcZ4ShYrXMoAhUq9KghRqJ5Eker7bbP6l>

3 October 2025 World animal day
<https://www.facebook.com/PIBS.PMNH/posts/pfbid024qaeAAG815qUuhdx3vP4ShakdP7D3AETA6dtgTUXp5SJTD8qxUNgy2pNKM04XrDI>

5 November 2026 Palestine environment day activity
<https://www.facebook.com/PIBS.PMNH/posts/pfbid02RNxFjq2Rk6typhdUcBcEz7zoyS3XP8aPBF9ki77VzjhaMX7oAttyiZrojvyuM86ml>

11 Oct 2025 Visit by Evangelical Lutheran School
<https://www.facebook.com/PIBS.PMNH/posts/pfbid0UkLB3d9Q2gTqACjkXJTQAHGzGDFaBkM2aiuwTfQpHvEMVEEP5tD9xJypggEvF7jKl>

6 November 2026 gave talk on the international day of prevention of use of environment in armed conflict
<https://www.facebook.com/PIBS.PMNH/posts/pfbid022tL6BzbqHBFpuu4TKeFZCx1y4qGYtZBS8XTJtrkSZzP91396FojEHAWfLUqCWZeql>

A series of environmental programs for children 6-11 and youth 12-16 at PIBS

Program 1, 6 Feb 2026
<https://www.facebook.com/PIBS.PMNH/posts/pfbid08rJrPGW1nioeb8ydDS5PXJY1c9Y3Jjcx8cazwhDunR5k7d5eqLxbohsBNvDEsZz8l>

Program 2, 13 Feb 2026
<https://www.facebook.com/PIBS.PMNH/posts/pfbid09scHp5gY3ywK3FPXqy6Pmf5WsNWBxiZPY8yzBH69mzp7gKTE8XinwzXH8HQQTgCNl>

Program 3, 20 Feb 2026
<https://www.facebook.com/PIBS.PMNH/posts/pfbid0qgrgejC8GP3JH4KwsUCibz8C7mmBQXxDfH4kVoTJnwig4qb1c4nAw1CYgKa2PQxl>

Program 4, 26 Feb 2026
<https://www.facebook.com/PIBS.PMNH/posts/pfbid0NLUGbYGnvyiZA3XEcJq7hjWUs4j42b4Ngh72sKC1jsWhjd1pFGdPrL2NAWPCCkqpl>

Program 5, 6 March 2026
<https://www.facebook.com/PIBS.PMNH/posts/pfbid02Quei3ALmeriKAp3R2T7Nga7h1aQ2T7pFk7e48RvHQH6KMNrkiSyAJzNhKMBUihkrl>

Program 6, 13 March 2026
<https://www.facebook.com/PIBS.PMNH/posts/pfbid02HFAbTYD92ZXeV1rUq8Nc3JeywSKLakpmsLhDKAFQk96sATWeucB97Qfvc8U4jn8gl>

Program 7, 27 March 2026
<https://www.facebook.com/PIBS.PMNH/posts/pfbid0RgY9Gv5QV6yBe8d364udDhu7XjPMPJ96UPz33PDNzRe7xqg5DDB4jiKNxGswYqedl>

Program 8, 17 April 2026
<https://www.facebook.com/PIBS.PMNH/posts/pfbid026JewvoZTN1EjWnhY2fKoKLcCHSP1NmKxUQNj3bYL5gym6UDkvGLi5cLVE6EsUE65l>

Program 9, 1 May 2026
<https://www.facebook.com/PIBS.PMNH/posts/pfbid035JSmRZPR7LWndxMJTxUYaMsh6LRfFYP796R1rV8X4MnEaQ9jTEFEEd32ogzi3pZnel>

Travels and global communication

Earlier trips helped build a network of supporters before 2025 which helped us in this project.⁴⁶
 October 2025 Trip to UAE for IUCN Regional Conservation Forum 2025 (include side gathering of National Geographic explorers and Barcelona Spain the Union for the Mediterranean Workshop on the EU Deforestation Regulation, and delivered six talks at universities, community spaces, and Rotary Clubs
<https://www.facebook.com/PIBS.PMNH/posts/pfbid0HDJwz5e2qaktRUDBpZd2z95nmuevoALCFwWUnpYLjH5gnua59ncw6URi8Vh8gLvHlVl>
<https://www.facebook.com/PIBS.PMNH/posts/pfbid024nJcg5ct9jZhMaW6DVuBSWek6Jes2bVGM4AAj7inLBuvi7Q4n6SfyJGjhsD3aAZMl>
 2- 6 February 2026 International Conservation Forum for Arabia's Biodiversity Sharjah Safari SICFAB 2026 focus on invasive species management
<https://www.facebook.com/PIBS.PMNH/posts/pfbid0357JgNtQQQvfxwxtdcYhtYoYzK8xV5uLKKBhscqiuZE4LGsr145zSeLT913yXPNUl>
 30 March - 1 April 2026 Gave talk on subject at ChangeNow.world conference in Paris
<https://www.facebook.com/PIBS.PMNH/posts/pfbid02d1KszY9rGRVHPT2q1fTy22JrB8odVMw8GU8kjDgjpBJFHLKHDNRbujp1zPE9efRl>
 June 23 to July 6, 2025 Ms. Zena Musleh of PIBS participated in the regional training course on "Technology for the Prevention and Control of Desertification and Sandstorm Disasters in Arab Countries", held in Lanzhou City, Gansu Province, People's Republic of China. Upon return gave a workshop (video <https://youtu.be/aIIGlgfRR0k>).
<https://www.facebook.com/PIBS.PMNH/posts/pfbid02e25fwaCbjGrLTkdnXwR1STaPbwvPTXpts1XDDb3dBAdb9XraSEG1Fw4VNE7WJVawL>

Field trips

11-18 March 2026

<https://www.facebook.com/PIBS.PMNH/posts/pfbid0P6bHFRBjzSjQjxrkrPqRE5YooY1PcrvUi2jPsMoQhB1iBKTFrvfd5XTPuQj7UnLl>

24 March 2026

<https://www.facebook.com/PIBS.PMNH/posts/pfbid0LXQnLaDbqmUbPv5zM5HxEBCEAM5Jr2HBzMkrDFn1qFdKKSfmgdKY8z2X2R4WMUml>

17 April 2026 Biodiversity students at Al-Quds university toured PIBS and field work to Wadi Fukin

<https://www.facebook.com/PIBS.PMNH/posts/pfbid02XvgDkWEogoy3XCWyroX9BB6LJTly8NaprtadKiFcEwhpcsWSgpnqX6r2CH2ECR2rl>

18-21 April 2026

<https://www.facebook.com/PIBS.PMNH/posts/pfbid0fHMwqYtSFvNyVASksiNxFCf94ew1SMoHpW8XTuYlkwG2XvVN8C63mLgy5kmtSoSYl>

December 5, 7 2025

<https://www.facebook.com/PIBS.PMNH/posts/pfbid0iiEVvcG2pRXsgL4LsDyJpHmvMMAGXtcr3S14mv2DrAovufvTgtnjhLrY84L44sv3l>

Videos and documents bringing up the work in the study area

13 Feb 2025 Introduction to work <https://youtu.be/Idjrt4dYmDs>

Environmental conservation during crisis https://youtu.be/S_2pCeW4wn8

May 2025 Celebrating 10 year PIBS <https://youtu.be/qt8OTGoS198>

PIBS 2025 Annual Report <https://www.palestinenature.org/annual-reports/2025-Annual-Report.pdf>

10 year anniversary booklet <https://www.palestinenature.org/annual-reports/10-Years-PIBS.pdf>

Palestinian land day promotional reel <https://www.facebook.com/reel/2391778224670608>

⁴⁶ For example, Qumsiyeh traveled to Uganda for a global gathering of conservationists as well as to COP meetings for CBD and UNFCCC. Qumsiyeh serves on local and global committees on taxonomic issues, climate change, biodiversity, spatial planning etc.

Annex 2. PIBS publications on Al-Arqoub area

- Salman, I. M., Salsaa', M., & Qumsiyeh, M. B. (2014) Distribution and cytogenetics of amphibians from the occupied Palestinian territories (West Bank of Jordan). *Jordan Journal of Natural History*, 1(1), 86-98.
- Qumsiyeh, M., Zavala, S., & Amr, Z. (2014) Decline in vertebrate biodiversity in Bethlehem, Palestine. *Jordan Journal of Biological Sciences*, 7(2), 101-107.
- Qumsiyeh, M. B., Najajreh, M., & Handal, E. (2015). Scientific research as a basis for education and environmental conservation: Examples from Palestinian governorates. Sixth Environmental Conference of the Environmental Education Center, Beit Jala. (2016 publication).
- Amr, Z. S., Handal, E. N., Bibi, F., Najajreh, M. H., & Qumsiyeh, M. B. (2016). Change of diet of the Eurasian Eagle Owl, *Bubo bubo*, suggests decline in biodiversity in Wadi Al Makhrou, Bethlehem Governorate, Palestinian Territories. *Slovak Raptor Journal*, 10, 75-79.
- Abusarhan, M. A., Handal, E. N., Ghattas, M. M., Amr, Z., & Qumsiyeh, M. B. (2016). Some records of butterflies (Lepidoptera) from the Palestinian Territories. *Jordan Journal of Biological Sciences*, 9(1), 11-23.
- Qumsiyeh, M. B., & Amr, Z. S. (2016). Protected areas in the occupied Palestinian Territories. *Jordan Journal of Natural History*, Special Issue 1.3, 25-46.
- Qumsiyeh, M., Khalilieh, A., Albaradeiya, I. M., & Al-Shaikh, B. (2016) Biodiversity conservation of Wadi Al-Quff protected area: Challenges and opportunities. *Jordan Journal of Natural History*, Special Issue 1, 3, 6-24.
- Handal, E. N., Amr, Z. S., & Qumsiyeh, M. B. (2016) Some records of reptiles from the Palestinian Territories. *Russian Journal of Herpetology*, 23(4), 261-270.
- Abusarhan, M., Amr, Z. S., Ghattas, M., Handal, E. N., & Qumsiyeh, M. B. (2017) Grasshoppers and locusts (Orthoptera: Caelifera) from the Palestinian Territories at the Palestine Museum of Natural History. *Zoology and Ecology*, 27(2), 134-154.
- Qumsiyeh, M. B., Handal, E., Chang, J., Abualia, K., Najajreh, M., & Abusarhan, M. (2017) Role of museums and botanical gardens in ecosystem services in developing countries: Case study and outlook. *International Journal of Environmental Studies*, 74(2), 340-350.
- Qumsiyeh, M. B. (2017) Nature and resistance in Palestine. *Active Arab Voices*.
- Handal, E. N., Al Wahsh, A. M., Amr, Z. S., Battiston, R., & Qumsiyeh, M. B. (2018) Mantids (Dictyoptera: Mantodea) from the Palestinian Territories with an updated list. *Articulata*, 33, 1-15.
- Qumsiyeh, M. B. (2018). Ethnoecology of Palestine: Preserving culture heritage of Palestine's natural history. Conference Proceedings. In 4th Hyperheritage International Seminar Proceedings (International Conference): Smart Heritage. <http://europia.fr/HIS4>
- Amr, Z. S., Najajreh, M. H., Zawahreh, M., Neubert, E., Handal, E. N., Abu Baker, M. A., & Qumsiyeh, M. B. (2018) Diversity and ecology of the land snails of the Occupied Palestinian Territories. *Zoology and Ecology*, 28(1), 25-35.
- Qumsiyeh, M. B., & Handal, E. N. (2018) Ecotourism: Opening a natural window to Palestine. *This Week in Palestine*, 244, 38-42
- Khan Aikins, T., Jaward Dramani, D., Mukakamari, D., Ndikubwimana, I., Gatali, C., Qumsiyeh, M. B., Mwinyi, A. A., Hassan, I. H., Shana, E., Keunen, H., Janssens De Bisthoven, L., Rochette, A. J., Vanhove, P. M., Musinguzi, L., Bassa, S., Kasangaki, A., Kigenyi, R., Ogwal, S. F., Muwanika, F., Koire, C., Muyizzi, J., Waiswa, R., Musinguzi, J., & Eilu, G. (2019) Monitoring natural resources in protected areas: Developing biodiversity indicators in and around protected areas in East- and West Africa and the Middle East key messages. ResearchGate

- Najajrah, M. H., Sawalheh, K., & Qumsiyeh, M. B. (2019). Systematic list, geographic distribution and ecological significance of lady beetles (Coleoptera: Coccinellidae) from the West Bank (Central Palestine). *Zootaxa*, 4664(1):1-46.
- Handal, E. N., & Qumsiyeh, M. B. (2019). First record of the Western Conifer Seed Bug *Leptoglossus occidentalis* Heidemann, 1910 (Heteroptera, Coreidae) from Palestine. *Jordan Journal of Biological Sciences*, 12(5), 657-658.
- Handal, E. N., Qumsiyeh, G. H., Hammash, S. Y., & Qumsiyeh, M. B. (2019) Status and conservation of the striped hyena (*Hyaena hyaena*) in the occupied Palestinian territories (West Bank). *Jordan Journal of Natural History*, 6, 11-18.
- Al-Harithi, T., Qumsiyeh, M. B., & Handal, E. N. (2019) Macrofaunal fossil assemblage from Beit Ummar, Hebron, Palestine. *Jordan Journal of Biological Sciences*, 13, 53-66.
- Qumsiyeh, M. B. (2019). Protecting people and nature in a World Heritage site. *Bethlehem University Magazine*, 26(2), 9.
- Saeed, R., & Qumsiyeh, M. B. (2020) Assessing long-term changes in the raptor fauna of the Fertile Crescent by reference to the nineteenth century works of Canon HB Tristram. *Sandgrouse (Journal of the Ornithological Society of the Middle East)*, 42, 69-77.
- Thaler, M., Al-Wahsh, A., Meuser, A., & Qumsiyeh, M. (2020). Macrofungi from The Hebron and Jerusalem Hills of Palestine. *Mycotaxon*, 135(1):1-23.
- Qumsiyeh, M. B., & Abusarhan, M. A. (2020) An environmental Nakba: The Palestinian environment under Israeli colonization. *Science For the People*, 23(1).
- Handal, E. N., & Qumsiyeh, M. B. (2021) Status and distribution of the invasive Myna *Acridotheres tristis* (Linnaeus, 1766) in the Occupied Palestinian Territories (West Bank). *Sandgrouse*, 43:129-132.
- Qumsiyeh, M. B. (2021). Challenging colonization: Building sustainable human and natural communities in Palestine. *Radical Ecological Democracy*.
- Al-Sheikh, B., & Qumsiyeh, M. B. (2021) Imperiled ecosystems in Palestine: Rare plants as indicators. In D. DiPaolo & J. Villella (Eds.), *Imperiled: The Encyclopedia of Conservation* (pp. 1-7). Elsevier.
- Al-Sheikh, B., & Qumsiyeh, M. B. (2021) New records for the native flora of the West Bank, the Occupied Palestinian Territories. *Jordan Journal of Natural History*, 8(2), 11-19.
- Handal, E. N., Amr, Z., Basha, W. S., & Qumsiyeh, M. B. (2021) Illegal trade in wildlife vertebrate species in the West Bank, Palestine. *Journal of Asia-Pacific Biodiversity*, 14(4):636-639.
- Pahl, J., & Qumsiyeh, M. B. (2021). Orchids of the Occupied Palestinian Territories (West Bank, Palestine). *Mediterranean Botany*, 42, e72120.
- Qumsiyeh, M. B., & Abusarhan, M. (2021). Biodiversity and environmental conservation in Palestine. In M. Öztürk, V. Altay, & R. Efe (Eds.), *Biodiversity Conservation and Sustainability in Asia, Vol. 1. Prospects and Challenges in West Asia and Caucasus* (pp. 1-22). Springer Nature.
- Mourad Hanna, E., Friberg, K. G., & Qumsiyeh, M. B. (2022) Temporal changes in traditional knowledge and use of wild plants in Artas, Palestine. *Palestine Exploration Quarterly*, 154(2), 81-94.
- Husein, D., & Qumsiyeh, M. B. (2022) Impact of Israeli segregation and annexation wall on Palestinian biodiversity. *Africana Studia*, 3:19-26.
- Qumsiyeh, M. B., Saeed, R., Najajreh, M. H., Katbeh-Badr, N., Ikhmais, H., Simonett, O., Mackey, A., & Libert, M. E. (2022). Environmental education and climate change in a colonial context. *Africana Studia*, 37:109-121.
- Qumsiyeh, M. B., & Abusarhan, M. (2022). Impact of COVID-19 pandemic on biodiversity conservation in the Israeli occupied West Bank, Palestine. *Africana Studia*, 37:49-58.
- Qumsiyeh, M. B. (Lead author). (2022). 6th National Report to the Convention on Biological Diversity. <https://chm.cbd.int/database/record?documentID=257520> PDF <https://www.cbd.int/doc/nr/nr-06/ps-nr-06-en.pdf>

- Gedeon, J. G., & Qumsiyeh, M. B. (2023). New floral records in the area of South Jerusalem Hills, Palestine. *Jordan Journal of Natural History*, 10(2), 11-20.
- Qumsiyeh, M. B., Husein, D., Boulad, N., Albaradeya, I. M., Mahasnah, M., Abusirhan, M., Najajreh, M. H., Al-Shaikh, B., Handal, E. N., & Amr, Z. S. (2023). Updating and enhancing the protected areas network of the State of Palestine: A step towards biodiversity conservation. *Parks Journal*, 29:107-118.
- Qumsiyeh, M. B., Bassous-Ghattas, R., Handal, E. N., Abusarhan, M., Najajreh, M. H., & Albaradeiyah, I. M. (2023) Biodiversity conservation of a new protected area 'Al-Arqoub', South Jerusalem Hills, Palestine. *Parks Journal*, 29:33-42.
- Qumsiyeh, M. B., & Clauer, H. (2023) Weaponizing Israeli national parks to ethnically cleanse Palestinians. *Palestine Israel Journal*, 3/4
- Allombert, C., & Qumsiyeh, M. B. (2024) Israel designation of "Nature Reserves": A tool of colonization. *International Review of Contemporary Law*, 6(4):9-14.
- Al-Sheikh, B., Qumsiyeh, M. B., & Hubbeih, A. S. (2024). Noteworthy records of vascular plants from the West Bank, Occupied Palestinian Territories. *Journal of Threatened Taxa*. 16(12): 26225–26233.
- Qumsiyeh, M. B., Najajrah, M. H., Handal, E. N., Gideon, J., & Abusarhan, M. A. (2024) The importance of urban eco-gardens for biodiversity and human sustainability: A case study from Palestine. *Cities and the Environment*, 17(1).
- Qumsiyeh, M. B., McHugh, C., Shaheen, S., & Najajrah, M. H. (2024). Bio-cultural landscape and eco-friendly agriculture in Al-Arqoub villages, south Jerusalem, Palestine. *Agroecology and Sustainable Food Systems*, 48(10), 1489–1513.
- Handal, E.N., Al-Shomali, S.L. and Adawi, S.H. (2024) Four New Records of Beetles (Coleoptera) from the Palestinian Territories–West Bank. *Jordan Journal of Natural History*, 11(1):18-23.
- Adawi, S. H., Handal, E. N., Romdane, M. S., Hmida, L., & Ahmed, R. B.(2024). Diversity of freshwater leeches (Annelida: Hirudinida) in the West Bank, Palestine. *Zoology in the Middle East*, 1–20.
- Handal, E.N., Al-Shomali, S.L. and Adawi, S.H. (2024) Four New Records of Beetles (Coleoptera) from the Palestinian Territories–West Bank. *Jordan Journal of Natural History*, 11(1), pp.18-23.
- Al-Sheikh, B. and J. Gedeon (2025) Newly Documented Invasive Alien Species in West Bank, Palestine. *Feddes Repertorium* 136(2):136-145.
- Qumsiyeh, M. B., Jarrar, K., & Sadr, M. (2025). Chapter 15. Durable Peace Education towards Sustainable Communities. pp 245-254 In *Peace Education around the World: Learning from the Past for the Future*. Edited by Robin Burns and Magnus Haavelsrud. Peace Knowledge Press.
- مازن قمصية 2025 حماية الطبيعة وخدمة الإنسان في فلسطين: الإستفادة من التجارب الإقليمية. الحمى أيار/مايو 2025 ص 26-27 <https://www.palestinenature.org/research/26-27-Protecting-Nature-in-Palestine.pdf>
- Qumsiyeh, MB (2025) Ecocide and Resistance in Palestine. *Progress in Political Economy* 3 Sept 2025 <https://www.ppesydney.net/ecocide-and-resistance-in-palestine/>
- IUCN 2025 New Protected Areas Network for Palestine https://www.palestinenature.org/conservation/PAN_Palestine_15Dec2025.pdf
- Qumsiyeh, M. B., & Bibee, A. (2026). The nexus of environmental justice and potential for sustainable tourism under colonial occupation in Palestine. Pp 167-185 In F. Higgins Desbiolle (Ed.), *Climate Justice in Tourism*. Channel View Publications, Bristol, Jackson.
- Qumsiyeh, M.B. and A. Gueverra (2026) Challenging the ecocide of colonization: case study of Palestine. *Protest*. Xx:1-17. In Press.
- Qumsiyeh, M.B., C.A. Buchanan, Z.S. Amr Challenges and Opportunities for Wildlife Management and Biodiversity Conservation under Complex Socio-Political Conditions: Case study from Palestine. Chapter accepted in book on Wildlife Management. In Press.

- Handal, A. P., Liu, H., Vogler, A. P., Gedeon, J. G. & Qumsiyeh, M. (2026). A molecular re-examination of taxonomy of Orchidaceae in the State of Palestine. *Jordan Journal of Natural History*, In press
- Qumsiyeh, M.B., Bibee, A. and Taqatqa, N. Legal mobilization against ecocide: Case study from Palestine. *Journal of Human Rights and the Environment*. Submitted 11/1/26.
- Qumsiyeh, M.B., J. Maidrand, and M.O. Awadallah (2026) Spacio-politics of colonization around Al-Walaja area (south Jerusalem, Palestine) and its impact on local sustainability issues. *Antipode*. In press.
- Qumsiyeh, M.B. Community participation in strengthening resilience in a bio-cultural heritage landscape: An example from Palestine. *Heritage Journal* Submitted 14/1/2026



Our team



ISBN 978-9950-8617-1-8



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